Grade 5 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
   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
   C. Properties of matter can be explained in terms of moving particles too small to be seen without tremendous magnification
   Scope and Sequence – Water Cycle and Weather
   a. Describe how changes in state (i.e., freezing/melting, condensation/evaporation/boiling) provide evidence that matter is made of particles too small to be seen
   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 – Water cycle and Weather
   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 (thermal energy) on the physical properties of water as it changes to and from a solid, liquid, or gas (i.e., freezes/melts, evaporates/condenses/boils)
   I. Mass is conserved during any physical or chemical change
   Scope and Sequence – Water Cycle and Weather
   a. Observe the mass of water remains constant as it changes state (as evidenced in a closed container)

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 – Solar System
   a. Observe and explain light being transferred from the source to the receiver (eye) through space in straight lines
   b. Observe and explain 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)
   C. Electromagnetic energy from the Sun (solar radiation) is a major source of energy on Earth
   Scope and Sequence – Water Cycle and Weather/Solar System
   a. Identify the Sun as the primary source of energy for temperature change on Earth

Grade 5 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

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 – Work and Simple Machines
   a. Identify the forces acting on a load and use a spring scale to measure the weight (resistance force) of the load
   D. Newton’s Laws of Motion explain the interaction of mass and forces, and are used to predict changes in motion
   Scope and Sequence – Work and Simple Machines
   a. Describe how friction affects the amount of force needed to do work over different surfaces or through different media
   F. Work transfers energy into and out of a mechanical system
   Scope and Sequence – Work and Simple Machines
a. Explain how work can be done on an object (force applied and distance moved) (No formula calculations at this level)
b. Identify the simple machines in common tools and household items
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. Observe and explain that simple machines change the amount of effort force and/or direction of force

**Grade 5 Strand 3: Characteristics and Interactions of Living Organisms**

1. There is a fundamental unity underlying the diversity of all living organisms
   D. Plants and animals have different structures that serve similar functions necessary for the survival of the organism
   Scope and Sequence – Classification of Plants and Animals
   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

2. Living organisms carry out life processes in order to survive
   C. Complex multicellular organisms have systems that interact to carry out life processes through physical and chemical means
   Scope and Sequence – Classification of Plants and Animals
   a. Compare the major organs/organ systems (e.g. support, reproductive, digestive, transport/circulatory, excretory, response) that perform similar functions for animals belonging to different vertebrate classes.

3. There is a genetic basis for the transfer of biological characteristics from one generation to the next through productive processes

**Grade 5 Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environments**

**Grade 5 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
   B. The hydrosphere is composed of water (a material with unique properties) and other materials
   Scope and Sequence – Water Cycle and Weather
   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
   C. The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles
   Scope and Sequence – Water Cycle and Weather
   a. Recognize the atmosphere is composed of a mixture of gases, water, and minute particles.

2. Earth’s systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes
   E. Changes in the form of water as it moves through Earth’s systems are described as the water cycle
   Scope and Sequence – Water Cycle and Weather
   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
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 Water Cycle and Weather
a. Identify and use appropriate tools (i.e., thermometer, anemometer, wind vane, rain gauge, satellite images, weather maps) to collect weather data (i.e., temperature, wind speed and direction, precipitation, cloud type and cover.)
b. Identify 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.

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 – Water Cycle and Weather
a. Explain how major bodies of water are important natural resources for human activity (e.g., food recreation, habitat, irrigation, solvent, transportation)
b. Describe how human needs and activities (e.g., irrigation damming of rivers, waste management, sources of drinking water) have affected the quantity and quality of major bodies of fresh water
c. Propose solutions to problems related to water quality and availability that result from human activity.

Grade 5 Strand 6: Composition and Structure of the Universe and the Motion of the Objects Within It

1. The universe has observable properties and structure
A. The Earth, Sun, and Moon are part of a larger system that includes other planets and smaller celestial bodies
Scope and Sequence – Solar System
a. Observe and identify the Earth is one of several planets within a solar system that orbits the Sun
b. Observe and identify the Moon orbits the Earth in about a month
c. Identify that 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
Scope and Sequence – Solar System
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

2. Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces
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 – Solar System
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

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
Scope and Sequence – Solar System
a. Identify that 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)
Grade 5 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
      d. Make suggestions for reasonable improvements or extensions of a fair test
   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., 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, force/weight to the nearest Newton
      e. Compare amounts/measurements
      f. 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 5 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 – Work and Simple Machines
      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
Scope and Sequence – Work and Simple Machines/Water Cycle and Weather/Solar System/Classification of Plants and Animals
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
Scope and Sequence – Simple Machines/Water Cycle and Weather/Solar System/Classification of Plants and Animals
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)

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

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)