ExploreLearning Gizmos®

Correlations for Texas Essential Knowledge Skills for Science

Explorelearning®

Third Grade

3.1: Scientific and engineering practices. The student asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.

3.1.D: The student is expected to: use tools, including hand lenses; metric rulers; Celsius thermometers; wind vanes; rain gauges; graduated cylinders; beakers; digital scales; hot plates; meter sticks; magnets; notebooks; Sun, Earth, Moon system models; timing devices; materials to support observation of habitats of organisms such as terrariums, aquariums, and collecting nets; and materials to support digital data collection such as computers, tablets, and cameras, to observe, measure, test, and analyze information;

Density
Magnetism
Measuring Volume
Observing Weather (Customary)
Observing Weather (Metric)
Weight and Mass

3.1.E: The student is expected to: collect observations and measurements as evidence;

Density
Observing Weather (Customary)
Observing Weather (Metric)
Phases of the Moon

3.1.F: The student is expected to: construct appropriate graphic organizers to collect data, including tables, bar graphs, line graphs, tree maps, concept maps, Venn diagrams, flow charts or sequence maps, and input-output tables that show cause and effect; and

Observing Weather (Customary)
Observing Weather (Metric)

3.1.G: The student is expected to: develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem.

Magnetism
Phases of Water
Phases of the Moon
Prairie Ecosystem

3.2: Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

3.2.B: The student is expected to: analyze data by identifying any significant features, patterns, or sources of error;

Density
Phases of Water

3.3: Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.

3.3.A: The student is expected to: develop explanations and propose solutions supported by data and models;

Observing Weather (Customary)
Observing Weather (Metric)

3.3.B: The student is expected to: communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

Observing Weather (Customary)
Observing Weather (Metric)

3.6: Matter and energy. The student knows that matter has measurable physical properties that determine how matter is identified, classified, changed, and used.

3.6.A: The student is expected to: measure, test, and record physical properties of matter, including temperature, mass, magnetism, and the ability to sink or float in water;

Density
Magnetism
Weight and Mass

3.6.B: The student is expected to: describe and classify samples of matter as solids, liquids, and gases and demonstrate that solids have a definite shape and that liquids and gases take the shape of their container;

Phases of Water

3.6.C: The student is expected to: predict, observe, and record changes in the state of matter caused by heating or cooling in a variety of substances such as ice becoming liquid water, condensation forming on the outside of a glass, or liquid water being heated to the point of becoming water vapor (gas); and

Phases of Water

3.7: Force, motion, and energy. The student knows the nature of forces and the patterns of their interactions.

3.7.A: The student is expected to: demonstrate and describe forces acting on an object in contact or at a distance, including magnetism, gravity, and pushes and pulls; and

Magnetism

3.8: Force, motion, and energy. The student knows that energy is everywhere and can be observed in cycles, patterns, and systems.

3.8.A: The student is expected to: identify everyday examples of energy, including light, sound, thermal, and mechanical; and

Energy Conversions

3.9: Earth and space. The student knows there are recognizable objects and patterns in Earth's solar system.

3.9.A: The student is expected to: construct models and explain the orbits of the Sun, Earth, and Moon in relation to each other; and

Phases of the Moon

3.9.B: The student is expected to: identify the order of the planets in Earth's solar system in relation to the Sun.

Solar System

3.1: Earth and space. The student knows that there are recognizable processes that change Earth over time.

3.10.A: The student is expected to: compare and describe day-to-day weather in different locations at the same time, including air temperature, wind direction, and precipitation;

Observing Weather (Customary)
Observing Weather (Metric)

3.12: Organisms and environments. The student describes patterns, cycles, systems, and relationships within environments.

3.12.B: The student is expected to: identify and describe the flow of energy in a food chain and predict how changes in a food chain such as removal of frogs from a pond or bees from a field affect the ecosystem;

Prairie Ecosystem

3.12.C: The student is expected to: describe how natural changes to the environment such as floods and droughts cause some organisms to thrive and others to perish or move to new locations; and

Prairie Ecosystem

3.13: Organisms and environments. The student knows that organisms undergo similar life processes and have structures that function to help them survive within their environments.

3.13.A: The student is expected to: explore and explain how external structures and functions of animals such as the neck of a giraffe or webbed feet on a duck enable them to survive in their environment; and

Comparing Climates (Customary)
Comparing Climates (Metric)

Fourth Grade

4.1: Scientific and engineering practices. The student asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.

4.1.B: The student is expected to: use scientific practices to plan and conduct descriptive investigations and use engineering practices to design solutions to problems;

- Magnetism
- Phases of the Moon
- Weathering
- Weight and Mass

4.1.D: The student is expected to: use tools, including hand lenses; metric rulers; Celsius thermometers; calculators; laser pointers; mirrors; digital scales; balances; graduated cylinders; beakers; hot plates; meter sticks; magnets; notebooks; timing devices; sieves; materials for building circuits; materials to support observation of habitats of organisms such as terrariums, aquariums, and collecting nets; and materials to support digital data collection such as computers, tablets, and cameras, to observe, measure, test, and analyze information;

- Circuit Builder
- Density
- Magnetism
- Measuring Volume

4.1.E: The student is expected to: collect observations and measurements as evidence;

- Circuit Builder
- Density
- Phases of Water
- Weight and Mass

4.1.F: The student is expected to: construct appropriate graphic organizers used to collect data, including tables, bar graphs, line graphs, tree maps, concept maps, Venn diagrams, flow charts or sequence maps, and input-output tables that show cause and effect; and

Circuit Builder
Comparing Climates (Customary)
Comparing Climates (Metric)
Density
Phases of Water
Weathering

4.1.G: The student is expected to: develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem.

Forest Ecosystem
Magnetism
Phases of Water
River Erosion
Weathering

4.2: Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

4.2.B: The student is expected to: analyze data by identifying any significant features, patterns, or sources of error;

Circuit Builder
Density
Ecosystems - undefined**STEM Case**

4.3: Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.

4.3.A: The student is expected to: develop explanations and propose solutions supported by data and models;

Erosion Rates
Weathering
Ecosystems - undefined**STEM Case**

4.3.B: The student is expected to: communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

Erosion Rates
Weathering
Ecosystems - undefined**STEM Case**

4.5: Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections across disciplines.

4.5.B: The student is expected to: identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems;

Weathering

4.5.E: The student is expected to: investigate how energy flows and matter cycles through systems and how matter is conserved;

Forest Ecosystem
Ecosystems - undefined**STEM Case**

4.5.G: The student is expected to: explain how factors or conditions impact stability and change in objects, organisms, and systems.

Forest Ecosystem
Weathering
Ecosystems - undefined**STEM Case**

4.6: Matter and energy. The student knows that matter has measurable physical properties that determine how matter is identified, classified, changed, and used.

4.6.A: The student is expected to: classify and describe matter using observable physical properties, including temperature, mass, magnetism, relative density (the ability to sink or float in water), and physical state (solid, liquid, gas);

Density
Phases of Water
Weight and Mass
Properties of Matter - undefined**STEM Case**

4.7: Force, motion, and energy. The student knows the nature of forces and the patterns of their interactions. The student is expected to plan and conduct descriptive investigations to explore the patterns of forces such as gravity, friction, or magnetism in contact or at a distance on an object.

Force and Fan Carts
Magnetism
Weight and Mass

4.8: Force, motion, and energy. The student knows that energy is everywhere and can be observed in cycles, patterns, and systems.

4.8.A: The student is expected to: investigate and identify the transfer of energy by objects in motion, waves in water, and sound;

Sled Wars

4.8.B: The student is expected to: identify conductors and insulators of thermal and electrical energy; and

Circuit Builder

4.8.C: The student is expected to: demonstrate and describe how electrical energy travels in a closed path that can produce light and thermal energy.

Circuit Builder

4.9: Earth and space. The student recognizes patterns among the Sun, Earth, and Moon system and their effects.

4.9.A: The student is expected to: collect and analyze data to identify sequences and predict patterns of change in seasons such as change in temperature and length of daylight; and

Seasons: Earth, Moon, and Sun

4.9.B: The student is expected to: collect and analyze data to identify sequences and predict patterns of change in the observable appearance of the Moon from Earth.

Phases of the Moon

4.1: Earth and space. The student knows that there are processes on Earth that create patterns of change.

4.10.A: The student is expected to: describe and illustrate the continuous movement of water above and on the surface of Earth through the water cycle and explain the role of the Sun as a major source of energy in this process;

Water Cycle

4.10.B: The student is expected to: model and describe slow changes to Earth's surface caused by weathering, erosion, and deposition from water, wind, and ice; and

Erosion Rates
River Erosion
Weathering

4.10.C: The student is expected to: differentiate between weather and climate.

Comparing Climates (Customary)
Comparing Climates (Metric)

4.12: Organisms and environments. The student describes patterns, cycles, systems, and relationships within environments.

4.12.A: The student is expected to: investigate and explain how most producers can make their own food using sunlight, water, and carbon dioxide through the cycling of matter;

Ecosystems - undefined **STEM Case**

4.12.B: The student is expected to: describe the cycling of matter and flow of energy through food webs, including the roles of the Sun, producers, consumers, and decomposers; and

Forest Ecosystem
Ecosystems - undefined **STEM Case**

4.13: Organisms and environments. The student knows that organisms undergo similar life processes and have structures that function to help them survive within their environments.

4.13.A: The student is expected to: explore and explain how structures and functions of plants such as waxy leaves and deep roots enable them to survive in their environment; and

Comparing Climates (Customary)
Comparing Climates (Metric)

4.13.B: The student is expected to: differentiate between inherited and acquired physical traits of organisms.

Inheritance

Fifth Grade

5.1: Scientific and engineering practices. The student asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.

5.1.B: The student is expected to: use scientific practices to plan and conduct descriptive and simple experimental investigations and use engineering practices to design solutions to problems;

Circuit Builder
Energy Conversions
Eyes and Vision 1 - Seeing Color
Magnetism
Properties of Matter - undefined**STEM Case**

5.1.D: The student is expected to: use tools, including calculators, microscopes, hand lenses, metric rulers, Celsius thermometers, prisms, concave and convex lenses, laser pointers, mirrors, digital scales, balances, spring scales, graduated cylinders, beakers, hot plates, meter sticks, magnets, collecting nets, notebooks, timing devices, materials for building circuits, materials to support observations of habitats or organisms such as terrariums and aquariums, and materials to support digital data collection such as computers, tablets, and cameras to observe, measure, test, and analyze information;

Circuit Builder
Density
Magnetism
Measuring Volume

5.1.E: The student is expected to: collect observations and measurements as evidence;

Circuit Builder
Density

5.1.F: The student is expected to: construct appropriate graphic organizers used to collect data, including tables, bar graphs, line graphs, tree maps, concept maps, Venn diagrams, flow charts or sequence maps, and input-output tables that show cause and effect; and

Circuit Builder
Density
Energy Conversions
Magnetism
Weathering

5.1.G: The student is expected to: develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem.

Magnetism
River Erosion
Seasons: Earth, Moon, and Sun
Ecosystems - undefined**STEM Case**

5.2: Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

5.2.B: The student is expected to: analyze data by identifying any significant features, patterns, or sources of error;

Circuit Builder
Density
Ecosystems - undefined**STEM Case**
Fruit Production - undefined**STEM Case**

5.3: Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.

5.3.A: The student is expected to: develop explanations and propose solutions supported by data and models;

Animal Group Behavior - undefined**STEM Case**
Ecosystems - undefined**STEM Case**

Fruit Production - undefined STEM Case

5.3.B: The student is expected to: communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

Animal Group Behavior - undefined STEM Case
Ecosystems - undefined STEM Case
Fruit Production - undefined STEM Case

5.5: Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections across disciplines.

5.5.E: The student is expected to: investigate how energy flows and matter cycles through systems and how matter is conserved;

Ecosystems - undefined STEM Case

5.5.G: The student is expected to: explain how factors or conditions impact stability and change in objects, organisms, and systems.

Animal Group Behavior - undefined STEM Case
Ecosystems - undefined STEM Case

5.6: Matter and energy. The student knows that matter has measurable physical properties that determine how matter is identified, classified, changed, and used.

5.6.A: The student is expected to: compare and contrast matter based on measurable, testable, or observable physical properties, including mass, magnetism, relative density (sinking and floating using water as a reference point), physical state (solid, liquid, gas), volume, solubility in water, and the ability to conduct or insulate thermal energy and electric energy;

Circuit Builder
Density
Magnetism
Measuring Volume
Mineral Identification
Phases of Water
Properties of Matter - undefined STEM Case

5.6.D: The student is expected to: illustrate how matter is made up of particles that are too small to be seen such as air in a balloon.

Properties of Matter - undefined**STEM Case**

5.8: Force, motion, and energy. The student knows that energy is everywhere and can be observed in cycles, patterns, and systems.

5.8.A: The student is expected to: investigate and describe the transformation of energy in systems such as energy in a flashlight battery that changes from chemical energy to electrical energy to light energy;

Energy Conversions

5.8.B: The student is expected to: demonstrate that electrical energy in complete circuits can be transformed into motion, light, sound, or thermal energy and identify the requirements for a functioning electrical circuit; and

Circuit Builder

5.8.C: The student is expected to: demonstrate and explain how light travels in a straight line and can be reflected, refracted, or absorbed.

Color Absorption
Eyes and Vision 1 - Seeing Color
Heat Absorption

5.9: Earth and space. The student recognizes patterns among the Sun, Earth, and Moon system and their effects. The student is expected to demonstrate that Earth rotates on its axis once approximately every 24 hours and explain how that causes the day/night cycle and the appearance of the Sun moving across the sky, resulting in changes in shadow positions and shapes.

Seasons: Earth, Moon, and Sun

5.10: Earth and space. The student knows that there are recognizable patterns and processes on Earth.

5.10.A: The student is expected to: explain how the Sun and the ocean interact in the water cycle and affect weather;

Water Cycle

5.10.B: The student is expected to: model and describe the processes that led to the formation of sedimentary rocks and fossil fuels; and

Carbon Cycle
Rock Cycle

5.10.C: The student is expected to: model and identify how changes to Earth's surface by wind, water, or ice result in the formation of landforms, including deltas, canyons, and sand dunes.

River Erosion

5.11: Earth and space. The student understands how natural resources are important and can be managed. The student is expected to design and explain solutions such as conservation, recycling, or proper disposal to minimize environmental impact of the use of natural resources.

Ecosystems - undefinedSTEM Case

5.12: Organisms and environments. The student describes patterns, cycles, systems, and relationships within environments.

5.12.B: The student is expected to: predict how changes in the ecosystem affect the cycling of matter and flow of energy in a food web; and

Ecosystems - undefinedSTEM Case

5.12.C: The student is expected to: describe a healthy ecosystem and how human activities can be beneficial or harmful to an ecosystem.

Pond Ecosystem
Ecosystems - undefined STEM Case
Fruit Production - undefined STEM Case

5.13: Organisms and environments. The student knows that organisms undergo similar life processes and have structures and behaviors that help them survive within their environments.

5.13.B: The student is expected to: explain how instinctual behavioral traits such as turtle hatchlings returning to the sea and learned behavioral traits such as orcas hunting in packs increase chances of survival.

Animal Group Behavior - undefined STEM Case

Sixth Grade

6.1: Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.

6.1.A: The student is expected to: ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

Coral Reefs 2 - Biotic Factors

6.1.B: The student is expected to: use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

Seasons: Earth, Moon, and Sun
Tides - Metric
Chemical and Physical Changes - Middle School STEM Case

Ecosystems - Middle School STEM Case
Fruit Production - Middle School STEM Case

6.1.D: The student is expected to: use appropriate tools such as graduated cylinders, metric rulers, periodic tables, balances, scales, thermometers, temperature probes, laboratory ware, timing devices, pH indicators, hot plates, models, microscopes, slides, life science models, petri dishes, dissecting kits, magnets, spring scales or force sensors, tools that model wave behavior, satellite images, hand lenses, and lab notebooks or journals;

Density
Magnetism
Measuring Volume
Triple Beam Balance
Weight and Mass

6.1.E: The student is expected to: collect quantitative data using the International System of Units (SI) and qualitative data as evidence;

Measuring Volume
Sled Wars

6.1.G: The student is expected to: develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

Carbon Cycle
Phase Changes
Seasons: Earth, Moon, and Sun
Sled Wars
Tides - Metric

6.2: Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

6.2.B: The student is expected to: analyze data by identifying any significant descriptive statistical features, patterns, sources of error, or limitations;

Describing Data Using Statistics

6.2.C: The student is expected to: use mathematical calculations to assess quantitative relationships in data; and

Roller Coaster Physics
Seasons: Earth, Moon, and Sun
Sled Wars

6.3: Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.

6.3.A: The student is expected to: develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

Carbon Cycle
Roller Coaster Physics
Seasons in 3D
Chemical and Physical Changes - Middle School **STEM Case**
Ecosystems - Middle School **STEM Case**
Fruit Production - Middle School **STEM Case**

6.3.B: The student is expected to: communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

Roller Coaster Physics
Chemical and Physical Changes - Middle School **STEM Case**
Ecosystems - Middle School **STEM Case**
Fruit Production - Middle School **STEM Case**

6.5: Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections across disciplines.

6.5.A: The student is expected to: identify and apply patterns to understand and connect scientific phenomena or to design solutions;

Force and Fan Carts

6.5.B: The student is expected to: identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems;

Coral Reefs 1 - Abiotic Factors
Coral Reefs 2 - Biotic Factors
Force and Fan Carts

6.5.E: The student is expected to: analyze and explain how energy flows and matter cycles through systems and how energy and matter are conserved through a variety of systems;

Chemical Changes
Roller Coaster Physics
Sled Wars
Chemical and Physical Changes - Middle School **STEM Case**

6.5.G: The student is expected to: analyze and explain how factors or conditions impact stability and change in objects, organisms, and systems.

Coral Reefs 1 - Abiotic Factors
Coral Reefs 2 - Biotic Factors
Natural Selection
Ecosystems - Middle School **STEM Case**
Fruit Production - Middle School **STEM Case**

6.6: Matter and energy. The student knows that matter is made of atoms, can be classified according to its properties, and can undergo changes.

6.6.A: The student is expected to: compare solids, liquids, and gases in terms of their structure, shape, volume, and kinetic energy of atoms and molecules;

Phase Changes
Phases of Water
Chemical and Physical Changes - Middle School **STEM Case**

6.6.D: The student is expected to: compare the density of substances relative to various fluids; and

Density

6.6.E: The student is expected to: identify the formation of a new substance by using the evidence of a possible chemical change, including production of a gas, change in thermal energy, production of a precipitate, and color change.

Chemical Changes

6.7: Force, motion, and energy. The student knows the nature of forces and their role in systems that experience stability or change.

6.7.A: The student is expected to: identify and explain how forces act on objects, including gravity, friction, magnetism, applied forces, and normal forces, using real-world applications;

Crumple Zones
Gravity Pitch

6.7.C: The student is expected to: identify simultaneous force pairs that are equal in magnitude and opposite in direction that result from the interactions between objects using Newton's Third Law of Motion.

Crumple Zones

6.8: Force, motion, and energy. The student knows that the total energy in systems is conserved through energy transfers and transformations.

6.8.A: The student is expected to: compare and contrast gravitational, elastic, and chemical potential energies with kinetic energy;

Energy of a Pendulum
Inclined Plane - Sliding Objects
Roller Coaster Physics
Sled Wars

6.8.B: The student is expected to: describe how energy is conserved through transfers and transformations in systems such as electrical circuits, food webs, amusement park rides, or photosynthesis; and

Energy Conversion in a System
Roller Coaster Physics
Sled Wars
Ecosystems - Middle School STEM Case

6.8.C: The student is expected to: explain how energy is transferred through transverse and longitudinal waves.

Longitudinal Waves
Waves

6.9: Earth and space. The student models the cyclical movements of the Sun, Earth, and Moon and describes their effects.

6.9.A: The student is expected to: model and illustrate how the tilted Earth revolves around the Sun, causing changes in seasons; and

Seasons in 3D
Seasons: Earth, Moon, and Sun
Seasons: Why do we have them?

6.9.B: The student is expected to: describe and predict how the positions of the Earth, Sun, and Moon cause daily, spring, and neap cycles of ocean tides due to gravitational forces.

Ocean Tides
Tides - Metric

6.1: Earth and space. The student understands the rock cycle and the structure of Earth.

6.10.A: The student is expected to: differentiate between the biosphere, hydrosphere, atmosphere, and geosphere and identify components of each system;

Carbon Cycle

6.10.C: The student is expected to: describe how metamorphic, igneous, and sedimentary rocks form and change through geologic processes in the rock cycle.

Rock Cycle

6.12: Organisms and environments. The student knows that interdependence occurs between living systems and the environment.

6.12.A: The student is expected to: investigate how organisms and populations in an ecosystem depend on and may compete for biotic factors such as food and abiotic factors such as availability of light and water, range of temperatures, or soil composition;

Coral Reefs 1 - Abiotic Factors
Coral Reefs 2 - Biotic Factors
Food Chain
Pond Ecosystem

6.12.B: The student is expected to: describe and give examples of predatory, competitive, and symbiotic relationships between organisms, including mutualism, parasitism, and commensalism; and

Food Chain
Ecosystems - Middle School STEM Case
Fruit Production - Middle School STEM Case

6.13: Organisms and environments. The student knows that organisms have an organizational structure and variations can influence survival of populations.

6.13.C: The student is expected to: describe how variations within a population can be an advantage or disadvantage to the survival of a population as environments change.

Natural Selection
Rainfall and Bird Beaks - Metric

Seventh Grade

7.1: Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.

7.1.B: The student is expected to: use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

Conduction and Convection
Fan Cart Physics
Heat Transfer by Conduction
Muscles and Bones

7.1.D: The student is expected to: use appropriate tools such as graduated cylinders, metric rulers, periodic tables, balances, scales, thermometers, temperature probes, laboratory ware, timing devices, pH indicators, hot plates, models, microscopes, slides, life science models, petri dishes, dissecting kits, magnets, spring scales or force sensors, tools that model wave behavior, satellite images, hand lenses, and lab notebooks or journals;

Cell Types
Distance-Time and Velocity-Time Graphs - Metric
Frog Dissection
Measuring Volume
Triple Beam Balance

7.1.E: The student is expected to: collect quantitative data using the International System of Units (SI) and qualitative data as evidence;

Distance-Time and Velocity-Time Graphs - Metric
Fan Cart Physics
Muscles and Bones

7.1.G: The student is expected to: develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

Circulatory System
Conduction and Convection
Digestive System
Muscles and Bones
Plate Tectonics

7.2: Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

7.2.C: The student is expected to: use mathematical calculations to assess quantitative relationships in data; and

Distance-Time and Velocity-Time Graphs - Metric
Fan Cart Physics

7.3: Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.

7.3.A: The student is expected to: develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

Digestive System
Muscles and Bones
Ecosystems - Middle School **STEM Case**

7.3.B: The student is expected to: communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

Digestive System
Muscles and Bones
Ecosystems - Middle School **STEM Case**

7.5: Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections across disciplines.

7.5.B: The student is expected to: identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems;

Coral Reefs 1 - Abiotic Factors
Fan Cart Physics

7.5.E: The student is expected to: analyze and explain how energy flows and matter cycles through systems and how energy and matter are conserved through a variety of systems;

Food Chain
Ecosystems - Middle School STEM Case

7.5.F: The student is expected to: analyze and explain the complementary relationship between structure and function of objects, organisms, and systems; and

Cell Types
Circulatory System
Digestive System
Muscles and Bones

7.5.G: The student is expected to: analyze and explain how factors or conditions impact stability and change in objects, organisms, and systems.

Fan Cart Physics
Plate Tectonics
Ecosystems - Middle School STEM Case

7.6: Matter and energy. The student distinguishes between elements and compounds, classifies changes in matter, and understands the properties of solutions.

7.6.A: The student is expected to: compare and contrast elements and compounds in terms of atoms and molecules, chemical symbols, and chemical formulas;

Chemical Equations
Chemical and Physical Changes - Middle School STEM Case

7.6.C: The student is expected to: distinguish between physical and chemical changes in matter;

Chemical Changes
Chemical and Physical Changes - Middle School STEM Case

7.7: Force, motion, and energy. The student describes the cause-and-effect relationship between force and motion.

7.7.B: The student is expected to: distinguish between speed and velocity in linear motion in terms of distance, displacement, and direction;

Distance-Time and Velocity-Time Graphs - Metric

7.7.C: The student is expected to: measure, record, and interpret an object's motion using distance-time graphs; and

Distance-Time Graphs - Metric

7.7.D: The student is expected to: analyze the effect of balanced and unbalanced forces on the state of motion of an object using Newton's First Law of Motion.

Crumple Zones
Fan Cart Physics

7.8: Force, motion, and energy. The student understands the behavior of thermal energy as it flows into and out of systems.

7.8.A: The student is expected to: investigate methods of thermal energy transfer into and out of systems, including conduction, convection, and radiation;

Conduction and Convection
Convection Cells
Heat Absorption
Heat Transfer by Conduction
Radiation

7.8.B: The student is expected to: investigate how thermal energy moves in a predictable pattern from warmer to cooler until all substances within the system reach thermal equilibrium; and

Conduction and Convection

7.8.C: The student is expected to: explain the relationship between temperature and the kinetic energy of the particles within a substance.

Phase Changes
Temperature and Particle Motion

7.9: Earth and space. The student understands the patterns of movement, organization, and characteristics of components of our solar system.

7.9.A: The student is expected to: describe the physical properties, locations, and movements of the Sun, planets, moons, meteors, asteroids, comets, Kuiper belt, and Oort cloud;

Comparing Earth and Venus
Solar System

7.9.B: The student is expected to: describe how gravity governs motion within Earth's solar system; and

Gravity Pitch

7.1: Earth and space. The student understands the causes and effects of plate tectonics.

7.10.A: The student is expected to: describe the evidence that supports that Earth has changed over time, including fossil evidence, plate tectonics, and superposition; and

Building Pangaea
Plate Tectonics

7.10.B: The student is expected to: describe how plate tectonics causes ocean basin formation, earthquakes, mountain building, and volcanic eruptions, including supervolcanoes and hot spots.

Plate Tectonics

7.11: Earth and space. The student understands how human activity can impact the hydrosphere.

7.11.B: The student is expected to: describe human dependence and influence on ocean systems and explain how human activities impact these systems.

Coral Reefs 1 - Abiotic Factors
Coral Reefs 2 - Biotic Factors

7.12: Organisms and environments. The student understands that ecosystems are dependent upon the cycling of matter and the flow of energy.

7.12.A: The student is expected to: diagram the flow of energy within trophic levels and describe how the available energy decreases in successive trophic levels in energy pyramids; and

Food Chain
Ecosystems - Middle School STEM Case

7.12.B: The student is expected to: describe how ecosystems are sustained by the continuous flow of energy and the recycling of matter and nutrients within the biosphere.

Forest Ecosystem
Ecosystems - Middle School STEM Case

7.13: Organisms and environments. The student knows how systems are organized and function to support the health of an organism and how traits are inherited.

7.13.A: The student is expected to: identify and model the main functions of the systems of the human organism, including the circulatory, respiratory, skeletal, muscular, digestive, urinary, reproductive, integumentary, nervous, immune, and endocrine systems;

Circulatory System
Digestive System
Muscles and Bones

7.13.B: The student is expected to: describe the hierarchical organization of cells, tissues, organs, and organ systems within plants and animals;

Cell Types

7.13.C: The student is expected to: compare the results of asexual and sexual reproduction of plants and animals in relation to the diversity of offspring and the changes in the population over time; and

Inheritance

7.13.D: The student is expected to: describe and give examples of how natural and artificial selection change the occurrence of traits in a population over generations.

Evolution: Mutation and Selection
Evolution: Natural and Artificial Selection

Eighth Grade

8.1: Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.

8.1.B: The student is expected to: use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

Carbon Cycle
Crumple Zones
Fan Cart Physics
Rainfall and Bird Beaks - Metric

8.1.D: The student is expected to: use appropriate tools such as graduated cylinders, metric rulers, periodic tables, balances, scales, thermometers, temperature probes, laboratory ware, timing devices, pH indicators, hot plates, models, microscopes, slides, life science models, petri dishes, dissecting kits, magnets, spring scales or force sensors, tools that model wave behavior, satellite images, weather maps, hand lenses, and lab notebooks or journals;

Cell Types
Measuring Volume
Triple Beam Balance
pH Analysis
pH Analysis: Quad Color Indicator

8.1.E: The student is expected to: collect quantitative data using the International System of Units (SI) and qualitative data as evidence;

Crumple Zones
Fan Cart Physics

8.1.G: The student is expected to: develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

Carbon Cycle
Crumple Zones
H-R Diagram
Waves
Weather Maps - Metric

8.2: Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

8.2.C: The student is expected to: use mathematical calculations to assess quantitative relationships in data; and

Fan Cart Physics

8.3: Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.

8.3.A: The student is expected to: develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

Carbon Cycle
Heredity and Traits - Middle School **STEM Case**

8.3.B: The student is expected to: communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

Carbon Cycle
Heredity and Traits - Middle School **STEM Case**

8.5: Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections across disciplines.

8.5.B: The student is expected to: identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems;

Greenhouse Effect - Metric
Rainfall and Bird Beaks - Metric

8.5.E: The student is expected to: analyze and explain how energy flows and matter cycles through systems and how energy and matter are conserved through a variety of systems;

Chemical Changes
Chemical Equations
Ecosystems - Middle School STEM Case

8.5.F: The student is expected to: analyze and explain the complementary relationship between the structure and function of objects, organisms, and systems; and

Cell Structure
Cell Types

8.5.G: The student is expected to: analyze and explain how factors or conditions impact stability and change in objects, organisms, and systems.

Prairie Ecosystem
Rainfall and Bird Beaks - Metric

8.6: Matter and energy. The student understands that matter can be classified according to its properties and matter is conserved in chemical changes that occur within closed systems.

8.6.D: The student is expected to: compare and contrast the properties of acids and bases, including pH relative to water; and

pH Analysis
pH Analysis: Quad Color Indicator

8.6.E: The student is expected to: investigate how mass is conserved in chemical reactions and relate conservation of mass to the rearrangement of atoms using chemical equations, including photosynthesis.

Balancing Chemical Equations
Chemical Changes

8.7: Force, motion, and energy. The student understands the relationship between force and motion within systems.

8.7.A: The student is expected to: calculate and analyze how the acceleration of an object is dependent upon the net force acting on the object and the mass of the object using Newton's Second Law of Motion; and

Crumple Zones
Fan Cart Physics

8.7.B: The student is expected to: investigate and describe how Newton's three laws of motion act simultaneously within systems such as in vehicle restraints, sports activities, amusement park rides, Earth's tectonic activities, and rocket launches.

Crumple Zones
Fan Cart Physics

8.8: Force, motion, and energy. The student knows how energy is transferred through waves.

8.8.A: The student is expected to: compare the characteristics of amplitude, frequency, and wavelength in transverse waves, including the electromagnetic spectrum; and

Waves

8.9: Earth and space. The student describes the characteristics of the universe and the relative scale of its components.

8.9.A: The student is expected to: describe the life cycle of stars and compare and classify stars using the Hertzsprung-Russell diagram;

H-R Diagram

8.9.C: The student is expected to: research and analyze scientific data used as evidence to develop scientific theories that describe the origin of the universe.

Big Bang Theory - Hubble's Law

8.1: Earth and space. The student knows that interactions between Earth, ocean, and weather systems impact climate.

8.10.A: The student is expected to: describe how energy from the Sun, hydrosphere, and atmosphere interact and influence weather and climate;

Coastal Winds and Clouds - Metric

8.10.B: The student is expected to: identify global patterns of atmospheric movement and how they influence local weather; and

Convection Cells
Hurricane Motion - Metric
Weather Maps - Metric

8.11: Earth and space. The student knows that natural events and human activity can impact global climate.

8.11.A: The student is expected to: use scientific evidence to describe how natural events, including volcanic eruptions, meteor impacts, abrupt changes in ocean currents, and the release and absorption of greenhouse gases influence climate;

Greenhouse Effect - Metric

8.11.B: The student is expected to: use scientific evidence to describe how human activities, including the release of greenhouse gases, deforestation, and urbanization, can influence climate; and

Carbon Cycle

8.11.C: The student is expected to: describe the carbon cycle.

Carbon Cycle

8.12: Organisms and environments. The student understands stability and change in populations and ecosystems.

8.12.A: The student is expected to: explain how disruptions such as population changes, natural disasters, and human intervention impact the transfer of energy in food webs in ecosystems;

Food Chain
Forest Ecosystem
Ecosystems - Middle School STEM Case

8.12.C: The student is expected to: describe how biodiversity contributes to the stability and sustainability of an ecosystem and the health of the organisms within the ecosystem.

Coral Reefs 1 - Abiotic Factors
Coral Reefs 2 - Biotic Factors

8.13: Organisms and environments. The student knows how cell functions support the health of an organism and how adaptation and variation relate to survival.

8.13.A: The student is expected to: identify the function of the cell membrane, cell wall, nucleus, ribosomes, cytoplasm, mitochondria, chloroplasts, and vacuoles in plant or animal cells;

Cell Structure
Cell Types

8.13.B: The student is expected to: describe the function of genes within chromosomes in determining inherited traits of offspring; and

Evolution: Mutation and Selection
Fast Plants® 1 - Growth and Genetics
Heredity and Traits - Middle School STEM Case

8.13.C: The student is expected to: describe how variations of traits within a population lead to structural, behavioral, and physiological adaptations that influence the likelihood of survival and reproductive success of a species over generations.

Evolution: Mutation and Selection
Evolution: Natural and Artificial Selection
Rainfall and Bird Beaks - Metric

Biology

B.1: Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.

B.1.B: The student is expected to: apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

Cell Respiration - High School STEM Case
Enzymes - High School STEM Case
Meowsis - High School STEM Case
Nitrogen Cycle - High School STEM Case
Photosynthesis - High School STEM Case
Protein Synthesis - High School STEM Case

B.1.D: The student is expected to: use appropriate tools such as microscopes, slides, Petri dishes, laboratory glassware, metric rulers, digital balances, pipets, filter paper, micropipettes, gel electrophoresis and polymerase chain reaction (PCR) apparatuses, microcentrifuges, water baths, incubators, thermometers, hot plates, data collection probes, test tube holders, lab notebooks or journals, hand lenses, and models, diagrams, or samples of biological specimens or structures;

Cell Types
DNA Profiling

B.1.F: The student is expected to: organize quantitative and qualitative data using scatter plots, line graphs, bar graphs, charts, data tables, digital tools, diagrams, scientific drawings, and student-prepared models;

Embryo Development
GMOs and the Environment
Natural Selection
Rainfall and Bird Beaks - Metric
Ecosystems - High School STEM Case

B.1.G: The student is expected to: develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

Embryo Development
GMOs and the Environment
Genetic Engineering
Mouse Genetics (One Trait)
Mouse Genetics (Two Traits)

B.2: Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

B.2.B: The student is expected to: analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

Chicken Genetics
Fast Plants® 1 - Growth and Genetics
Fast Plants® 2 - Mystery Parent
Mouse Genetics (One Trait)

Mouse Genetics (Two Traits)

B.2.C: The student is expected to: use mathematical calculations to assess quantitative relationships in data; and

Chicken Genetics
Fast Plants® 1 - Growth and Genetics
Fast Plants® 2 - Mystery Parent
Mouse Genetics (Two Traits)

B.3: Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.

B.3.A: The student is expected to: develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

DNA Profiling
GMOs and the Environment
Enzymes - High School STEM Case
Homeostasis - High School STEM Case
Meowsis - High School STEM Case

B.3.B: The student is expected to: communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

Building DNA
Cell Division
Food Chain
Diffusion - High School STEM Case
Enzymes - High School STEM Case
Homeostasis - High School STEM Case

B.5: Science concepts--biological structures, functions, and processes. The student knows that biological structures at multiple levels of organization perform specific functions and processes that affect life.

B.5.A: The student is expected to: relate the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids, to the structure and function of a cell;

Identifying Nutrients
Enzymes - High School STEM Case

B.5.B: The student is expected to: compare and contrast prokaryotic and eukaryotic cells, including their complexity, and compare and contrast scientific explanations for cellular complexity;

Cell Types

B.5.C: The student is expected to: investigate homeostasis through the cellular transport of molecules; and

Osmosis
Paramecium Homeostasis
Diffusion - High School STEM Case
Homeostasis - High School STEM Case
Osmosis - High School STEM Case

B.5.D: The student is expected to: compare the structures of viruses to cells and explain how viruses spread and cause disease.

Virus Lytic Cycle

B.6: Science concepts--biological structures, functions, and processes. The student knows how an organism grows and the importance of cell differentiation.

B.6.A: The student is expected to: explain the importance of the cell cycle to the growth of organisms, including an overview of the stages of the cell cycle and deoxyribonucleic acid (DNA) replication models;

Cell Division
Meowsis - High School **STEM Case**

B.6.B: The student is expected to: explain the process of cell specialization through cell differentiation, including the role of environmental factors; and

Embryo Development

B.6.C: The student is expected to: relate disruptions of the cell cycle to how they lead to the development of diseases such as cancer.

Cell Division

B.7: Science concepts--mechanisms of genetics. The student knows the role of nucleic acids in gene expression.

B.7.A: The student is expected to: identify components of DNA, explain how the nucleotide sequence specifies some traits of an organism, and examine scientific explanations for the origin of DNA;

Building DNA
DNA Analysis

B.7.B: The student is expected to: describe the significance of gene expression and explain the process of protein synthesis using models of DNA and ribonucleic acid (RNA);

RNA and Protein Synthesis
Protein Synthesis - High School **STEM Case**

B.7.C: The student is expected to: identify and illustrate changes in DNA and evaluate the significance of these changes; and

Evolution: Mutation and Selection
Evolution: Natural and Artificial Selection
Meowsis - High School **STEM Case**

B.7.D: The student is expected to: discuss the importance of molecular technologies such as polymerase chain reaction (PCR), gel electrophoresis, and genetic engineering that are applicable in current research and engineering practices.

DNA Profiling
GMOs and the Environment
Genetic Engineering

B.8: Science concepts--mechanisms of genetics. The student knows the role of nucleic acids and the principles of inheritance and variation of traits in Mendelian and non-Mendelian genetics.

B.8.A: The student is expected to: analyze the significance of chromosome reduction, independent assortment, and crossing-over during meiosis in increasing diversity in populations of organisms that reproduce sexually; and

Meiosis
Meowsis - High School **STEM Case**

B.8.B: The student is expected to: predict possible outcomes of various genetic combinations using monohybrid and dihybrid crosses, including non-Mendelian traits of incomplete dominance, codominance, sex-linked traits, and multiple alleles.

Chicken Genetics
Fast Plants® 1 - Growth and Genetics
Fast Plants® 2 - Mystery Parent
Mouse Genetics (One Trait)
Mouse Genetics (Two Traits)

B.9: Science concepts--biological evolution. The student knows evolutionary theory is a scientific explanation for the unity and diversity of life that has multiple lines of evidence.

B.9.A: The student is expected to: analyze and evaluate how evidence of common ancestry among groups is provided by the fossil record, biogeography, and homologies, including anatomical, molecular, and developmental; and

Embryo Development

B.10: Science concepts--biological evolution. The student knows evolutionary theory is a scientific explanation for the unity and diversity of life that has multiple mechanisms.

B.10.A: The student is expected to: analyze and evaluate how natural selection produces change in populations and not in individuals;

Evolution: Mutation and Selection
Evolution: Natural and Artificial Selection
Natural Selection
Evolution - High School **STEM Case**

B.10.B: The student is expected to: analyze and evaluate how the elements of natural selection, including inherited variation, the potential of a population to produce more offspring than can survive, and a finite supply of environmental resources, result in differential reproductive success;

Evolution: Mutation and Selection
Evolution: Natural and Artificial Selection
Natural Selection
Evolution - High School **STEM Case**

B.10.D: The student is expected to: analyze evolutionary mechanisms other than natural selection, including genetic drift, gene flow, mutation, and genetic recombination, and their effect on the gene pool of a population.

Evolution - High School **STEM Case**

B.11: Science concepts--biological structures, functions, and processes. The student knows the significance of matter cycling, energy flow, and enzymes in living organisms.

B.11.A: The student is expected to: explain how matter is conserved and energy is transferred during photosynthesis and cellular respiration using models, including the chemical equations for these processes; and

Cell Energy Cycle
Cell Respiration - High School **STEM Case**
Photosynthesis - High School **STEM Case**

B.11.B: The student is expected to: investigate and explain the role of enzymes in facilitating cellular processes.

Cell Respiration - High School **STEM Case**
Enzymes - High School **STEM Case**

B.12: Science concepts--biological structures, functions, and processes. The student knows that multicellular organisms are composed of multiple systems that interact to perform complex functions.

B.12.A: The student is expected to: analyze the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals; and

Digestive System
Enzymes - High School **STEM Case**

B.13: Science concepts--interdependence within environmental systems. The student knows that interactions at various levels of organization occur within an ecosystem to maintain stability.

B.13.A: The student is expected to: investigate and evaluate how ecological relationships, including predation, parasitism, commensalism, mutualism, and competition, influence ecosystem stability;

Food Chain
Ecosystems - High School STEM Case

B.13.B: The student is expected to: analyze how ecosystem stability is affected by disruptions to the cycling of matter and flow of energy through trophic levels using models;

Food Chain
Ecosystems - High School STEM Case

B.13.C: The student is expected to: explain the significance of the carbon and nitrogen cycles to ecosystem stability and analyze the consequences of disrupting these cycles; and

Carbon Cycle
Nitrogen Cycle - High School STEM Case
Ocean Carbon Equilibrium - High School STEM Case

B.13.D: The student is expected to: explain how environmental change, including change due to human activity, affects biodiversity and analyze how changes in biodiversity impact ecosystem stability.

Coral Reefs 1 - Abiotic Factors
Coral Reefs 2 - Biotic Factors
Ecosystems - High School STEM Case
Photosynthesis - High School STEM Case

Chemistry

C.1: Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.

C.1.B: The student is expected to: apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

- Calorimetry Lab
- Ideal Gas Law
- Sticky Molecules
- Titration
- Water Crisis - High School STEM Case

C.1.D: The student is expected to: use appropriate tools such as Safety Data Sheets (SDS), scientific or graphing calculators, computers and probes, electronic balances, an adequate supply of consumable chemicals, and sufficient scientific glassware such as beakers, Erlenmeyer flasks, pipettes, graduated cylinders, volumetric flasks, and burettes;

- Moles
- Titration

C.1.E: The student is expected to: collect quantitative data using the International System of Units (SI) and qualitative data as evidence;

- Calorimetry Lab
- Chemical Equations
- Energy Conversion in a System
- Moles
- Water Crisis - High School STEM Case

C.1.G: The student is expected to: develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

- Covalent Bonds
- Electron Configuration

Element Builder
Ideal Gas Law
Nuclear Decay

C.2: Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

C.2.B: The student is expected to: analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

Electron Configuration
Ionic Bonds
Periodic Trends

C.2.C: The student is expected to: use mathematical calculations to assess quantitative relationships in data; and

Calorimetry Lab
Ideal Gas Law
Moles
Water Crisis - High School STEM Case

C.3: Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions.

C.3.A: The student is expected to: develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

Energy Conversion in a System
Solubility and Temperature
Sticky Molecules
Titration
Water Crisis - High School STEM Case

C.3.B: The student is expected to: communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

Energy Conversion in a System
Melting Points
Solubility and Temperature
Titration
Water Crisis - High School STEM Case

C.5: Science concepts. The student understands the development of the Periodic Table and applies its predictive power.

C.5.B: The student is expected to: predict the properties of elements in chemical families, including alkali metals, alkaline earth metals, halogens, noble gases, and transition metals, based on valence electrons patterns using the Periodic Table; and

Element Builder
Ionic Bonds

C.5.C: The student is expected to: analyze and interpret elemental data, including atomic radius, atomic mass, electronegativity, ionization energy, and reactivity to identify periodic trends.

Electron Configuration
Periodic Trends

C.6: Science concepts. The student understands the development of atomic theory and applies it to real-world phenomena.

C.6.A: The student is expected to: construct models using Dalton's Postulates, Thomson's discovery of electron properties, Rutherford's nuclear atom, Bohr's nuclear atom, and Heisenberg's Uncertainty Principle to show the development of modern atomic theory over time;

Bohr Model of Hydrogen
Bohr Model: Introduction

C.6.B: The student is expected to: describe the structure of atoms and ions, including the masses, electrical charges, and locations of protons and neutrons in the nucleus and electrons in the electron cloud;

Element Builder
Electrons and Chemical Reactions - High School STEM Case

C.6.D: The student is expected to: calculate average atomic mass of an element using isotopic composition; and

Average Atomic Mass
Isotopes

C.6.E: The student is expected to: construct models to express the arrangement of electrons in atoms of representative elements using electron configurations and Lewis dot structures.

Covalent Bonds
Electron Configuration
Element Builder

C.7: Science concepts. The student knows how atoms form ionic, covalent, and metallic bonds.

C.7.B: The student is expected to: name and write the chemical formulas for ionic and covalent compounds using International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules;

Covalent Bonds
Ionic Bonds

C.7.D: The student is expected to: analyze the properties of ionic, covalent, and metallic substances in terms of intramolecular and intermolecular forces.

Melting Points

C.8: Science concepts. The student understands how matter is accounted for in chemical substances.

C.8.A: The student is expected to: define mole and apply the concept of molar mass to convert between moles and grams;

Chemical Equations
Moles
Water Crisis - High School STEM Case

C.8.B: The student is expected to: calculate the number of atoms or molecules in a sample of material using Avogadro's number;

Chemical Equations
Moles
Stoichiometry
Water Crisis - High School STEM Case

C.9: Science concepts. The student understands how matter is accounted for in chemical reactions.

C.9.A: The student is expected to: interpret, write, and balance chemical equations, including synthesis, decomposition, single replacement, double replacement, and combustion reactions using the law of conservation of mass;

Balancing Chemical Equations
Chemical Changes
Chemical Equations

C.9.C: The student is expected to: perform stoichiometric calculations, including determination of mass relationships, gas volume relationships, and percent yield; and

Chemical Equations
Stoichiometry
Water Crisis - High School STEM Case

C.9.D: The student is expected to: describe the concept of limiting reactants in a balanced chemical equation.

Limiting Reactants

C.10: Science concepts. The student understands the principles of the kinetic molecular theory and ideal gas behavior.

C.10.A: The student is expected to: describe the postulates of the kinetic molecular theory;

Temperature and Particle Motion

C.10.B: The student is expected to: describe and calculate the relationships among volume, pressure, number of moles, and temperature for an ideal gas; and

Ideal Gas Law

C.10.C: The student is expected to: define and apply Dalton's law of partial pressure.

Equilibrium and Pressure

C.11: Science concepts. The student understands and can apply the factors that influence the behavior of solutions.

C.11.A: The student is expected to: describe the unique role of water in solutions in terms of polarity;

Sticky Molecules

C.11.C: The student is expected to: investigate how solid and gas solubilities are influenced by temperature using solubility curves and how rates of dissolution are influenced by temperature, agitation, and surface area;

Solubility and Temperature

C.11.E: The student is expected to: calculate the concentration of solutions in units of molarity; and

Titration

C.12: Science concepts. The student understands and applies various rules regarding acids and bases.

C.12.B: The student is expected to: define acids and bases and distinguish between Arrhenius and Bronsted-Lowry definitions;

Titration

C.12.C: The student is expected to: differentiate between strong and weak acids and bases;

Titration

C.12.E: The student is expected to: define pH and calculate the pH of a solution using the hydrogen ion concentration.

Titration
pH Analysis
pH Analysis: Quad Color Indicator

C.13: Science concepts. The student understands the energy changes that occur in chemical reactions.

C.13.B: The student is expected to: investigate the process of heat transfer using calorimetry;

Calorimetry Lab

C.13.C: The student is expected to: classify processes as exothermic or endothermic and represent energy changes that occur in chemical reactions using thermochemical equations or graphical analysis; and

Chemical Changes
Reaction Energy

C.13.D: The student is expected to: perform calculations involving heat, mass, temperature change, and specific heat.

Calorimetry Lab
Energy Conversion in a System

C.14: Science concepts. The student understands the basic processes of nuclear chemistry.

C.14.A: The student is expected to: describe the characteristics of alpha, beta, and gamma radioactive decay processes in terms of balanced nuclear equations;

Nuclear Decay

C.14.B: The student is expected to: compare fission and fusion reactions; and

Nuclear Reactions

Physics

P.1: Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models.

P.1.B: The student is expected to: apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations, and use engineering practices to design solutions to problems;

Air Track
Crumple Zones
Golf Range
Inclined Plane - Sliding Objects
Roller Coaster Physics

P.1.D: The student is expected to: use appropriate tools such as balances, ballistic carts or equivalent, batteries, computers, constant velocity cars, convex lenses, copper wire, discharge tubes with power supply (H, He, Ne, Ar), data acquisition probes and software, dynamics and force demonstration equipment, electrostatic generators, electrostatic kits, friction blocks, graph paper, graphing technology, hand-held visual spectroscopes, inclined planes, iron filings, lab masses, laser pointers, magnets, magnetic compasses, metric rulers, motion detectors, multimeters (current, voltage, resistance), optics bench, optics kit, photogates, plane mirrors, prisms, protractors, pulleys, resistors, rope or string, scientific calculators, stopwatches, springs, spring scales, switches, tuning forks, wave generators, or other equipment and materials that will produce the same results;

Circuits
Inclined Plane - Sliding Objects
Ray Tracing (Lenses)
Ray Tracing (Mirrors)
Ripple Tank

P.1.E: The student is expected to: collect quantitative data using the International System of Units (SI) and qualitative data as evidence;

Energy of a Pendulum
Free-Fall Laboratory
Golf Range
Roller Coaster Physics

P.1.F: The student is expected to: organize quantitative and qualitative data using bar charts, line graphs, scatter plots, data tables, labeled diagrams, and conceptual mathematical relationships;

Air Track
Energy of a Pendulum
Inclined Plane - Sliding Objects
Magnetic Induction
Simple Harmonic Motion

P.1.G: The student is expected to: develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

Crumple Zones
Ripple Tank
Roller Coaster Physics

Simple Harmonic Motion
Waves

P.2: Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs.

P.2.B: The student is expected to: analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

Energy of a Pendulum
Inclined Plane - Sliding Objects

P.2.C: The student is expected to: use mathematical calculations to assess quantitative relationships in data; and

Coulomb Force (Static)
Energy of a Pendulum
Period of Mass on a Spring
Roller Coaster Physics

P.5: Science concepts. The student knows and applies the laws governing motion in a variety of situations.

P.5.A: The student is expected to: analyze different types of motion by generating and interpreting position versus time, velocity versus time, and acceleration versus time using hand graphing and real-time technology such as motion detectors, photogates, or digital applications;

Distance-Time Graphs - Metric
Distance-Time and Velocity-Time Graphs - Metric
Free-Fall Laboratory

P.5.B: The student is expected to: define scalar and vector quantities related to one- and two-dimensional motion and combine vectors using both graphical vector addition and the Pythagorean theorem;

Adding Vectors
Vectors

P.5.C: The student is expected to: describe and analyze motion in one dimension using equations with the concepts of distance, displacement, speed, velocity, frames of reference, and acceleration;

Distance-Time Graphs - Metric
Distance-Time and Velocity-Time Graphs - Metric

P.5.D: The student is expected to: describe and analyze acceleration in uniform circular and horizontal projectile motion in two dimensions using equations;

Feed the Monkey (Projectile Motion)
Golf Range
Uniform Circular Motion

P.5.E: The student is expected to: explain and apply the concepts of equilibrium and inertia as represented by Newton's first law of motion using relevant real-world examples such as rockets, satellites, and automobile safety devices;

Crumple Zones
Fan Cart Physics

P.5.F: The student is expected to: calculate the effect of forces on objects, including tension, friction, normal, gravity, centripetal, and applied forces, using free body diagrams and the relationship between force and acceleration as represented by Newton's second law of motion;

Atwood Machine
Crumple Zones
Fan Cart Physics
Inclined Plane - Simple Machine
Uniform Circular Motion

P.5.G: The student is expected to: illustrate and analyze the simultaneous forces between two objects as represented in Newton's third law of motion using free body diagrams and in an experimental design scenario; and

Crumple Zones

P.6: Science concepts. The student knows the nature of forces in the physical world.

P.6.A: The student is expected to: use scientific notation and predict how the magnitude of the electric force between two objects depends on their charges and the distance between their centers using Coulomb's law;

Coulomb Force (Static)
Pith Ball Lab

P.6.B: The student is expected to: identify and describe examples of electric and magnetic forces and fields in everyday life such as generators, motors, and transformers;

Electromagnetic Induction

P.6.D: The student is expected to: analyze, design, and construct series and parallel circuits using schematics and materials such as switches, wires, resistors, lightbulbs, batteries, voltmeters, and ammeters; and

Circuit Builder
Circuits

P.6.E: The student is expected to: calculate current through, potential difference across, resistance of, and power used by electric circuit elements connected in both series and parallel circuits using Ohm's law.

Advanced Circuits
Circuits

P.7: Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum.

P.7.A: The student is expected to: calculate and explain work and power in one dimension and identify when work is and is not being done by or on a system;

Inclined Plane - Simple Machine

P.7.B: The student is expected to: investigate and calculate mechanical, kinetic, and potential energy of a system;

Energy of a Pendulum
Inclined Plane - Sliding Objects
Potential Energy on Shelves
Roller Coaster Physics
Sled Wars

P.7.C: The student is expected to: apply the concept of conservation of energy using the work-energy theorem, energy diagrams, and energy transformation equations, including transformations between kinetic, potential, and thermal energy;

Air Track
Crumple Zones
Energy of a Pendulum
Inclined Plane - Sliding Objects
Roller Coaster Physics
Sled Wars

P.7.D: The student is expected to: calculate and describe the impulse and momentum of objects in physical systems such as automobile safety features, athletics, and rockets; and

Air Track
Roller Coaster Physics
Sled Wars

P.7.E: The student is expected to: analyze the conservation of momentum qualitatively in inelastic and elastic collisions in one dimension using models, diagrams, and simulations.

2D Collisions
Air Track

P.8: Science concepts. The student knows the characteristics and behavior of waves.

P.8.A: The student is expected to: examine and describe simple harmonic motion such as masses on springs and pendulums and wave energy propagation in various types of media such as surface waves on a body of water and pulses in ropes;

Period of Mass on a Spring
Period of a Pendulum
Simple Harmonic Motion
Waves

P.8.B: The student is expected to: compare the characteristics of transverse and longitudinal waves, including electromagnetic and sound waves;

Waves

P.8.C: The student is expected to: investigate and analyze characteristics of waves, including velocity, frequency, amplitude, and wavelength, and calculate using the relationships between wave speed, frequency, and wavelength;

Waves

P.8.D: The student is expected to: investigate behaviors of waves, including reflection, refraction, diffraction, interference, standing wave, the Doppler effect and polarization and superposition; and

Doppler Shift
Doppler Shift Advanced
Ripple Tank

P.8.G: The student is expected to: describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens.

Ray Tracing (Lenses)
Ray Tracing (Mirrors)

P.9: Science concepts. The student knows examples of quantum phenomena and their applications.

P.9.A: The student is expected to: describe the photoelectric effect and emission spectra produced by various atoms and how both are explained by the photon model for light;

Photoelectric Effect