Embedded Inquiry

Conceptual Strand - *Understandings about scientific inquiry and the ability to conduct inquiry are essential for living in the 21st century.*

Guiding Question - *What tools, skills, knowledge, and dispositions are needed to conduct scientific inquiry?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
GLE 0607.Inq.1 Design and conduct open-ended scientific investigations.	✓0607.Inq.1 Design and conduct an open-ended scientific investigation to answer a question that includes a control and appropriate variables.	SPI 0607.Inq.1 Design a simple experimental procedure with an identified control and appropriate variables.	**Asking Questions and Defining Problems** • Asking questions and defining problems in grades 6–8 builds from grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models. • Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. (MS-PS2-3) • Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1) **Planning and Carrying Out Investigations** • Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions. • Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS2-2) • Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. (MS-PS2-5)
GLE 0607.Inq.2	✓0607.Inq.2	SPI 0607.Inq.2	**Analyzing and Interpreting Data**

Use appropriate tools and techniques to gather, organize, analyze, and interpret data.	Identify tools and techniques needed to gather, organize, analyze, and interpret data collected from a moderately complex scientific investigation.	Select tools and procedures needed to conduct a moderately complex experiment. SPI 0607.Inq.3 Interpret and translate data in a table, graph, or diagram.	• Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1) • Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)
GLE 0607.Inq.3 Synthesize information to determine cause and effect relationships between evidence and explanations.	✓0607.Inq.3 Use evidence from a dataset to determine cause and effect relationships that explain a phenomenon.	SPI 0607.Inq.3 Interpret and translate data in a table, graph, or diagram. SPI 0607.Inq.4 Draw a conclusion that establishes a cause and effect relationship supported by evidence.	**Engaging in Argument from Evidence** • Engaging in argument from evidence in 6–8 builds from K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. • Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-PS2-4) **Connections to Nature of Science** **Scientific Knowledge is Based on Empirical Evidence** Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS2-2),(MS-PS2-4) **Cause and Effect** Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS2-3),(MS-PS2-5) **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)

GLE 0607.Inq.4 Recognize possible sources of bias and error, alternative explanations, and questions for further exploration.	✓0607.Inq.4 Review an experimental design to determine possible sources of bias or error, state alternative explanations, and identify questions for further investigation.	SPI 0607.Inq.5 Identify a faulty interpretation of data that is due to bias or experimental error.	**Engaging in Argument from Evidence** • Engaging in argument from evidence in 6–8 builds from K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. • Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-PS2-4) **Constructing Explanations and Designing Solutions** • Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS-PS3-3)
GLE 0607.Inq.5 Communicate scientific understanding using descriptions, explanations, and models.	✓0607.Inq.5 Design a method to explain the results of an investigation using descriptions, explanations, or models.	SPI 0607.Inq.1 Design a simple experimental procedure with an identified control and appropriate variables. SPI 0607.Inq.3 Interpret and translate data in a table, graph, or diagram.	**Systems and System Models** Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-1),(MS-PS2-4) **Developing and Using Models** • Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to describe unobservable mechanisms. (MS-PS3-2) • Develop and use a model to describe phenomena. (MS-ESS1-1),(MS-ESS1-2)

Embedded Technology & Engineering

Conceptual Strand - *Society benefits when engineers apply scientific discoveries to design materials and processes that develop into enabling technologies.*

Guiding Question - *How do science concepts, engineering skills, and applications of technology improve the quality of life?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
GLE 0607.T/E.1 Explore how technology responds to social, political, and economic needs.	✓0607.T/E.1 Use appropriate tools to test for strength, hardness, and flexibility of materials.	SPI 0607.T/E.1 Identify the tools and procedures needed to test the design features of a prototype.	**Connections to Engineering, Technology, and Applications of Science** **Influence of Science, Engineering, and Technology on Society and the Natural World** The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-PS2-1) **Influence of Science, Engineering, and Technology on Society and the Natural World** • All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1) • The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)
GLE 0607.T/E.2 Know that the engineering design process involves an ongoing series of events that incorporate design constraints, model building, testing, evaluating, modifying, and retesting.	✓0607.T/E.2 Apply the engineering design process to construct a prototype that meets certain specifications.	SPI 0607.T/E.2 Evaluate a protocol to determine if the engineering design process was successfully applied.	**Constructing Explanations and Designing Solutions** • Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1)

			• Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS1-4) **ETS1.B: Developing Possible Solutions** • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to MS-LS2-5) **MS-ETS1-1.** **Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.** **MS-ETS1-2.** **Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.** **MS-ETS1-3.** **Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.** **MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.** **ETS1.A: Defining and Delimiting Engineering Problems** The more precisely a design task’s criteria and constraints can be defined, the more likely it is that

			the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1) **ETS1.B: Developing Possible Solutions** • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3) • Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) • Models of all kinds are important for testing solutions. (MS-ETS1-4) **ETS1.C: Optimizing the Design Solution** • Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3) • The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MSETS1-4)
GLE 0607.T/E.3 Compare the intended benefits with the unintended consequences of a new technology.	✓0607.T/E.3 Explore how the unintended consequences of new technologies can impact society.	SPI 0607.T/E.3 Distinguish between the intended benefits and the unintended consequences of a new technology.	**Constructing Explanations and Designing Solutions** • Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1)

			ETS1.B: Developing Possible Solutions • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to MS-LS2-5) **Influence of Science, Engineering, and Technology on Society and the Natural World** • All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1) • The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)
GLE 0607.T/E.4 Describe and explain adaptive and assistive bioengineered products.	✓0607.T/E.4 Research bioengineering technologies that advance health and contribute to improvements in our daily lives. ✓0607.T/E.5 Develop an adaptive design and test its effectiveness.	SPI 0607.T/E.4 Differentiate between adaptive and assistive engineered products (e.g., food, biofuels, medicines, integrated pest management).	**Not addressed**

Standard 1 – Cells

Conceptual Strand 1 - *All living things are made of cells that perform functions necessary for life.*

Guiding Question 1 - *How are plant and animals cells organized to carry on the processes of life?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
Not addressed at the grade level.			

STEMs TO SUNSHINE

Standard 2 – Interdependence

Conceptual Strand 2 - *All life is interdependent and interacts with the environment.*

Guiding Question 2 - *How do living things interact with one another and with the non-living elements of their environment?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
GLE 0607.2.1 Examine the roles of consumers, producers, and decomposers in a biological community.	✓0607.2.1 Compare and contrast the different methods used by organisms to obtain nutrition in a biological community.	SPI 0607.2.1 Classify organisms as producers, consumers, scavengers, or decomposers according to their role in a food chain or food web.	**MS-LS2-1.** **Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.** **MS-LS2-2.** **Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.** **MS-LS2-5.** **Evaluate competing design solutions for maintaining biodiversity and ecosystem services.** **LS2.A: Interdependent Relationships in Ecosystems** • Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1) • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1) • Growth of organisms and population increases are limited by access to resources. (MS-LS2-1) • Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species
GLE 0607.2.2 Describe how matter and energy are transferred through an ecosystem.	✓0607.2.2 Create a graphic organizer that illustrates how biotic and abiotic elements of an environment interact. ✓0607.2.3 Use a food web or energy pyramid to demonstrate the interdependence of organisms within a specific biome.	SPI 0607.2.2 Interpret how materials and energy are transferred through an ecosystem. SPI 0607.2.3 Identify the biotic and abiotic elements of the major biomes.	

			involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2) **LS2.B: Cycle of Matter and Energy Transfer in Ecosystems** • Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4) • Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5)
GLE 0607.2.3 Draw conclusions from data about interactions between the biotic and abiotic elements of a particular environment.	✓0607.2.3 Use a food web or energy pyramid to demonstrate the interdependence of organisms within a specific biome. ✓0607.2.4	SPI 0607.2.2 Interpret how materials and energy are transferred through an ecosystem. SPI 0607.2.3 Identify the biotic and abiotic elements of the major biomes.	**MS-LS2-3.** **Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.** **MS-LS2-4.**

	Create poster presentations to illustrate differences among the world's major biomes.	SPI 0607.2.4 Identify the environmental conditions and interdependencies among organisms found in the major biomes.	**Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.**
GLE 0607.2.4 Analyze the environments and the interdependence among organisms found in the world's major biomes.	✓0607.2.3 Use a food web or energy pyramid to demonstrate the interdependence of organisms within a specific biome. ✓0607.2.4 Create poster presentations to illustrate differences among the world's major biomes.	SPI 0607.2.4 Identify the environmental conditions and interdependencies among organisms found in the major biomes.	**LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4) • Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5) **LS4.D: Biodiversity and Humans** • Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary to MS-LS2-5)

Standard 3 – Flow of Matter & Energy

Conceptual Strand 3 – *Matter and energy flow through the biosphere.*

Conceptual Strand 3 – *Matter and energy flow through the biosphere.*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
Not addressed at the grade level.			

Standard 4 – Heredity

Conceptual Strand 4 – *Plants and animals reproduce and transmit heredity information.*

Guiding Question 4 – *What are the principal mechanisms by which living things reproduce and transmit information between parents and offspring?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
Not addressed at the grade level.			

Standard 5 – Biodiversity & Change

Conceptual Strand 5 – *A rich diversity of complex organisms have developed in response to a continually changing environment.*

Guiding Question 5 – *How does natural selection explain haw organisms have changed over time?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
Not addressed at the grade level.			

Standard 6 – The Universe

Conceptual Strand 6 – *The cosmos is vast and explored well enough to know basic structures and operational principals.*

Guiding Question 6 – *What big ideas guide human understanding about the origin and structure of the universe, Earth's place in the cosmos, and observable motions and patterns in the sky?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
GLE 0607.6.1 Analyze information about the major components of the universe.	✓0607.6.1 Use data to draw conclusions about the major components of the universe.	SPI 0607.6.1 Use data to draw conclusions about the major components of the universe.	**MS-ESS1-2.** **Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.** **MS-ESS1-3.** **Analyze and interpret data to determine scale properties of objects in the solar system.** **MS-ESS1-4.** **Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.** **ESS1.A: The Universe and Its Stars** • Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) • Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2) **ESS1.B: Earth and the Solar System** • The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MSESS1-3) • This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun.

			The seasons are a] result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1) • The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2) **ESS1.C: The History of Planet Earth** The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.
GLE 0607.6.2 Describe the relative distance of objects in the solar system from earth.	✓0607.6.2 Construct a model of the solar system showing accurate positional relationships and relative distances.	SPI 0607.6.2 Explain how the relative distance of objects from the earth affects how they appear.	**MS-ESS1-3.** **Analyze and interpret data to determine scale properties of objects in the solar system.** **ESS1.A: The Universe and Its Stars** • Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) • Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2) **ESS1.B: Earth and the Solar System** • The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MSESS1-3) • This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a] result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1) •

<table>
<tr>
<td>GLE 0607.6.3

Explain how the positional relationships among the earth, moon, and sun control the length of the day, lunar cycle, and year.</td>
<td>✓0607.6.3

Investigate how the earth, sun, and moon are responsible for a day, lunar cycle, and year.
✓0607.6.4

Explain why the positions of the earth, moon, and sun were used to develop calendars and clocks.</td>
<td>SPI 0607.6.3

Distinguish among a day, lunar cycle, and year based on the movements of the earth, sun, and moon.</td>
<td rowspan="5">MS-ESS1-1.
Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

ESS1.A: The Universe and Its Stars
• Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1)
• Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2)

ESS1.B: Earth and the Solar System
• The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MSESS1-3)
• This model of the solar system can explain eclipses of the sun and the moon. Earth’s spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a] result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)</td>
</tr>
<tr>
<td>GLE 0607.6.4

Describe the different stages in the lunar cycle.</td>
<td>Not addressed</td>
<td>SPI 0607.6.4

Explain the different phases of the moon using a model of the earth, moon, and sun.</td>
</tr>
<tr>
<td>GLE 0607.6.5

Produce a model to demonstrate how the moon produces tides.</td>
<td>✓0607.6.5

Illustrate the positions of the earth, moon, and sun during specific tidal conditions.</td>
<td>SPI 0607.6.5

Predict the types of tides that occur when the earth and moon occupy various positions.</td>
</tr>
<tr>
<td>GLE 0607.6.6

Illustrate the relationship between the seasons and the earth-sun system.</td>
<td>✓0607.6.6

Diagram the relationship of the earth and sun that accounts for the seasons.</td>
<td>SPI 0607.6.6

Use a diagram that shows the positions of the earth and sun to explain the four seasons.</td>
</tr>
<tr>
<td>GLE 0607.6.7

Describe the causes of lunar and solar eclipses.</td>
<td>✓0607.6.7

Model the positions of the earth, moon, and sun during solar and lunar eclipses.</td>
<td>SPI 0607.6.7

Explain the difference between a solar and a lunar eclipse.</td>
</tr>
</table>

Standard 7 – The Earth

Conceptual Strand 7 - *Major geologic events that occur over eons or brief moments in time continually shape and reshape the surface of the Earth, resulting in continuous global change.*

Guiding Question 7 - *How is the earth affected by long-term and short term geological cycles and the influence of man?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
Not addressed at the grade level.			

STEMs TO SUNSHINE

Standard 8 - The Atmosphere

Conceptual Strand 8 - *The earth is surrounded by an active atmosphere and an energy system that controls the distribution life, local weather, climate, and global temperature.*

Guiding Question 8 - *How do the physical characteristics and the chemical makeup of the atmosphere influence surface processes and life on Earth?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
GLE 0607.8.1 Design and conduct an investigation to determine how the sun drives atmospheric convection.	✓0607.8.1 Recognize how convection currents in the atmosphere produce wind.	SPI 0607.8.1 Analyze data to identify events associated with heat convection in the atmosphere.	**MS-ESS2-1.** **Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.** **MS-ESS2-4.** **Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.** **MS-ESS2-5.** **Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.** **MS-ESS2-6.** **Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.** **ESS2.A: Earth's Materials and Systems** • All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1) • The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to
GLE 0607.8.2 Describe how the sun's energy produces the wind.	✓0607.8.2 Design an experiment to investigate differences in the amount of the sun's energy absorbed by a variety of surface materials.	SPI 0607.8.2 Recognize the connection between the sun's energy and the wind.	
GLE 0607.8.3 Investigate the relationship between currents and oceanic temperature differences.	✓0607.8.3 Design an experiment to demonstrate how ocean currents are associated with the sun's energy. ✓0607.8.4 Analyze ocean temperature data to demonstrate how these conditions affect the weather in nearby land masses. ✓0607.8.5 Interpret data found on ocean current maps.	SPI 0607.8.3 Describe how temperature differences in the ocean account for currents.	
GLE 0607.8.4 Analyze meteorological data to predict weather conditions.	✓0607.8.6 Use data collected from instruments such as a barometer, thermometer, psychrometer, and anemometer to describe local weather conditions.	SPI 0607.8.4 Interpret meteorological data to make predictions about the weather.	

			billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2) **ESS2.C: The Roles of Water in Earth's Surface Processes** • Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) • The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MSESS2-5) • Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4) • Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6) • Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (MS-ESS2-2) **ESS2.D: Weather and Climate** • Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6) • Because these patterns are so complex, weather can only be predicted

Standard 9 – Matter

Conceptual Strand 9 - *The composition and structure of matter is known, and it behaves according to principles that are generally understood.*

Guiding Question 9 - *How does the structure of matter influence its physical and chemical behavior?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
Not addressed at the grade level.			

STEMs TO SUNSHINE

Standard 10 - Energy

Conceptual Strand 10 - *Various forms of energy are constantly being transformed into other types without any net loss of energy from the system.*

Guiding Question 10 - *What basic energy related ideas are essential for understanding the dependency of the natural and man-made worlds on energy?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
GLE 0607.10.1 Compare and contrast the three forms of potential energy.	✓0607.10.1 Compare potential and kinetic energy. ✓0607.10.2 Create a poster that illustrates different forms of potential energy.	SPI 0607.10.1 Distinguish among gravitational potential energy, elastic potential energy, and chemical potential energy.	**MS-PS3-2.** **Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.** **PS3.A: Definitions of Energy** • Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (MS-PS3-1) • A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2) • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3),(MS-PS3-4)
GLE 0607.10.2 Analyze various types of energy transformations.	✓0607.10.3 Design a model that demonstrates a specific energy transformation.	SPI 0607.10.2 Interpret the relationship between potential and kinetic energy.	**MS-PS3-1.** **Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.** **MS-PS3-3.** **Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.** **MS-PS3-4.** **Plan an investigation to determine the relationships among the energy transferred, the type of matter,**

GLE 0607.10.3 Explain the principles underlying the Law of Conservation of Energy.	✓0607.10.4 Explain why a variety of energy transformations illustrate the Law of Conservation of Energy.	SPI 0607.10.3 Recognize that energy can be transformed from one type to another. SPI 0607.10.4 Explain the Law of Conservation of Energy using data from a variety of energy transformations.	**the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.** **MS-PS3-5.** **Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.** **PS3.B: Conservation of Energy and Energy Transfer** • When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5) • The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4) • Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3) **PS3.C: Relationship Between Energy and Forces** When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2) **ETS1.A: Defining and Delimiting an Engineering Problem** The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. (secondary to MS-PS3-3) **ETS1.B: Developing Possible Solutions** A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well

			they meet criteria and constraints of a problem. (secondary to MS-PS3-3) **Energy and Matter** • Energy may take different forms (e.g. energy in fields, thermal energy, and energy of motion). (MS-PS3-5) • The transfer of energy can be tracked as energy flows through a designed or natural system. (MSPS3-3)

STEMs TO SUNSHINE

Standard 11 – Motion

Conceptual Strand 11 - *Objects move in ways that can be observed, described, predicted, and measured.*
Guiding Question 11 - *What causes objects to move differently under different circumstances?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
Not addressed at the grade level.			

STEMs TO SUNSHINE

Standard 12 - Forces in Nature

Conceptual Strand 12 - *Everything in the universe exerts a gravitational force on everything else; there is an interplay between magnetic fields and electrical currents.*
Guiding Question 12 - *What are the scientific principles that explain gravity and electromagnetism?*

Grade Level Expectations (GLE)	Checks For Understanding (CFU)	State Performance Indicator (SPI)	Next Generation Science Standards (NGSS)
GLE 0607.12.1 Describe how simple circuits are associated with the transfer of electrical energy.	✓0607.12.1 Prepare a poster that illustrates how electricity passes through a simple circuit to produce heat, light, or sound.	SPI 0607.12.1 Identify how simple circuits are associated with the transfer of electrical energy when heat, light, sound, and chemical changes are produced.	**MS-PS2-3.** **Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.** **MS-PS2-5.** **Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.** **PS2.B: Types of Interactions** • Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3) • Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS-PS2-4) • Forces that act at a distance (electric and magnetic) can be explained by fields that extend through space and can be mapped by their effect on a test object (a ball, a charged object, or a magnet, respectively). (MS-PS2-5)
GLE 0607.12.2 Explain how simple electrical circuits can be used to determine which materials conduct electricity.	✓0607.12.2 Determine a material's electrical conductivity by testing it with a simple battery/bulb circuit. ✓0607.12.3 Compare and contrast the characteristics of objects and materials that conduct electricity with those that are electrical insulators.	SPI 0607.12.2 Identify materials that can conduct electricity.	