2020 Oklahoma Academic Standards for Science

Interim Science Curriculum Frameworks: 6th Grade

With the revision of the Oklahoma Academic Standards for Science (OAS-S) in the Spring of 2020, it has been a priority of the Oklahoma State Department of Education (OSDE) to ensure Oklahoma educators are provided with the opportunity to deeply understand the instructional shifts needed to fully meet the intent of the standards, while also supporting educators with a vision and resources that promote effective implementation of the standards.

Placement changes were made to the Oklahoma Academic Standards for Middle School Science to provide stronger learning connections within a grade-level and strengthen learning progressions across the 6th-8th grade band standards. To support school districts and educators as they begin implementing the 2020 Middle School Science standards, the OSDE has developed a supplemental document that will serve as interim middle school level science curriculum frameworks for the 2020-21 school year

The Interim Science Curriculum Frameworks showcase how the 2020 OAS-S can be bundled together within a given grade level to support classroom instruction and to help educators see some of the connections across standards. These instructional bundles serve as one-way school districts or educators might choose to develop a unit of study that incorporates multiple standards or performance expectations. However, districts and educators might have different connections and combinations that drive the instruction provided to students.

As with the existing Oklahoma Curriculum Frameworks for Science, the interim frameworks provide an explanation of the standards or performance expectations in lay-terms, known as “In a Nutshell.” This is followed by a 3D Storyline, which provides a narrative for educators about how the three dimensions of science (disciplinary core ideas, crosscutting concepts, and science and engineering practices) intersect to support students in reaching mastery of a standard or performance expectation, and each instructional bundle includes Student Actions, and Student Misconceptions paired with Actual Concepts.

New to the Interim Science Curriculum Frameworks are the links to free and open instructional resources which include lessons, units, and other instructional supports that are aligned with the standards in a given instructional bundle. The instructional resources linked serve as examples that teachers or districts might use. However, determinations about curriculum and instructional resources used by districts or teachers are decided at the local level. If the instructional resources provided in the curriculum frameworks are utilized, please ensure that best practices for science safety as well as school or district policies for science safety are followed.

Upcoming Revisions for All Science Frameworks

Beginning in the 2020-2021 school year, the OSDE will be working with Oklahoma educators to revise and add to the existing Oklahoma Science Curriculum Frameworks. This will involve the expansion of resources for currently included grade-levels and courses, as well as the additions of Pre-Kindergarten, Physics, Environmental Science, and Earth and Space Science Frameworks. Applications to participate in this process will be available later this fall.

For questions or feedback on the interim curriculum frameworks, please email heather.johnston@sde.ok.gov.

6th Grade Science Interim Curriculum Frameworks

Physical Sciences

Performance Expectations		Bundle	Timeline
6.PS1.4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.	Energy as Temperature and Waves	6-7 Weeks
6.PS3.3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. *		
6.PS3.4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.		
6.PS4.2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.		

Life Sciences

Performance Expectations		Bundle	Timeline
6.LS1.1	Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.	Molecules to Organisms: Structures and Processes	7-8 Weeks
6.LS1.2	Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.		
6.LS1.3	Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.		

6.LS1.8	Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.		
Earth and Space Sciences			
Performance Expectations		**Bundle**	**Timeline**
6.ESS1.4	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's geologic history.	Energy Flow and Geoscience Processes	6-7 Weeks
6.ESS2.1	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives these processes within and among Earth's systems.		
6.ESS2.2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.		
6.ESS2.3	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.		
Performance Expectations		**Bundle**	**Timeline**
6.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.	Earth Systems and Interactions	8-9 Weeks
6.ESS2.5	Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.		
6.ESS2.6	Develop and use a model to describe how unequal heating and rotation of the Earth causes patterns of atmospheric and oceanic circulation that determine regional climates.		

6.ESS3.2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.		

*Standard includes engineering concepts.

Bundle: Energy as Temperature and Waves	
Timeline: 6-7 Weeks	
Performance Expectations	
6.PS1.4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
6.PS3.3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.*
6.PS3.4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
6.PS4.2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
In a Nutshell	
Students should be able to understand that temperature is a measurement used to determine how fast the particles are moving inside of a substance or how much energy the substance contains. Students should be able to understand that the state of matter is determined by the temperature and pressure of a substance, the amount of a substance and the type of substance will all affect the total amount of energy it has. Students should also understand the difference between heat and temperature, which the term heat, in science, refers to the transfer of thermal energy. Whether a wave in water, a sound wave, or a light wave, all waves have some features in common. A wave is a disturbance involving the transfer of energy from place to place. The wave itself is not moving. It transfers energy. Each wave has a repeating pattern of wavelengths, frequency, and amplitude that allows for energy or information to travel distances. When waves encounter different materials they can be reflected, absorbed, or transmitted.	

3-Dimensional Storyline
Woven throughout this bundle is the movement and transfer of energy. Energy is a single quantity due to the fact that a system's total energy is conserved. Thermal energy, kinetic energy and the energy found in light and sound waves are included in this bundle. Students should understand that the temperature of matter is really a measurement of the matter's average kinetic energy. The state of matter, the amount of matter, and type of matter will affect the amount of energy it contains. Matter in a solid state has a low energy level, the particles are in a fixed position and may vibrate in position but will not change location. Matter in a liquid state has a higher energy level than a solid, as the particles are freer to move and change location and are constantly in contact with other liquid particles. Matter in a gas state has an even higher energy level and is spaced out and may only come in contact with other particles upon random collisions. In this bundle, students should be able to develop models for each state of matter and predict how the model would change with the changes in state of the matter. Matter that goes through a change in internal temperature or pressure, can undergo a phase (state) change. If matter is in a solid state, and its internal temperature is increased (or the pressure is decreased or both), the matter will transform into a liquid state (called the melting point). If you continue to add thermal energy (and thus kinetic energy) to the matter (or further decrease pressure), the matter will reach its boiling point and it will begin vaporization; changing from a liquid into a gaseous state. If the particles in matter change directly from a solid state to a gaseous state; this process is called sublimation and can be achieved through the addition of temperature or a decrease in pressure. If the internal temperature of matter is decreased changing from a gas to liquid, this is called condensation. When matter changes from a liquid to a solid state, it has reached its freezing point. The process of physically changing directly from a gas to a solid is known as deposition. To create a solid from a liquid, you might have to decrease the temperature by a large amount and then add pressure. For example, oxygen (O2) will solidify at -218.8 degrees Celsius at standard pressure. However, it will freeze at warmer temperatures when the pressure is increased. Students should be able to develop models to demonstrate both phase change and energy transfer within the system to predict and/or describe these processes. Students should be able to construct

explanations to show that through a phase transition, no energy is created or destroyed just transformed and/or transferred within the system.

In these performance expectations, students should understand the difference between heat energy, temperature, and thermal energy. Heat energy is a term used in science to refer to the energy transferred due to the temperature difference between two objects. The transfer of heat is always from hotter objects to colder ones. Temperature is a measure of the average kinetic energy of the particles in a material. The more kinetic energy particles have, the higher the material's temperature will be. Thermal energy is a term used when referring to the internal energy of an object. There is a proportional relationship between temperature and total energy of a system, which depends on types, states and amount of matter in the system. The amount of matter in a system will affect the amount of energy needed to change the temperature of the matter. The more atoms, the more energy the substance will need in order to undergo a phase change. Although materials have the ability to undergo phase transitions, the total amount of energy in a system will not change. Transfers of energy happen when objects collide and when they transfer from hotter objects to colder ones. This transfer of energy can change the overall temperature of the matter and is directly proportional to the amount of energy transferred, the amount of matter present, and the environment. Energy is transferred out of hotter regions or objects and into colder ones in three different ways—by conduction within solids, by the flow of liquid or gas (convection), and by radiation, which can travel across space. Students should understand that within these energy transfers, the total energy is not lost or gained. Students should be able to apply their knowledge of heat energy to construct and test a device that either minimizes or maximizes the transfer of heat energy between two objects or mediums. Students can analyze the data to detect patterns in the transfer of heat energy between objects or mediums.

There are different kinds of waves such as sound, light and mechanical waves. Waves travel in straight lines. A wave carries energy from a source to a point some distance away. All waves transmit energy not matter. Waves can vary in the amount of energy they carry as well as how fast or slow they move. Sound and light both are composed of waves. Two different models are needed to explain the behavior of light waves. The particle model explains light as a stream of tiny particles of energy called photons. When a beam of high frequency light shines on some metals, it causes electrons to move so much they can be knocked out of the metal. A wave model is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. For example, when light shines on an object, it is

reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. When waves are absorbed by a surface, the energy of the wave is transferred to the particles in the surface. When sound waves are reflected quickly it produces an echo.

Also, the path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. Using this information, students can develop and use models to describe that waves are reflected, absorbed, or transmitted through various materials. Examples of models could include drawings, simulations, and written descriptions. Geologists use seismic waves and their reflection at interfaces between layers to probe structures deep in the planet. Through an understanding that structures can be designed to serve particular functions by taking into account properties of different materials, students can design structures that absorb, reflect, and refract light or sound waves.

Student Actions

Students will be able to:

- Develop a model to describe the motion of atoms and/or molecules in a solid, liquid and gas state.
- Construct an argument using evidence to explain that temperature is a measure of the average kinetic energy contained in the particles of matter and that temperature is not a direct measure of a system's total thermal energy.
- Plan and carry out an investigation to determine that total thermal energy depends on state, type of matter, and number of atoms in the system.
- Use mathematics and computational thinking to describe the phenomena that the temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule
- Explain from evidence that the changes of state occur with variations in temperature and/or pressure.
- Plan an investigation to observe that the transfer of thermal energy is transferred from hotter regions or objects to colder ones.
- Explain from evidence that the term "heat" refers to transfer of thermal energy.
- Construct and test a device that either minimizes or maximizes the transfer of heat energy between two objects or mediums.

- Modify a design based on data analysis to improve the efficiency of a device to reduce or increase the amount of energy that is transferred.
- Develop a model to describe how sound waves require a medium in order to be transmitted and how the type of medium affects the characteristics of the sound waves.
- Analyze data to construct an explanation that light can travel through space and does not need to travel through a medium.
- Plan and conduct an investigation to describe, test, and predict the behavior of light when it shines on an object, is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light.
- Plan and carry out investigations that describe, test and predict the path that light travels when it passes between different transparent materials (e.g., air and water, air and glass).
- Use a wave model to describe how the path of light is affected when it moves from one medium to another (e.g. air to water) and how this difference in medium can affect the brightness and color (i.e. frequency-dependency) of the light traveling through the various mediums.
- Use models to describe that light behaves as both a wave and a particle.

Key Misconceptions	Key Understandings
1. Atoms of a solid are not moving. 2. Particles of a gas are closely packed with no empty space between them. 3. Solid substances do not expand or contract with changes in temperature. 4. The mass of atoms or molecules of a substance increases when temperature increases and decreases when the temperature increases. 5. The molecules of a substance break down into individual atoms when the substance boils/evaporates. During evaporation, water breaks down into hydrogen and oxygen.	1. All atoms and molecules are in constant motion. 2. There are differences in the spacing, motion, and interaction of atoms and molecules that make up solids, liquids, and gases. 3.-4. For any single state of matter, increasing the temperature typically increases the distance between atoms or molecules. Therefore, most substances expand when heated. 5.-7. When heated, solids can change into liquids and liquids can change into gases. When cooled, gases can change into liquids and liquids can change into solids. These changes of state can be

6.	Heat is made of “heat molecules”.		explained in terms of changes in the proximity, motion, and interaction of atoms and molecules.
7.	Molecules change shape during a phase change.	8.	For any single state of matter, the average speed of the atoms or molecules increases as the temperature of a substance increases and decreases as the temperature of a substance decreases
8.	Increasing the speed/kinetic energy of a substance does not change the temperature of a substance.	9.-11.	Thermal energy is associated with the temperature and the mass of an object and the material of which the object is made.
9.	Thermal energy is not related to the material of the matter.	12.-13.	Energy can be transformed (converted) within a system.
10.	Thermal energy is not related to the mass of the object.	14.-15.	Energy can be transferred from one system to another (or from a system to its environment) in different ways: by conduction, mechanically, electrically, or by radiation (electromagnetic waves).
11.	Inanimate objects do not have any thermal energy.	16.	Waves travel through a medium.
12.	Energy can be created.	17.	Waves travel the same speed if in the same medium.
13.	Energy can be transformed into a force.	18.	Light travels in straight lines, but the path of light is bent at the interface between materials when it travels from one material to another.
14.	Energy is not transferred from one object to the other unless they are in direct contact with one another.	19.	Waves interact with materials by being reflected, absorbed, transmitted.
15.	When two objects of different temperatures are in contact with each other, thermal energy is transferred from the warmer to the cooler object and “cold energy” is also transferred from the colder object to the warmer object.	20.	Refraction is the change in direction of propagation of a wave due to a change in its transmission medium.
16.	Waves transport matter.		
17.	There must be a medium for a wave to travel through.		
18.	Waves do not have energy.		
19.	Big waves travel faster than small waves in the same medium.		
20.	In refraction, the characteristics of light change.		
21.	There is no interaction between light and matter.		

	21. Light interacts with matter in different ways.
Free and Open Instructional Resources	
K20 Center 6.PS1.4	Phenomenon-Based Instructional Task: Look What You've Done – I'm Melting! ● This resource provides guidance on using two different phenomena (dry ice at room temperature and gallium melting in the palm of a hand) to engage students with energy and matter science concepts ● Also includes a formative assessment task and rubric to evaluate student thinking on energy and states of matter using an analogous phenomenon (ice fumaroles).
OpenSciEd Unit 6.PS1.4, 6.PS3.3, 6.PS3.4, 6.PS4.2	Unit on Thermal Energy: How can containers keep stuff from warming up or cooling down? ● Description: This unit bundles multiple standards to support student learning around thermal energy transfer. ● Includes teacher and student videos, simulations, teacher guide, student worksheets, and formative assessments.
GRC Lesson 6.PS1.4 & 6.PS3.5	Lesson: Dye in Motion ● Phenomenon: Food coloring moves differently in hot water than cold water. ● Description: Students will learn about the science concepts associated with particle motion, temperature and heat. It includes a formative assessment.
GRC Lesson 6.PS1.4 & 6.PS3.4	Lesson: Breathless ● Phenomenon: When water changes from one state (phase) to another, energy is involved. ● Description: Students will learn about the science concepts associated with particle motion, temperature and heat. It is written around the 5E Learning cycle and includes 3 analogous phenomena and a formative assessment.
GRC Lesson 6.PS3.3	Lesson: Keeping it Cold ● Phenomenon: An ice cube melts faster when placed directly on the countertop than on a towel. ● Description: Students will construct and test a device that either minimizes or maximizes thermal energy transfer. It also includes a formative assessment.

GRC Lesson 6.PS3.3	Lesson: Orange Glow ● Phenomenon: Spacecraft re-enter Earth's atmosphere at 1648 degrees Celsius. ● Description: Students will construct and test a device that either minimizes or maximizes thermal energy transfer. It also includes a formative assessment.
GRC Lesson 6.PS3.4	Lesson: Hot Rocks ● Phenomenon: A small bite of hot cheese pizza does not burn my mouth, but a big bite burns my mouth. ● Description: Students will learn about the science concepts associated with heat energy and kinetic motion of molecules. It includes a formative assessment.
GRC Lesson 6.PS4.2	Lesson: The Original AutoTune ● Phenomenon: Speaking into a fan causes my voice to change. ● Description: Students will learn how to develop models that illustrate when waves are reflected, absorbed, or transmitted through various materials.
NGSS Concord Assessment 6.PS1.4 & 6.PS3.4	Assessment tasks that can be used to gain insights into students' progress in building proficiency towards a performance expectation. ● Scroll down to Energy - click on blue LP Question Links

Bundle: Molecules to Organisms – Structures and Processes	
Timeline: 7-8 Weeks	
Performance Expectations	
6.LS1.1	Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
6.LS1.2	Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
6.LS1.3	Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
6.LS1.8	Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
In a Nutshell	
Cells are the smallest unit that can be considered alive. All living things are made of one or more cells. Some cells contain structures which carry out specific functions within the cell. In multicellular organisms, groups of cells work together to perform tasks and are called tissues, groups of tissues may work together to form organs that, together, perform a particular function in the body. In response to environmental stimuli, signals are transmitted along nerve cells to the brain, which are then processed by the brain. The brain then produces memories and/or behaviors as a result of the processed stimuli. Students should be able to understand this process and explain that memories or behaviors are a result of sensory receptors responding to environmental stimuli by sending messages to the brain.	
3-Dimensional Storyline	
With this set of expectations, students will discover all living things are made of cells. Microscopes (or internet images) allow students to observe cells directly, while an enlarged model of the cell provides a more in-depth examination of the organelles within the cell. Structure of cells and the parts of the cell is always related to	

function. By making and observing models, students will get a better understanding of scale and proportion and how the structure of the organelles contributes to this function. Students will also understand how the cells form a network of systems which ultimately run entire organisms.

Through this bundle, students will understand that the smallest unit of life is the cell. Students will plan and carry out investigations to discover some organisms are made up entirely of one cell (unicellular) while others may contain many different numbers (multicellular) and kinds of cells. Unicellular organisms (microorganisms), like multicellular organisms, need food, water, a way to dispose of waste, and an environment in which they can live. Cells have specialized structures which are responsible for these specialized functions within the cell to include: the cell membrane (the boundary that controls what enters and leaves the cell), nucleus (where genetic material is located within the cell, the control center of the cell), cell wall (provides support and protection in plant cells), chloroplasts (the location of photosynthesis in plant, algae or phytoplankton cells) and mitochondria (powerhouse of the cell - where energy-rich molecules for the cell (ATP) are created). Organelles perform their individual functions, and then work together to perform the function of the cell as a whole.

Students will engage in argument from evidence to explain that cells work as individual units, and in multicellular organisms, the body is a system of these multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues or organs that are specialized for particular body functions. A group of similar cells working together to perform a task makes up tissues, a group of tissues working together forms organs, and several organs may work together to complete the tasks for an entire organism; for example, a group of cardiac cells work together to form a valve in the heart; several kinds of tissue (including muscle tissue) make up the heart (an organ) which pumps blood to the lungs (another organ) and to the body to deliver oxygen to every cell and pick up wastes via arteries and veins. All of these subunits work together as the cardiovascular system which is one of many body systems that work together to perform the functions of the entire body.

Students are expected to gather and synthesize information about the sensory receptors that respond to stimuli. Stimuli include anything that incites or induces an action to a response. In turn, nerve cells transmit this stimuli input as signals to the brain. When the brain receives these signals, they are processed and can result in either a behavior or storage of

a memory. A crosscutting concept that can be utilized to aid in the understanding of information processing is cause and effect relationships. For example, a stimulus, such as touching a hot stove, will be detected as input through sensory receptors in skin cells. A signal is sent to the brain via nerve cells where the brain interprets this signal as pain resulting in an immediate response or behavior such as pulling the hand away from the hot object. This example can also result in memory being stored regarding hot objects and pain.

Inquiry based investigations allow students to gather and synthesize information that pertains to various sense receptors and the type of input that can occur (electromagnetic, mechanical, chemical). Stimuli is obtained through the various senses of an organism. An investigation might include having students close their eyes as they listen to a variety of different sounds or music. The stimuli may evoke different behaviors or memories in students.

Sometimes, the stimuli may cross over into more than one sense. For instance, the relationship between the sense of taste and smell are very related and have a cause and effect relationship. The understanding of active membrane receptors, neural systems for taste and smell, and odor receptors in the upper nasal cavity can aid each other. Students can investigate this relationship. At this grade level, students should be able to explain that past experiences (memories) allow us to perceive and interpret stimuli, such as sights and smells, in unique ways. Students should be able to provide a basic and conceptual explanation that sensory cells respond to stimuli in the environment.

Student Actions

Students Will...

- Engage in an argument from evidence to differentiate between living and non-living cells.
- Conduct an investigation to produce data to demonstrate organisms are made up of cells.
- Conduct an investigation to produce data that organisms may be unicellular or multicellular.
- Develop a model to demonstrate that cells are the smallest unit of life.
- Develop a model to describe the primary role of the nucleus, chloroplast, and mitochondria.
- Develop a model to demonstrate the structure and function of the cell membrane, which forms the boundary that controls what enters and leaves the cell and the cell wall, which provides extra support for the plant cell.

- Engage in argument from evidence that plant cells contain structures that animal cells do not (i.e. chloroplasts and cell wall).
- Use a written argument supported by evidence to explain that the body is a system of multiple interacting subsystems.
- Develop a model to demonstrate that the body subsystems are groups of cells that work together to form tissues and organs that perform specialized functions for the body.
- Plan and carry out an investigation to show that a stimulus can cause a behavior to occur.
- Analyze data, including first hand experiences, to show that a stimulus can cause a memory to form.
- Effectively communicate information to explain that sensory receptors respond to stimuli resulting in immediate behaviors and/or memories.
- Develop a model to show how sensory receptors respond to different inputs and transmit signals along the nerve cells.
- Use a model to explain that nerve signals are received and processed in the brain, which results in behavior or memories.

Key Misconceptions	Key Understandings
1. All cells are the same size and shape, (i.e. there is a generic cell). 2. There are no single-celled organisms. 3. Some living parts of organisms are not made of cells. 4. Cells do not carry out essential life functions for themselves: they do not require water they do not extract energy from food, they do not eliminate their own wastes, they do not reproduce, they do not make molecules for their own growth and repair. 5. Cells are not organized into the body structures of the organism they are part of.	1. Although there are many different types of cells in terms of size, structure, and function, all cells have certain characteristics in common. 2. All living things are composed of one or more cells. 3. All living things are composed of one or more cells. 4. Cells carry out essential life functions. 5. Different body structures are made up of different types of cells. 6. Reaction/response rates to stimuli can vary from person to person. 7. Different stimuli can result in different reaction/response times.

6. Everyone has the same reaction/response rate to stimuli. 7. There is no difference in reaction time using different stimuli. 8. Lack of sleep has no effect on reaction time. 9. Stress does not affect reaction time.	8. Lack of sleep can result in slower processing and slower reaction/response times. 9. Stress can have a negative effect on reaction/response time.

Free and Open Instructional Resources	
GRC Lesson 6.LS1.1	Lesson: Onion Cells ● Phenomenon: Onion cells look different than diatoms cells. ● Description: This lesson requires a microscope so that students can investigate how all living things are made of cells. It includes a formative assessment.
GRC Lesson 6.LS1.1	Lesson: Pond Life 1 ● Phenomenon: There are living organisms in pond water that can only be seen using a microscope. ● Description: This investigation requires a microscope so that students can investigate pond water. It includes a formative assessment.
GRC Lesson 6.LS1.2	Lesson: Pond Life 2 ● Phenomenon: Some single-celled organisms in pond water can move. ● Description: This lesson builds on Pond Life 1 to begin focusing on cell structure and function. A microscope is not needed and there is a formative assessment.
GRC Lesson 6.LS1.2	Lesson: Green Leaves **This investigation can be done at home with a support.** ● Phenomenon: Leaves are darker on the top as compared to the underside. ● Description: This lesson focuses on the science ideas around cell structure and function, and supports students in developing investigative questions. A formative assessment is included.

GRC Lesson 6.LS1.3	Lesson: Health Report ● Phenomenon: In the United States alone, roughly 22 million people have been diagnosed with asthma. ● Description: This less engages students in developing reports about the effects of diseases on body systems, addressing the disciplinary core idea of hierarchy of systems in organisms.
GRC Lesson 6.LS1.3	Lesson: My Pulse ● Phenomenon: I can feel my pulse in my neck after I exercise. ● Description: This investigation requires the use of prepared slides of blood and tissues to investigate the hierarchy of systems in organisms.
GRC Lesson 6.LS1.8	Lesson: Senses and Sensibility ● Phenomenon: Sometimes I can recognize things by the way they feel. ● Description: This investigation uses a memory game to engage students in learning how the senses function (role of the brain in response to stimuli).

Bundle: Energy Flow & Geoscience Processes	
Timeline: 6-7 Weeks	
Performance Expectations	
6.ESS1.4	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's geologic history.
6.ESS2.1	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives these processes within and among Earth's systems.
6.ESS2.2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
6.ESS2.3	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
In a Nutshell	
Energy and matter cycle throughout our planet. As they do, the matter changes chemically and physically. The planet's systems interact to shape Earth's history and future. The water cycle is only one of these many systems, and it causes weathering and erosion on the surface of Earth and in its interior. By mapping the natural events in an area and understanding the geological forces involved, future events can be predicted. Large plates of Earth's surface have moved and continue to move due to natural forces in the Earth's interior. This process is evident from observations of rock, fossils, continental shapes, and the ocean floor. Earth's history is documented in chronological order using the fossil record, which is a collection of fossils found in layers of rock around the planet. This history contains information on the existence, diversity, and extinctions of life over time.	
3-Dimensional Storyline	
By the end of grade 6, students should develop an understanding that Earth's systems, microscopic to global in size, have cycles that interact with each other. These cycles are predictable systems. Each system's stability and	

changes may be examined by observing patterns in the system over time at various scales in size. Students will have had previous instruction on 6.PS1.4, 6.PS3.3, 6.PS3.4 and 6.PS4.2. This instruction regarding energy, matter and waves directly support the processes that occur within Earth's systems.

All of Earth's processes are the result of energy flowing (from the sun and interior of Earth) and matter cycling among and within the planet's systems. Transfers of energy and movements of matter cause physical and chemical changes to occur in Earth's materials and organisms. For example, minerals and rock are cycled through the rock cycle by means of various processes including melting, crystallization, weathering, deformation, and sedimentation. Most changes occur gradually, such as microscopic particle movement that takes place during weathering and erosion by the water cycle's continuous movement, but larger catastrophic events, such as earthquakes and volcanic eruptions, also account for changes to Earth's surface. These processes, both small and global in size, and their interactions have shaped and will continue to shape the Earth.
Students should have an opportunity to develop a model or models to describe the cycling of Earth's materials and the flow of energy that drives these processes at various scales in size. Students can also construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Through this bundle of performance expectations, students can see how energy transfer occurs when large plates of the Earth's surface move and that the energy transfer can be identified through instruments that measure waves. Maps of ancient land and water locations can provide evidence of changes in the Earth's plates. Data analysis, including patterns on maps of earthquakes and volcanoes relative to plate boundaries, the distribution of fossils and rocks, continental shapes, and seafloor spreading provide evidence of past plate motion. This evidence can prompt students to ask questions about why and how this happens.

Tectonic plates are large pieces of Earth's crust that move away from, collide into, and slide past other plates at incredibly slow rates and are due to stresses caused by convection currents occurring inside the Earth's mantle. These movements generate new ocean seafloor at mid-ocean ridges and destroy old ocean floor at trenches (e.g. subduction zones) as plates overlap or pull away from each other. As they slide, these plates generate a large amount of energy

transfer through seismic waves that are detectable by instruments called seismographs. Analyzing and interpreting seismic wave data can assist students in explaining plate movement.

Fossils are mineral replacements, preserved remains, or traces of organisms that lived in the past. The fossil record documents Earth's history by organizing the location and placement of fossils that have been discovered in strata of sedimentary rock. These fossils have been placed in chronological order with older rock in bottom layers and newer rock in upper layers of undisturbed rock. These fossils document the existence, diversity, extinction, and change of many life forms. Because of the conditions necessary to preserve organisms, not all types of organisms that existed in the past have left fossils that can be retrieved. Ancestral relationships may also be explained by looking at the anatomical similarities of fossils of organisms found in sedimentary rock.

The crosscutting concept of finding patterns can assist students in analyzing and interpreting data of the fossil record that documents the existence, diversity, extinction, and change of life forms throughout the history of life on Earth, under the assumption that natural laws and processes (e.g. weathering, erosion, and deposition) operate today as in the past. These patterns might be found in comparing like organisms from different time periods that are thought to be related and determining what factors might have caused changes to occur. Patterns might also be detected by studying the organisms and their numbers found in fossils that occurred after catastrophic events, thus identifying cause and effect relationships. Biological unity and species' diversity can be identified by applying scientific ideas to construct explanations for the anatomical similarities and differences among modern and fossil organisms to infer ancestral relationships.

The geological time scale interpreted from rock strata provides a way to organize Earth's history. The time scale provides a relative chronological order of major events that have changed the Earth's geographical features such as glaciation, glacier formation of rivers and mountain chains, and volcanic eruptions. It also provides relative order of species' adaptations and extinctions. Observing snapshots of Earth's major geological and biological events that have occurred over a large span of time (scale/proportion/quantity) will assist students in constructing a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's geological history.

Student Actions
Students Will... • Apply scientific reasoning to describe the relationship between water and the surface features and underground formations caused by erosion and weathering. • Develop a model that describes the chemical and physical changes produced by the cycling of energy and matter through Earth's systems. • Construct an explanation based on evidence for how the interaction of the planet's systems (microscopic to global in size) have shaped Earth's history and will determine its future. Examples of these changes include earthquakes, volcano, surface weathering, erosion, and deposition. • Develop and/or revise a model to show the relationships among Earth's processes (large and small) that are a result of the cycling of matter and the flow of energy within and among the planet's systems. • Analyze and interpret data to explain how tectonic plates have continually generated new ocean sea floor at ridges of diverging plates and destroyed old sea floor at trenches of converging plates. • Construct a scientific explanation that supports the theory of plate tectonics based on evidence that demonstrates the idea that fossils of identical species have been found on various plates that used to be connected. • Apply scientific ideas about how the present shapes of the continents and how they can be made to fit together relatively well, supports the theory that Pangaea once existed. • Construct a scientific explanation based on valid and reliable evidence in order to show that major events (i.e. formation of mountain chains and ocean basins, adaptation and extinction of organism, volcanic eruptions, glaciation, development of water structures, and erosion) are recorded in the layers of Earth's strata. • Develop and use a model using geologic evidence, such as rock strata, as a way to organize Earth's history to show the order of events in the geological time scale. • Apply scientific ideas and principles to explain that fossils and the rock strata are normally found in order relative to each other (i.e. relative dating) and are not able to provide absolute dates. • Argue using geologic evidence that older fossils and rock strata are usually found in the bottom layers of an undeformed cross section and that newer fossils and rock strata are typically found in the top layers of an undeformed cross section (e.g. law of superposition).

- Use graphical displays of data sets from charts, graphs, or images to identify patterns in the chronological placement of fossils in the layers of sedimentary rock.

Key Misconceptions	Key Understandings
1. Rocks must be heavy. 2. Soil must have always been in its present form. 3. Mountains are created rapidly. 4. Earth is molten, except for its crust. 5. Earthquakes are rare events (media coverage of earthquakes is limited and biased to U.S. area or high death tolls.) 6. Magma comes from molten layer beneath Earth's crust (older cosmologies, Franklin's idea, as well as popular literature such as Dante's Inferno, and some religious tracts). 7. Volcanic eruptions are rare events (media coverage is biased by location and death tolls). 8. Most magma forms as rock melts due to an increase in temperature (in real life this is the way most things melt, coupled with knowledge that temperature rises within Earth). 9. Crust and Lithosphere (or plates) are synonymous terms. 10. Only continents move. (Wegener's original concept, along with the common use of 'Continental Drift' term in general texts, secondary education earth science films, etc.) 11. Most crust motions (especially those associated with processes of mountain building or deep-sea	1. Rocks can vary in weight depending on composition, size, and density. 2. Soil is a dynamic system composed of weathered particles, water, air, and organic material. 3. Mountain building is a slow process. 4. The Earth's outer core is molten, the inner core and crust are solid, and the mantle is hot semi-solid rock. 5. Smaller earthquakes are fairly common. Larger earthquakes are less common. 6. As parts of the crust are subducted and sink into the Earth's mantle they begin to melt. Magma can also come from plumes in the mantle. Convection currents in the mantle can cause heat to be transferred to overlying rocks at mid-ocean ridges, causing these rocks to melt. 7. Volcanic eruptions occur frequently around the planet at varying scales. Magma forms as rocks melt due to changes in temperature and pressure. 8. The Earth's crust is only the upper portion of the Lithosphere, while the Lithosphere includes all of the crust and the uppermost portion of the mantle. 9. Earth's plates, which include continental crust and oceanic crust, move. 10. Most crust motions are lateral and can cause vertical shifts in crust.

trench formation) are due to vertical motions, not lateral. 12. Divergent ocean ridges are due to vertical uplift or convergence, rather than divergence. 13. Oceans are responsible for oceanic crust (rather than being closer to the other way round). 14. The edge of a continent is the same thing as a plate boundary. 15. Earth shaking is deadly (as opposed to building collapse, tsunamis, landslides, fire, etc.) 16. Earthquakes occur from collapse of subterranean hollow spaces (tie to older cosmologies). 17. Students often think of mountain building as occurring only through catastrophic events such as earthquakes or volcanoes. They often fail to recognize the slow process of uplift over millions of years. 18. Continents do not move. 19. Earth and space science have a unique aspect of scale that may be problematic for students. 20. Fossils are the remains of dead organisms. Fossils cannot tell us about the environment in which plants or animals lived long ago.	11. Divergent ocean ridges are a result of the temperature of the crust at the boundary causing the crust to expand. 12. Oceans are not the cause of oceanic crust, but the thin high-density nature of oceanic crust causes it to create a basin for ocean to form in. 13. Plate boundaries can exist at the edges of continents, within the interior of a continent, or in the middle of oceanic crust. 14. Earthquakes cause structures and object to collapse and fall which can be deadly, the actual shaking is not deadly. 15. Earthquakes are caused by the release of energy at a fault causing movement along a fault. 16. Mountain building and other geologic events can take millions of years to occur. 17. Continents are part of Earth's tectonic plates, which move over the surface of the Earth. 18. For example, comprehending the length of time it takes for mountains to erode is difficult for some students. 19. Fossils also include other types of evidence such as tracks and traces. 20. Fossils can provide evidence of past environmental conditions.

Free and Open Instructional Resources	
K20 Center 6.ESS2.2	Phenomenon-Based Instructional Task: Wandering Water • Resource is labeled "8th Grade" as the standard was originally at that grade-level. • This resource provides guidance on using two different phenomena (time lapse video of glaciers and a time lapse video of the changes in a river as it meanders) to engage students with how water movements change land's surface features. • Also includes a formative assessment task and rubric to evaluate student thinking on water's role in shaping land using an analogous phenomenon (sand from mountains).
K20 Center 6.ESS2.3	Phenomenon-Based Instructional Task: Puzzling About the Past **2nd lesson listed** • Resource is labeled "8th Grade" as the standard was originally at that grade-level. • This resource utilizes maps and data to investigate the history of planet Earth (plate tectonics and large-scale system interactions). • Also includes a formative assessment task to evaluate student thinking on plate motion locations of volcanoes.
GRC Lesson 6.ESS1.4	Lesson: Oklahoma's Geologic Time Scale • Phenomenon: The Arbuckle Mountains were once islands. • Description: This investigation utilizes models to obtain, organize, and analyze information to be used as evidence in an explanation about rock strata and geologic time. It includes a formative assessment.
GRC Lesson 6.ESS2.2	Lesson: Pathways of Change • Phenomenon: The old sidewalks seem to be more worn out than new sidewalks. • Description: This investigation is useful as a first lesson on geoscience processes. It includes a formative assessment.
GRC Lesson 6.ESS2.3	Lesson: What to See on the Seafloor • Phenomenon: The Hawaiian Islands are not all the same age.

	• Description: This investigation engages students in one line of evidence supporting the theory of plate tectonics. Lesson includes a formative assessment.
GRC Lesson 6.ESS2.3	Lesson: Iceland had Geothermal Energy • Phenomenon: People in Iceland get most of their energy from geothermal energy sources. • Description: This lesson engages students in using multiple lines of evidence to support the theory of plate tectonics. It includes a formative assessment.

Bundle: Earth Systems and Interactions	
Timeline: 8-9 Weeks	
Performance Expectations	
6.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.
6.ESS2.5	Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
6.ESS2.6	Develop and use a model to describe how unequal heating and rotation of the Earth causes patterns of atmospheric and oceanic circulation that determine regional climates.
6.ESS3.2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
In a Nutshell	
All the water on Earth is in constant movement and is continuously changing states throughout the water or hydrologic cycle. The energy from the sun, drives the cycling of water and its change of states. Gravity pulls precipitation downward and it also pulls denser air and water down which creates currents. Weather can change in a short amount of time and factors such as, air pressure, temperature, humidity, precipitation, and wind can cause those changes. Weather can be predicted, but weather forecasting has not been perfected. Data from weather maps, diagrams, and other visualizations can be used to detect and predict weather patterns. The sun drives all weather patterns on Earth. Ocean currents can redistribute energy from the sun, which can affect regional climates. Your location on the planet (i.e. Latitude and longitude) will determine the weather and climate experienced. Large bodies of water can also affect the weather patterns in a given area. By mapping the natural hazards in an area and understanding the geological forces involved, future catastrophic events can be predicted and mitigated.	

3-Dimensional Storyline
Through the water cycle, water is cycled and recycled through both the living and non-living components of Earth's ecosystems. The global movement of water, driven by energy from the sun and the forces of gravity, continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation, crystallization, and precipitation, as well as downhill, flows on land through run-off and groundwater. Transpiration is the process plants use to carry water from their roots to their leaves, where it will then be evaporated. Evaporation uses energy from the sun to change the water from the leaves or bodies of water into moisture in the air. Once this moisture in the air is cooled, the water molecules in the gas state begin condensing to form a liquid water droplet. This condensing of gas particles to liquid is called condensation, and as the droplets collide with other droplets of water, they stick together and become heavy enough so that the force of gravity causes these drops to fall as precipitation (no matter what state the water may be in). Water may then be used by living organisms or it may move downhill propelled by gravity to rejoin bodies of water. When teaching weather, climate, and differential heating of the Earth students need to understand the difference between the phenomena and possible causes. Some cause and effect relationships, like the heating of the Earth and the redistribution of that energy, influence much of the weather on the planet. Students can use models to represent complex weather systems and their interactions. An example of this would be the transfer of energy through convection. Weather consists of short-term atmospheric conditions, which can vary from day to day. Weather is the condition of the atmosphere at any given time. Students can analyze data such as weather maps, diagrams, and visualizations and interpret weather patterns to help them understand the atmospheric changes that can occur daily in weather. Air masses always flow from a high-pressure area to a low-pressure area (which is created by differences in temperatures due to unequal heating of Earth's surface). This air movement creates weather (defined as temperature, precipitation, pressure, and wind) that changes over time, dependent on location. Students can develop models for air masses through planning and conducting investigations to collect data about convection and convection currents. Fluids with a lower density can be used to model a low-pressure area and fluids with a greater density can be used to model a high-pressure area. Weather conditions can result from different types of air masses colliding thereby creating storms.

Differences in pressure at different areas can cause different types of weather. Students can analyze weather data for a period of time and interpret how differences in temperature and air pressure can result in changes in weather.

Sunlight unevenly heats the Earth's surface, both land and oceans, which releases it over time and redistributes it through ocean currents, which in turn heats the atmosphere (i.e. differential heating). The resulting temperature patterns, together with the Earth's rotation (e.g. Coriolis effect) and location of continents and oceans, create large-scale patterns of atmospheric circulation. Our Earth has an atmosphere, it creates a blanket of gases that regulates the average surface temperature of our planet. Students can conduct investigations and analyze the resulting data from different Earth materials that are submitted to thermal energy via sunlight or heat lamp to determine how thermal radiation affects these materials. Students can use models to explain how differential heating of Earth's materials works through the heating and cooling of different Earth materials. They can analyze data to see the patterns.

Bodies of water influence weather and climate for areas near to them. Water absorbs energy much slower that other Earth materials. It takes five times more heat energy to raise an amount of water one degree than it takes to raise the temperature of an equal amount of dry soil or sand. Because of this, it creates low and high-pressure areas, which in turn influences the weather (sea and ocean breezes). Wind is caused from these pressure differences. Areas near the equator have very low-pressure areas, so this creates the Coriolis effect (wind created because of Earth's rotation).

The water cycle, weather models and related geological forces can help predict the likelihood of future events. Many natural hazards are preceded with certain phenomena that allow for reliable predictions, such as volcanic eruptions and severe weather. Other hazards, such as earthquakes, cannot be so easily predicted. This can be accomplished through a thorough analysis and understanding of geological forces, such as tectonic plate motion, and by mapping natural hazards in a region, such as weather. Using patterns occurring in this data and the resulting predictions, technologies can be developed to mitigate the effects of these catastrophic nature events. This data includes locations, magnitudes, and frequencies of the hazards, and other information from satellite systems and other technologies that can record data inside or outside of the Earth.

Student Actions
Students Will... • Engage in argument from evidence to describe how global movements of water and its changes in form are propelled by sunlight and gravity and water cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation as well as downhill flows on land. • Obtain, evaluate, and communicate how weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. • Analyze and interpret data to show that interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. • Ask questions and define problems on how the ocean exerts a major influence and collect and analyze weather and climate data to predict future weather patterns. • Use mathematical thinking to explain that weather patterns are complex and can only be predicted using probabilities. • Develop and use a model to describe that oceanic densities vary due to temperature and salinity. • Plan and carry out investigations to show that density, temperature, and salinity variations drive an interconnected global pattern of ocean currents. • Ask questions and define problems related to how the ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. • Obtain, evaluate, and communicate how weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. • Analyze and interpret data to show that interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. • Ask questions and define problems on how the ocean exerts a major influence and collect and analyze weather and climate data to predict future weather patterns. • Use mathematical thinking to explain that weather patterns are complex and can only be predicted using probabilities. • Develop and use a model to describe that oceanic densities vary due to temperature and salinity.

- Plan and carry out investigations to show that density, temperature, and salinity variations drive an interconnected global pattern of ocean currents.
- Ask questions and define problems related to how the ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.
- Use graphical displays (e.g., maps, charts, graphs, and/or tables) to map patterns of natural hazards in a region such as volcanic eruptions, earthquakes, and severe weather.
- Distinguish between causal and correlational relationships among geological forces and natural hazards such as volcanic eruptions, earthquakes, and severe weather.
- Consider limitations of data analysis and its accuracy in forecasting the locations and likelihoods of future hazardous events and observe how the accuracy of data, with better technological tools and methods, has improved.
- Construct, analyze, and/or interpret graphical displays of data to predict possible future hazardous events.

Key Misconceptions	Key Understandings
1. Water evaporates into the air only when the air is very warm or very cool. 2. When water evaporates, tiny droplets of water, not water vapor, are formed. 3. Cooler air can hold more water vapor than warmer air. 4. Clouds are like vessels that hold water. 5. There are water molecules in the clouds, but not in the air outside the clouds. 6. Clouds are made of water vapor. 7. Clouds, fog, and rain form as air becomes warmer. 8. The infrared radiation from the Sun is what is responsible for warming the Earth.	1. Water can evaporate at all temperatures. 2. When water evaporates, water vapor is formed. 3. Warmer air can hold more water vapor. 4. Clouds and rain form as air cools and water vapor in the air condenses into water droplets. 5. All air contains water vapor. 6. Clouds and rain form as air cools and water vapor in the air condenses into water droplets. 7. Clouds and rain form as air cools and water vapor in the air condenses into water droplets. 8. The visible and infrared sunlight are absorbed by the Earth's surface. 9. As altitude increases, atmospheric pressure decreases.

9. The Sun sends heat directly through space to Earth. 10. As one goes higher into the atmosphere (for example, climbing a mountain), the atmospheric pressure does not decrease. 11. Clouds come from somewhere above the sky. 12. Water only gets evaporated from the ocean or lakes. 13. Condensation on the outside of a container is water that seeped through the container itself (or sweated through the walls of the container). 14. Gases are not matter because they are invisible. 15. The H on weather maps stands for hot temperatures whereas L means cold weather. 16. Seasons are caused by the Earth's distance from the sun. 17. Wind speed is related to temperature of air. High speed means cold air and gentle or slow winds are warm. 18. Humid air is heavier than dry air. 19. Heat and temperature mean the same thing. 20. Natural hazards include man-made hazards.	10. The atmosphere contains water vapor. When air gets cooler, water vapor condenses. That means it changes to tiny droplets of liquid water. Water droplets clump together to form a cloud. 11. Water evaporates from many surfaces on Earth. 12. Condensation forms on the outside of a container as water vapor in the air cools and condenses into liquid form. 13. Gases are composed of atoms. 14. As the Earth orbits around the sun the angle at which the sun's rays strike Earth's surface changes due to the position of Earth's tilted axis relative to the sun. Earth's tilt does not change, only its position relative to the sun. 15. Wind speed is not directly related to temperature. 16. Dry air is denser than humid air and as a result heavier than humid air. 17. Heat is a total energy due to molecular motion in a substance. Temperature is a measure of the average heat energy of a substance. 18. An "H" on a weather map is the symbol for areas of high pressure and an "L" is the symbol for areas of low pressure. 19. Natural hazards are naturally occurring physical phenomena caused by either rapid or slow onset. (earthquakes, landslides, tsunamis, volcanoes, tornados, avalanches, floods, extreme temperatures, drought, wildfires etc.)

Free and Open Instructional Resources	
OpenSciEd Unit 6.ESS2.4 6.ESS2.5 6.ESS2.6 6.PS1.4	Unit on Weather, Climate & Water Cycling – Why does a lot of hail, rain, or snow fall at some times and not others? ● Description: This unit is broken into four separate lesson sets, from small-scale storms to mesoscale weather systems and climate-level patterns of precipitation. ● Includes teacher and student videos, simulations, teacher guide, student worksheets, and formative assessments.
GRC Lesson 6.ESS2.4	Lesson: Great Lakes Snow Analysis ● Phenomenon: Some areas of the Great Lakes receive more snow than others. ● Description: In this investigation students use the information they have gathered from reliable sources to apply the ideas that water cycling through Earth's systems is driven by energy from the sun and the force of gravity.
GRC Lesson 6.ESS2.4	Lesson: Sun-energy Moves the Water Cycle ● Phenomenon: After a rainstorm, water on the pavement in sunny areas evaporate faster than water in shady areas. ● Description: This investigation engages students in the understanding that the cycling of water through Earth's systems is driven by energy from the sun and the force of gravity.
GRC Lesson 6.ESS2.6	Lesson: Location, Location, Location! ● Phenomenon: Salt Lake City, Utah and Naples, Italy are located on the same latitude in the Northern Hemisphere, but the average July temperature in Salt Lake City is 90° F and in Naples 77°F. (Use your local city with a corresponding city in the Northern Hemisphere to compare climates with the same latitude) ● Description: This investigation engages students with the science idea that unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determines regional climates.
GRC Lesson 6.ESS2.6	Lesson: Rain ● Phenomenon: In Hawai'i annual rainfall varies from one area of an island to another.

	• Description: This lesson uses data analysis and a website simulator to engage students with the science idea that unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determines regional climates.
GRC Lesson 6.ESS3.2	Lesson: Specific Pacific Predictions • Phenomenon: Hurricanes arrive early in the school year. • Description: This lesson engages students with NOAA data to find patterns in the motion of hurricanes. This addresses the science ideas around forecasting natural disasters.
K20 Center 6.ESS3.2	Lesson: All Shook Up – What resources do geologist use to study earthquakes? • Description: Students will examine various forms of earthquake data ranging from intensity, magnitude, and first-person accounts to explore what factors contribute to the damage caused by earthquakes and how geologists use this information to pinpoint epicenters and focus of an earthquake. • Teachers will need to find supplemental materials to connect the ideas from this lesson to how they are being used to develop possible technologies that can forecast future catastrophic events.