



**Science 6**

**Curriculum**

**2026**

**SCOPE AND SEQUENCE**  
(Units and lessons are to be followed in order)

| Unit | Title            | Lesson(s)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Core Ideas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Instructional Days |
|------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 6.1  | Light and Matter | <p>Lesson 1: How can something act like a mirror and a window at the same time?</p> <p>Lesson 2: What happens if we change the light?</p> <p>Lesson 3: What happens when light shines on the one-way mirror?</p> <p>Lesson 4: How do similar amounts of light transmit through and reflect off the one-way mirror?</p> <p>Lesson 5: How do light and the one-way mirror interact to cause the one-way mirror phenomenon?</p> <p>Lesson 6: Why does the music student not see the teacher?</p> <p>Lesson 7: Why do the music student and the teacher see the music student but the music student can't see the teacher?</p> <p>Lesson 8: Why do we sometimes see different things when looking at the same object?</p> | <p>PS4.B: 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.</p> <p>PS4.B: 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.</p> <p>LS1.D: Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.</p> | 18                 |
| 6.2  | Thermal Energy   | <p>Lesson 1: Why does the temperature of the liquid in some cup systems change more than in others?</p> <p>Lesson 2: What cup features seem most important for keeping a drink cold?</p> <p>Lesson 3: How are the cup features that keep things cold the same or different for keeping</p>                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>PS1.A. Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change</p>                                                                                                                                                                                                                                                                                                                              | 37-40              |

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|  |  | <p>things hot?</p> <p>Lesson 4: How does a lid affect what happens to the liquid in the cup?</p> <p>Lesson 5: Where does the water on the outside of the cold cup system come from?</p> <p>Lesson 6: How can we explain the effect of a lid on what happens to the liquid in the cup over time?</p> <p>Lesson 7: If matter cannot enter or exit a closed system, how does a liquid in the system change temperature?</p> <p>Lesson 8: How does a cup's surface affect how light warms up a liquid inside the cup?</p> <p>Lesson 9: How does the temperature of a liquid on one side of a cup wall affect the temperature of a liquid on the other side of the wall?</p> <p>Lesson 10: What is the difference between a hot and a cold liquid?</p> <p>Lesson 11: Why do particles move more in hot liquids?</p> <p>Lesson 12: How does the motion of particles compare in a sample of matter at a given temperature?</p> <p>Lesson 13: How could the motion of particles on one side of a solid wall affect the motion of the particles on the other side of that wall?</p> <p>Lesson 14: Does our evidence support that cold is leaving the system or that heat is entering the system?</p> <p>Lesson 15: How do certain design features slow down the transfer of energy into a cup?</p> | <p>relative locations.</p> <p>PS1.A.The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.</p> <p>PS3.A. The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects.</p> <p>PS3.A.Temperature is not a measure of energy; the relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.</p> <p>PS3.A.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.</p> <p>PS3.B. When the kinetic energy of an object changes, there is inevitably some other change in energy at the same time.</p> <p>PS3.B. 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.</p> |  |
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|     |                                                       | <p>Lesson 16: How can we design a cup system to slow energy transfer into the liquid inside it?</p> <p>Lesson 17: How can we improve our first design to slow energy transfer into the cup system even more?</p> <p>Lesson 18: How can containers keep stuff from warming up or cooling down?</p>                                                                                                   | <p>PS3.B. Energy is spontaneously transferred out of hotter regions or objects and into colder ones.</p> <p>PS4.B. 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.</p> <p>ETS1.A. 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.</p> <p>ETS1.B. 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 the criteria and constraints of a problem.</p> |         |
| 6.3 | Weather, Climate, Water Cycling, and Computer Science | <p>Lesson 1- What causes this kind of precipitation event to occur?</p> <p>Lesson 2- What are conditions like on days when it hails?</p> <p>Lesson 3- How does the air higher up compare to the air near the ground?</p> <p>Lesson 4- Why is the air near the ground warmer than the air higher up?</p> <p>Lesson 5- What happens to the air and water at Earth's surface when it is warmed up?</p> | <p>PS1.A: In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.</p> <p>PS1.A: The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.</p> <p>PS3.A: The term "heat" as used in</p>                                                                                                                                                                                                                                                                                                                                                                                                                          | 35 Days |

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|  |  | <p>Lesson 6-How can we explain the movement of air in a hail cloud?</p> <p>Lesson 7- What happens to water vapor in the air if we cool the air down and why?</p> <p>Lesson 8- Why do clouds or storms occur sometimes, but not others.</p> <p>Lesson 9- Why don't water droplets or ice crystals fall from clouds all the time?</p> <p>Lesson 10- How could we revise our storm simulation to help explain what causes some clouds to produce hair and others do not?</p> <p>Lesson 11- How can we use the ideas we developed to explain and predict larger scale storm systems like hurricanes?</p> <p>Lesson 12- How could a lot of snow fall in Florida?</p> <p>Lesson 13- Why does it snow so much in some places?</p> <p>Lesson 14- Where did the snow come from in Florida?</p> <p>Lesson 15- What leads to different weather patterns in different places?</p> <p>Lesson 16- How did meteorologists predict Florida would get snow and how could we make those predictions better?</p> <p>Lesson 17- How can a place have a different climate than another place nearby?</p> | <p>everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects.</p> <p>PS3.A: The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material.</p> <p>PS4.B: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.</p> <p>ESS2.C: Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.</p> <p>ESS2.C: Global movements of water and its changes in form are propelled by sunlight and gravity.</p> <p>ESS2.C: 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.</p> |  |
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|     |                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>ESS2.C: Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.</p> <p>ESS2.D: Because these patterns are so complex, weather can only be predicted probabilistically.</p> <p>ESS2.D: 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.</p> <p>ESS2.D: 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.</p> <p>ESS2.D: Because these patterns are so complex, weather can only be predicted probabilistically.</p> |         |
| 6.4 | Plate Tectonics and Rock Cycling | <p>Lesson 1: What is causing Mt. Everest and other mountains to move, grow, or shrink?</p> <p>Lesson 2: How are earthquakes related to where mountains are located?</p> <p>Lesson 3: How does what we find on and below Earth's surface compare in different places?</p> <p>Lesson 4: What is happening to Earth's surface and the material below it during an earthquake?</p> <p>Lesson 5: How does plate movement affect the</p> | <p>ESS1.C. The geologic time scale interpreted from rock strata provides a way to organize Earth's history.</p> <p>ESS1.C Analysis of rock strata and the fossil record provide only relative dates, not an absolute scale.</p> <p>ESS2.A. 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</p>                                                                                                                                                                                                                                                                                                                                                                                                                           | 25 Days |

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|     |                 | <p>land around mountains such as Mt. Everest?</p> <p>Lesson 6: How could plate movement help us explain how Mt. Everest and other locations are changing in elevation?</p> <p>Lesson 7: What happens at mountains where we see volcanic activity?</p> <p>Lesson 8: What is occurring at locations where two plates are moving away from each other?</p> <p>Lesson 9: What causes mountains to change?</p> <p>Lesson 10: Where were Africa and South America in the past?</p> <p>Lesson 11: Where were the other plates located in the distant past?</p> <p>Lesson 12: Where did mountains that aren't at plate boundaries today, like the Appalachians and Urals, come from?</p> <p>Lesson 13: What causes mountains to shrink in elevation?</p> <p>Lesson 14: How is there an exposed marine fossil on Mt. Everest? And, what other remaining questions from our Driving Question Board can we now answer?</p> | <p>energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. These processes cause changes to Earth's materials (above and below the surface).</p> <p>ESS2.A. The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.</p> <p>ESS2.C. Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.</p> <p>ESS1.C. Tectonic processes continually generate new ocean sea floor at ridges and destroy old seafloor at trenches.</p> <p>ESS2.B. Plate Tectonics and Large-Scale System Interactions<br/>Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.</p> |                                                                    |
| 6.5 | Natural Hazards | <p>Lesson 1: What happens to a community when a tsunami occurs?</p> <p>Lesson 2: Where do tsunamis happen and what causes them?</p> <p>Lesson 3: What causes a tsunami to form and move?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>ESS3.B. Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.</p> <p>ETS1.A. The more precisely a design</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 21 Days (Additional Time may be taken for the culminating project) |

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|     |                                    | <p>Lesson 4: How can we forecast where and when tsunamis will happen and which communities are at risk?</p> <p>Lesson 5: How can we reduce damage from a tsunami wave?</p> <p>Lesson 6: How are tsunamis detected and warning signals sent?</p> <p>Lesson 7: What are ways we can communicate with people before and during a tsunami?</p> <p>Lesson 8: Which emergency communication systems are the most reliable in a hazard?</p> <p>Lesson 9: How can we model the systems put into place to protect communities?</p> <p>Lesson 10: How can we effectively prepare our communities for a natural hazard?</p> | <p>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.</p> <p>ETS1.B. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.</p> <p>PS4.C. Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.</p>                                                                                                                  |                                                                       |
| 7.6 | Earth's Resources and Human Impact | <p>Lesson 1: Why are floods and droughts happening more often?</p> <p>Lesson 2: What would we normally expect for these places and how do we know it's really changing?</p> <p>Lesson 3: How would increased temperatures affect evaporation?</p> <p>Lesson 4: Are rising temperatures affecting anything else in Earth's water system?</p> <p>Lesson 5: How are rising temperatures changing water stories in these communities?</p> <p>Lesson 6: How are rising temperatures connected to two seemingly different phenomena?</p>                                                                               | <p>ESS3.A: Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.</p> <p>ESS3.C: Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.</p> <p>ESS3.C: Typically as human</p> | 33-37 days (Additional Time may be taken for the culminating project) |

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|  |  | <p>Lesson 7: Are there any changes in the air that could be related to rising temperatures?</p> <p>Lesson 8: Are changes in carbon dioxide and methane related to or causing temperatures to increase?</p> <p>Lesson 9: Are the changes in the amount of CO<sub>2</sub> in the atmosphere part of normal cycles that Earth goes through?</p> <p>Lesson 10: What is happening in the world to cause the sharp rise in CO<sub>2</sub>?</p> <p>Lesson 11: Why could burning fossil fuels create a problem for CO<sub>2</sub> in the atmosphere?</p> <p>Lesson 12: How are changes to Earth's carbon system impacting Earth's water system?</p> <p>Lesson 13: Why is solving the climate change problem so challenging?</p> <p>Lesson 14: What things can people do to reduce carbon dioxide going into the atmosphere?</p> <p>Lesson 15: How can large-scale solutions work to reduce carbon in the atmosphere?</p> <p>Lesson 16: How are these solutions working in our communities?</p> <p>Lesson 17: What solutions work best for our school or community?</p> <p>Lesson 18: What can we explain now, and what questions do we still have?</p> | <p>populations and per-capita consumption of natural resources increases, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.</p> <p>ESS3.D: Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.</p> <p>ETS1.B: There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.</p> |  |
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## Unit 1 - Light and Matter

Timeframe: 18 days

Mandatory Resources: Customizable OpenSciEd lesson slides, customizable OpenSciEd lesson handouts, customizable OpenSciEd assessments, OpenSciEd ECA kit materials

Supplemental Resources and Materials: Table of contents, progress tracker, vocabulary organizer, binder/packet, teacher created student handouts

| Essential Questions                                                       | Learning Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Vocabulary                                                                                                 | Activities & Strategies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Instructional Mode                                                                                                                                       | Assessment                                                                                                             |
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| Why do we sometimes see different things when looking at the same object? | <p>Students will develop a shared set of classroom norms to guide their work together.</p> <p>Students will ask questions about the one-way mirror phenomenon that they investigate in the classroom by:</p> <ul style="list-style-type: none"> <li>Manipulating light in the scaled box model.</li> <li>Measuring transmitted and reflected light off different materials.</li> <li>Obtaining information from readings and videos.</li> </ul> <p>Students will agree upon and develop models to explain how light interacts with the one-way mirror, glass, regular mirrors, the eye,</p> | <ul style="list-style-type: none"> <li>Reflect</li> <li>Transmit</li> <li>Model</li> <li>System</li> </ul> | <p>Anchoring Phenomenon Routine</p> <ul style="list-style-type: none"> <li>Introduce the one-way mirror phenomena (Les 1).</li> <li>Independently develop a diagrammatic model to explain the phenomena and create a consensus model to demonstrate shared-thinking (Les 1).</li> <li>Elicit student questions surrounding the one-way mirror (digital driving question board) and related phenomena (Les 1).</li> </ul> <p>Navigation Routine</p> <ul style="list-style-type: none"> <li>Develop ideas for investigation to answer questions from the driving question board (Les 1).</li> <li>Independently or collaborative update what was figured out in the progress tracker (All lessons)</li> </ul> <p>Investigation Routine</p> <ul style="list-style-type: none"> <li>Observe the one-way mirror in and out of the box model. (Les 2)</li> <li>Investigate with the box model by moving the flashlight to Room B, make both rooms light, and make both rooms dark. (Les 2)</li> <li>Compare what happens when light shines on the one-way mirror, a pane of glass, and a regular mirror. (Les 3)</li> </ul> | <ul style="list-style-type: none"> <li>Direct Instruction</li> <li>Classroom discussion</li> <li>Inquiry-based and small group investigations</li> </ul> | <p>Lesson 7: Written explanation explaining the phenomenon</p> <p>Lesson 8: Portraits through glass- Transfer task</p> |

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|                                                                                                                                                            | <p>and the brain.</p> <p>Students will use a model to explain how the one-way mirror acts like a mirror on the light side of the system and acts like a window on the dark side of the system.</p> <p>Students will apply to an everyday phenomenon the science ideas and models developed for explaining the one-way mirror.</p> |  | <ul style="list-style-type: none"> <li>• Plan and carry out an investigation to determine how much light transmits through and reflects off of each material. (Les 3)</li> <li>• Read more about regular mirrors and one-way mirrors and how they are made. (Les 4)</li> <li>• Watch a video about how eyes see (Les 6)</li> <li>• Investigate how light interacts with a lens (Les 6).</li> <li>• Investigate conditions that make glass act like a one-way mirror (Les 8)</li> </ul> <p>Problemizing Routine</p> <ul style="list-style-type: none"> <li>• Expose the problem that the student has two inputs, but can only see himself (Les 5).</li> </ul> <p>Putting the Pieces Together:</p> <ul style="list-style-type: none"> <li>• Revise diagrammatic models from new observations to represent a path of light (Les 2)</li> <li>• Modify a model to explain what happens when light shines on the different structures in each material. (Les 4)</li> <li>• Create a diagrammatic model to explain the phenomena (Les 5).</li> <li>• Create a diagrammatic model to explain what happens when two light inputs reach the eyes. (Les 6).</li> <li>• Collaboratively explain the one-way mirror phenomena in writing (Les 7).</li> <li>• Answer questions from the driving question board. (Les 3, 8)</li> <li>• Observe and discuss a related phenomenon and independently complete transfer task- Portraits through the Looking Glass (Les 8).</li> </ul> |  |  |
| <p><b>Standards</b></p> <p>3.2.6-8.R: Develop and use a model to describe how waves are reflected, absorbed, or transmitted through various materials.</p> |                                                                                                                                                                                                                                                                                                                                   |  | <p><b>Science and Engineering Practices</b></p> <p>1.A Develop a model</p> <p>1.B Ask questions that arise from observations .</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |

3.1.6-8.H. Gather and synthesize information about how sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

- 2.A Ask questions.
- 2.B Modify a model based on evidence.
- 3.A Ask a testable question.
- 3.B Use evidence to modify a model.
- 4.A Develop a model to describe the unobservable mechanisms.
- 5.A Revise a model to explain.
- 6.A Ask questions.
- 6.B Develop a model.
- 7.A Construct an explanation using a model to explain.
- 8.A Use a model to describe .
- 8.B Apply science ideas and evidence to explain.

## Unit 2 - Thermal Energy

Timeframe: 37-40 days

Mandatory Resources: Customizable OpenSciEd lesson slides, customizable OpenSciEd lesson handouts, customizable OpenSciEd assessments, OpenSciEd ECA kit materials

Supplemental Resources and Materials: Table of contents, progress tracker, vocabulary organizer, binder/packet, teacher created student handouts

| Essential Questions                                            | Learning Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Vocabulary                                                                                                                                                                                                                            | Activities & Strategies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Instructional Mode                                                                                                                                       | Assessment                                                                                                                                                                                                                                                  |
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| How can containers keep stuff from warming up or cooling down? | <p>Students will ask questions and test variables surrounding a double layered cup and regular one layered cup to understand parts of the system that allows it to maintain a drinks temperature.</p> <p>Students will investigate cup features they conjecture are important to explaining the phenomenon.</p> <p>Students will model how matter can enter and exit the cup through the lid via evaporation in an open system and problematize a temperature change in a closed system</p> <p>Students will trace the transfer of energy into the drink as it warms up through a series of lab investigations and</p> | <ul style="list-style-type: none"> <li>Open System</li> <li>Closed System</li> <li>Condensation</li> <li>Kinetic Energy</li> <li>Temperature</li> <li>Thermal Energy</li> <li>Heat</li> <li>Absorption</li> <li>conduction</li> </ul> | <p>Anchoring Phenomenon Routine</p> <ul style="list-style-type: none"> <li>Introduce students to the regular cup and the fancy cup (Les 1)</li> <li>Brainstorm how to test the two cups to evaluate the claim (Les 1)</li> <li>Develop Systems Models for the two cups (Les 1)</li> </ul> <p>Navigation Routine</p> <ul style="list-style-type: none"> <li>Develop ideas for investigation to answer questions from the driving question board (Lesson 1).</li> <li>Independently or collaborative update what was figured out in the progress tracker (Lessons 1-18)</li> </ul> <p>Investigation Routine</p> <ul style="list-style-type: none"> <li>Investigate to figure out what features are important for maintaining temperature (Les 2)</li> <li>Investigate if the same features can keep liquids hot that keep them cold</li> <li>Plan and carry out investigations to determine effect of the lid (lesson 4)</li> <li>Plan and carry out two investigations to determine (1) the effect of a lid on how much the temperature of a hot liquid in a cup will drop and (2) the effect of a lid on changes in the mass of a hot liquid</li> </ul> | <ul style="list-style-type: none"> <li>Direct Instruction</li> <li>Classroom discussion</li> <li>Inquiry-based and small group investigations</li> </ul> | <p>Lesson 5: Written explanation- Cold Lemonade on a Hot Day</p> <p>Lesson 6: Explaining Lid Designs- Modeling particle movement</p> <p>Lesson 14: Icing injury assessment- Understanding energy transfer</p> <p>Lesson 18: Disaster Blanket Assessment</p> |

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|  | <p>simulation to determine absorption of light and thermal energy to change the temperature.</p> <p>Students will apply their understanding in a design challenge by designing their own drink container that will perform as well as a store bought up following a set of design criteria and constraints.</p> |  | <p>in the system. (Lesson 6)</p> <ul style="list-style-type: none"> <li>• Apply concepts of probability to calculate the mathematical mean for two different cup systems to compare the temperature drop and mass change in each condition. (Lesson 7)</li> <li>• Develop and use a particulate model of liquids and gases to explain the mass loss in an open system. (Lesson 4)</li> <li>• Construct an investigation to support or refute the claim that the formation of water droplets (condensation) on the outside of a cup of cold water comes from water leaking through the cup walls. (Lesson 9)</li> <li>• Measure the mass of a cup of cold water before and after condensation forms on the outside.</li> <li>• Observe condensation on the outside of a cup of cold water that has been dyed using food coloring.</li> <li>• Use our observations and data to construct an argument to refute the claim that water droplets on the outside of the cup come from inside the cup system.( Lesson 5)</li> <li>• Investigate the interaction between light and the cup surface (Lesson 8)</li> <li>• Brainstorm how to test whether heat or cold is entering or leaving the cup system (lesson 9)</li> <li>• Investigate differences between hot and cold liquids at the particle scale with the candy video and the food coloring lab(Lesson 10)</li> <li>• Observe a participle simulation to learn hot liquids have particles that move faster (Lesson 11)</li> <li>• Use a simulation to learn about kinetic energy (Lesson 12)</li> </ul> |  |  |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  | <ul style="list-style-type: none"> <li>• Learn about COld Cup Challenge and make design decisions (Lesson 15)</li> <li>• Complete Cold Cup Challenge (Lesson 16)</li> </ul> <p>Putting the Pieces Together</p> <ul style="list-style-type: none"> <li>• Use a model to show where water molecules can leave the cup system</li> <li>• Develop a plan to collect data and develop a model to explain mass lost (Lesson 6)</li> <li>• Revise cup system and explain related phenomena from DQB (Lesson 14)</li> <li>• Redesign the cup and complete model to predict energy transfer</li> </ul> <p>Problematizing</p> <ul style="list-style-type: none"> <li>• Develop a model for energy interactions</li> <li>• Use these models to explain temperature change (Lesson 7)</li> </ul>                                                                                                                              |  |  |
| <p style="text-align: center;"><b>Standards</b></p> <p>3.2.6-8.B Develop a model that predicts changes in the particle motion, temperature, and state of 1 pure substance when thermal energy is added or removed</p> <p>3.2.6-8.M Apply scientific principles to design construction and test a device that either minimizes or maximizes thermal energy transfer.</p> <p>3.2.6-8.N Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in average kinetic energy of the particles as measured by the temperature of the sample.</p> <p>3.2.6-8.O Construct, use and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.</p> <p>3.2.6-8.R Develop and use a model to describe how waves are reflected, absorbed, or reflected through various materials.</p> <p>3.5.6-8.M (ETS) Develop a model to generate data for iterative testing and</p> |  |  | <p style="text-align: center;"><b>Science and Engineering Practices</b></p> <p>1.A Develop a model<br/>1.B Ask questions that arise from observations .<br/>2.A Plan and carry out an investigation<br/>2.B Analyze and interpret data<br/>3.A Develop and use a model<br/>3.B Plan an investigation<br/>4.A Plan and carry out an investigation<br/>4.B Analyze and interpret data by applying concepts<br/>4.C Develop a model<br/>5.A Collect and analyze different forms of data<br/>5.B Construct an argument to support the claim<br/>6.A Develop and use a particle model of matter<br/>6.B Plan an investigation<br/>7.A Develop two models to show relationships<br/>8.A Develop and use models to describe light transmission<br/>9.A Carry out an investigation<br/>10.A Develop models<br/>11.A Construct and explanation<br/>12.A Analyze and interpret data<br/>12.B Carry out an investigation</p> |  |  |

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| <p>modification of a proposed object, tool, or process such that an optimal design can be achieved</p> | <p>13.A Carry out investigations using a particle model of matter<br/> 14.A Develop and use models to track how energy transfers<br/> 14.B Construct written arguments<br/> 15.A Obtain and use information from scientific texts<br/> 15.B Develop a consensus model<br/> 16.A Design a solution<br/> 16.B Carry out investigation to collect data<br/> 17.A Design a solution that is modified based on test results<br/> 17.B Carry out investigations to collect data<br/> 18.A Develop a model based on patterns<br/> 18.B Evaluate a design solution</p> |
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### Unit 3 -Weather, Climate, Water Cycling and Computer Science

**Timeframe:**35 days

**Mandatory Resources:**Customizable OpenSciEd lesson slides, customizable OpenSciEd lesson handouts, customizable OpenSciEd assessments, OpenSciEd ECA kit materials

**Supplemental Resources and Materials:**Table of contents, progress tracker, vocabulary organizer, binder/packet, teacher created student handouts

| Essential Questions                                                                          | Learning Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Vocabulary                                                                                                                                                                                                                                                                                                                                                                                       | Activities & Strategies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Instructional Mode                                                                                                                                       | Assessment                                                                                                                                                                                                               |
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| Why does a lot of hail, rain, or snow fall at some times and in some places, but not others? | <p>Students will analyze and interpret data about weather conditions on days when it hails to determine patterns in variables.</p> <p>Students will plan and carry out investigations, collect data and make sense of the data surrounding changes in the humidity, density, and energy transfer in the system during storm events.</p> <p>Students will work with manipulatives and simulations to explain how molecules in different phases change in different conditions and why air moves the way it does.</p> <p>Students will create and redefine models in</p> | <ul style="list-style-type: none"> <li>Precipitation</li> <li>Hail</li> <li>Hailstone</li> <li>Altitude</li> <li>Density</li> <li>Airparcel</li> <li>Condensation</li> <li>condensation/boiling point</li> <li>Phase change</li> <li>freezing/melting point</li> <li>Flow chart</li> <li>Hurricane</li> <li>Air pressure</li> <li>Air mass</li> <li>Prevailing winds</li> <li>Climate</li> </ul> | <p>Anchoring Phenomenon Routine</p> <ul style="list-style-type: none"> <li>Introduce the hailstorm phenomena (Les 1).</li> <li>Independently develop diagrammatic models at regular and particle levels scales to explain the phenomena and create a consensus model to demonstrate shared-thinking (Les 1).</li> <li>Elicit student questions surrounding the hailstorm (digital driving question board) and related phenomena (Les 1).</li> <li>Introduce the Florida snowstorm phenomena (Les 12).</li> <li>Independently develop a diagrammatic model to explain the phenomena and create a consensus model to demonstrate shared thinking (Les 12).</li> <li>Elicit student question surrounding the snowstorm (digital driving question board) (Les 12).</li> </ul> <p>Navigation Routine</p> | <ul style="list-style-type: none"> <li>Direct Instruction</li> <li>Classroom discussion</li> <li>Inquiry-based and small group investigations</li> </ul> | <p>Lesson 6: Explaining the movement of air in a hail cloud.</p> <p>Lesson 10: Diagrammatic and Programming Models</p> <p>Lesson 11: Hurricane assessment- Transfer task</p> <p>Lesson 17: Dry Places- Transfer task</p> |

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|  | <p>an Earth-system model and/or particle level model to explain changes in the air that cause different precipitation events.</p> <p>Students will develop a revision plan for a thunderstorm simulation specifying additional interface elements, interactions, and outputs in the simulation that a programmer would need to include to provide visualization of the mechanisms that help explain why some storms form large hail and others don't and iteratively test changes to code of the simulation to represent these relationships.</p> <p>Students will apply ideas from hailstorm models in the first half of the unit and seek to explain how it can be applied to a snowstorm event in Florida.</p> <p>Students will make sense of how weather is predicted, seeing the computer science thinking they have done throughout the unit is central to these ideas.</p> |  | <ul style="list-style-type: none"> <li>• Develop ideas for investigation to answer questions from the driving question board (Lesson 1).</li> <li>• Develop ideas for investigation to answer questions from the driving question board (Les 12)</li> <li>• Independently or collaboratively update what was figured out in the progress tracker (All lessons)</li> </ul> <p>Investigation Routine</p> <ul style="list-style-type: none"> <li>• Analyze radar and weather data from case sites to determine patterns in the data (Les 2).</li> <li>• Analyze weather balloon data to determine at all locations the air gets colder higher in the atmosphere. (Les 3)</li> <li>• Investigate temperature differences near the surface and above the surface (Les 4).</li> <li>• Investigate what happens to warm air and water near the surface with the three water and air investigations (Les 5).</li> <li>• Investigate condensation with cooling warm humid air and the water droplet investigation (Les 7).</li> <li>• Use close reading strategies to read "What is a cloud?" (Les 7).</li> <li>• Investigate conditions in storm development with the storm simulations. Determine input variables that would improve the simulations using if/then statements (Les 8).</li> <li>• Investigate forces that keep objects suspended in the air</li> </ul> |  |  |
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|  | <p>Students will make sense of differences in climate in places and apply their understanding to develop an explanation for why South America has a tropical rainforest in one part of the continent and a temperate rainforest in another part of the continent.</p> |  | <p>with the ping pong ball and hair dryer (Les 9).</p> <ul style="list-style-type: none"> <li>• Investigate convection currents with the water tub observations (Les 9).</li> <li>• Obtain information by reading “Tracing Hailstone Paths” (Les 10).</li> <li>• Analyze data from additional locations that receive a lot of snow (Les 13).</li> <li>• Gather data that explains where the cold air in Florida came from using time-series maps (Les 14).</li> <li>• Investigate cold and warm air masses with the hot and hold water investigation and the dry ice investigation. (Les 14)</li> <li>• Analyze precipitation data in the lower 48 states and use Global climate Cards to understand what causes climate patterns. (Les 15)</li> <li>• Investigate forecasting weather with “How to Forecast” reading and a storymap (Les 16)</li> </ul> <p>Putting the Pieces Together</p> <ul style="list-style-type: none"> <li>• Collaboratively create a diagrammatic model at a particle level to represent temperature differences near the surface and higher in the atmosphere (Les 3)</li> <li>• Collaboratively create a diagrammatic model at a particle level to represent why the air near the ground is warmer than the air higher up (Les 4).</li> <li>• Create a model of the soap bubble bottle and the heated</li> </ul> |  |  |
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|                  |  |  | <p>balloon that shows how density changes within the system (Les 5).</p> <ul style="list-style-type: none"> <li>• Collaboratively build a consensus model at a particle level to demonstrate what happens to warm air near the surface on days when it hails (Les 6).</li> <li>• Independently explain the formation of a hail cloud (Les 6).</li> <li>• Model forces acting on matter that keep matter suspended and bring matter down to the ground. (Les 9)</li> <li>• Connect the water tub observations to the movement of fluids in a cloud (Les 9).</li> <li>• Create a final hail model for a subquestion (Les 10).</li> <li>• Construct IF/THEN statements for a programmer to make updates to the simulation (Les 10).</li> <li>• Individually apply ideas with the Hurricane Assessment-Transfer task (Les 11).</li> <li>• Answer questions from the driving question board (Les 11).</li> <li>• Create side-by-side models to explain why some places get a lot of snow (Les 13).</li> <li>• Answer questions from the driving question board (Les 17).</li> <li>• Co-construct variables and independently complete the Dry Places Assessment-Transfer task (Les 17).</li> </ul> |  |  |
| <b>Standards</b> |  |  | <b>Science and Engineering Practices</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |

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| <p>3.2.6-8.B: Develop a model that predicts and describes changes in the particle motion, temperature, and state of a pure substance when thermal energy is added or removed.</p> <p>3.3.6-8.H: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.</p> <p>3.3.6-8.J: Collect data to provide evidence for how the motion and complex interactions of air masses result in changes in weather conditions.</p> <p>3.3.6-8.I: 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.</p> | <p>1.A Develop a model.</p> <p>1.B Ask questions that arise from careful observation of phenomena and models. Use these questions to clarify and seek additional information.</p> <p>2.A Analyze and interpret data using graphical displays (e.g., maps, charts, graphs, tables) of large data sets to identify temporal and spatial patterns.</p> <p>2.B Design</p> <p>3.A Analyze and interpret sets of data to identify patterns (similarities across data sets) that provide evidence.</p> <p>3.B Develop a model to show the relationship to explain.</p> <p>4.A Collect, analyze, and interpret data using graphical displays.</p> <p>4.B Develop and use a model to describe phenomena and unobservable mechanisms.</p> <p>5.A Collect and use observations and data as evidence.</p> <p>5.B Develop and use a particle-level model to show unobservable mechanisms.</p> <p>6.B Analyze and interpret data. Using these relationships, construct an explanation.</p> <p>6.B Obtain information by reading scientific texts.</p> <p>7.A Carry out an investigation.</p> <p>7.B Use a model to describe unobservable mechanisms.</p> <p>8.A Collect data on changes to the values of input variables.</p> <p>8.B Evaluate the limitations.</p> <p>9.A Use a model to predict and explain .</p> <p>9.B Construct an explanation.</p> <p>9.C Identify important variables, qualitative relationships, and mechanisms that work together to help explain and predict.</p> <p>10.A Develop a model.</p> <p>10.B Develop two computational models.</p> <p>11.A Construct an explanation.</p> <p>12.A Develop an initial model to predict given the confluence of variables.</p> <p>12.B Ask questions.</p> <p>13.A Collect data to answer questions.</p> <p>14.A Collect and use data.</p> <p>15.A Analyze and interpret data.</p> <p>15.B Analyze and interpret data.</p> <p>16.A Integrate scientific and technical information in text and media to explain.</p> <p>17.A Develop and use a model.</p> |
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## Unit 4 - Plate Tectonic and Rock Cycling

Timeframe: 25 days

Mandatory Resources: Customizable OpenSciEd lesson slides, customizable OpenSciEd lesson handouts, customizable OpenSciEd assessments, OpenSciEd ECA kit materials

Supplemental Resources and Materials: Table of contents, progress tracker, vocabulary organizer, binder/packet, teacher created student handouts

| Essential Questions                    | Learning Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Vocabulary                                                                                                               | Activities & Strategies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Instructional Mode                                                                                                                                             | Assessment                                                                                                                                                                              |
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| What Causes Earth's Surface to Change? | <p>Students will analyze data from many locations and time periods, applying the ideas of temporal and spatial scales accompanied by causal and correlational relationships to determine the reason why mountains and landscapes grow, move, and shrink.</p> <p>Students will develop a cross-sectional model of Earth that connects movement in the mantle with movement of plates at Earth's surface and determine causal and correlational relationships between plate movement, earthquakes, volcanoes, erosion, and magma movement along with their related energy sources.</p> <p>Students will develop a</p> | <ul style="list-style-type: none"> <li>• Magnitude</li> <li>• Earthquake</li> <li>• Magma</li> <li>• Deposits</li> </ul> | <p>Anchoring Phenomena Routine</p> <ul style="list-style-type: none"> <li>• Read about Mt Everest and four other mountains (Lesson 1)</li> </ul> <p>Navigation Routine</p> <ul style="list-style-type: none"> <li>• form DQB, brainstorm investigations (Lesson 1)</li> </ul> <p>Investigation Routine</p> <ul style="list-style-type: none"> <li>• Watch a video on Mt Everest, use Seismic Explorer to determine pattern between earthquakes and increasing elevation (Lesson 2)</li> <li>• Develop models to predict what we would find underground</li> <li>• Watch a storymap to learn about what is below the surface (Lesson 3)</li> <li>• Develop a cross section model of the North America plate (lesson 4)</li> <li>• Use a map to investigate volcano locations</li> <li>• Draw conclusions about volcanoes and mountain changes (Lesson 7)</li> <li>• Investigate artifacts from the Mid-Atlantic Ridge to support or refute our claims (Lesson 8)</li> <li>• Examine patterns in data across the continents (Lesson 10)</li> <li>• Physically model plate movement with puzzle pieces using scientific evidence in an expert group and jigsaw group (Les 11).</li> </ul> | <ul style="list-style-type: none"> <li>• Direct Instruction</li> <li>• Classroom discussion</li> <li>• Inquiry-based and small group investigations</li> </ul> | <p>Lesson 1: Initial model</p> <p>Lesson 11: Evaluating Two Models</p> <p>Lesson 13: Erosion rates of Mt Everest and Mt Mitchell</p> <p>Lesson 14: Transfer Task- Fossil Assessment</p> |

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|  | <p>model to show how plates collide or spread apart from one another over long periods of time, forming the different landforms we see.</p> <p>Students will analyze multiple sources of data and information (e.g., large data sets on maps, cross-section graphs, text, tables, and labs) to construct models and explanations for processes that build up and wear down Earth's surface over different timescales.</p> <p>Students will explain how processes above the surface and below the surface work together to cause the changes seen at and below the surface.</p> |  | <ul style="list-style-type: none"> <li>• Use the Ancient Earth Globe simulation to evaluate models of where plates were in the distant past (Les 12).</li> <li>• Read about erosion and uplift rates to model the processes that are changing the surface of the Earth (Les 13).</li> </ul> <p>Putting the Pieces Together</p> <ul style="list-style-type: none"> <li>• Look for patterns in GPS and use a physical model to demonstrate plate movement</li> <li>• Use the seismic explorer to investigate movement of all plates (Lesson 5)</li> <li>• Use our models to explain elevation changes</li> <li>• Answer many questions from the DQB (Lesson 6)</li> <li>• Answer questions and make predictions from DQB about the Andes Mountains and the Mid Atlantic Ridge (Lesson 9)</li> <li>• Evaluate the strengths and weaknesses of models and provide a rationale for where plates were in the distant past (Les 11).</li> <li>• Explain what caused the changes at ancient mountains with evidence from the Ancient Earth Globe (Les 12).</li> <li>• Predict changes at mountain based on calculations that are currently causing mountains to change in elevation (Les 13).</li> <li>• Revisit the DQB to determine which questions can be answered (Les 14).</li> <li>• Apply the ideas from the unit to complete the transfer task to explain how a fossil is exposed on the top of Mt. Everest by modeling and writing (Les 14).</li> </ul> |  |  |
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| Standards                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Science and Engineering Practices                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| <p>3.3.6-8.D 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.</p> <p>3.3.6-8.G Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.</p> <p>3.3.6-8.E Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.</p> <p>3.3.6-8.G Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.</p> | <p>1.A Develop a Model</p> <p>1.B Ask questions that arise from analysis of information</p> <p>2.A Present an oral and written argument</p> <p>2.B Use digital tools to examine a large data set</p> <p>3.A. Develop Models to describe the structure, composition and materials below Earth's surface</p> <p>3.B Construct a scientific explanation</p> <p>4.A. Develop a profile model</p> <p>4.B Construct an explanation</p> <p>5.A Analyze a graphical display of a large data set</p> <p>6.A. Develop and use models</p> <p>6.B. Construct an argument supporting a model</p> <p>7.A. Apply scientific ideas and evidence to construct an explanation</p> <p>8.A. Support or refute a claim orally and in writing</p> <p>8.B. Compare data and evidence from the case cards</p> <p>9.A. Construct an explanation</p> <p>10.A Analyze maps displaying patterns</p> <p>11.A Construct an explanation including reasoning that shows evidence</p> <p>12.A Construct a scientific explanation based on evidence from a model</p> <p>13.A Apply mathematical concepts (proportional relationships and unit rates) from unobservable processes</p> <p>14.A Develop and use a model</p> <p>14.B Construct an explanation based upon prior investigations and evidence</p> |

## Unit 5 - Natural Hazards

**Timeframe: 21 days** (Additional Time may be taken for the culminating project)

**Mandatory Resources:** Customizable OpenSciEd lesson slides, customizable OpenSciEd lesson handouts, customizable OpenSciEd assessments, OpenSciEd ECA kit materials

**Supplemental Resources and Materials:** Table of contents, progress tracker, vocabulary organizer, binder/packet, teacher created student handouts

| Essential Questions                                             | Learning Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Vocabulary                                                                                                                                                                                    | Activities & Strategies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Instructional Mode                                                                                                                                       | Assessment                                                                                                                                                                   |
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| Where do Natural Hazards Happen and how do we prepare for them? | <p>Students will analyze maps, graphs, physical models, videos and simulations to identify where tsunamis occur, how they form, how they move across the ocean, and what happens as they approach shore.</p> <p>Students will forecast which communities are most at risk for a tsunami and why.</p> <p>Students will evaluate engineering design solutions and technologies to mitigate the effects of tsunamis by identifying criteria and constraints and using a systematic process to rate the solutions and identify trade-offs.</p> <p>Students will apply these science ideas to consider how to communicate about another natural</p> | <ul style="list-style-type: none"> <li>Amplitude</li> <li>Primary criteria</li> <li>Secondary criteria</li> <li>Tradeoff</li> <li>Stakeholders</li> <li>Systems</li> <li>subsystem</li> </ul> | <p>Anchoring Phenomenon Routine</p> <ul style="list-style-type: none"> <li>Read about a 2011 earthquake that triggered a tsunami</li> <li>Watch videos on impact to people and structures</li> <li>Brainstorm related phenomena</li> <li>Generate list of data and information to better understand natural hazards (Lesson 1)</li> </ul> <p>Investigation Routine</p> <ul style="list-style-type: none"> <li>Investigate patterns related to causes of tsunamis</li> <li>Analyze data to notice only certain types of earthquakes cause tsunamis (Lesson 2)</li> <li>Analyze wave models to make sense how tsunamis form and move to shore-Chain of Events Poster (Lesson 3)</li> <li>Define the problem and identify criteria and constraints for community safety solutions</li> <li>Read tsunami warning information (Lesson 6)</li> <li>Evaluate tsunami preparation and response communication solutions (Lesson 7)</li> </ul> <p>Putting the Pieces Together</p> <ul style="list-style-type: none"> <li>Use the Tsunami Chain of Events poster to construct an explanation of</li> </ul> | <ul style="list-style-type: none"> <li>Direct Instruction</li> <li>Classroom discussion</li> <li>Inquiry-based and small group investigations</li> </ul> | <p>Lesson 1: Initial design solutions</p> <p>Lesson 4: Explaining and Forecasting Tsunami Risk</p> <p>Lesson 10: Assessing Hazard Risk and Determining Stakeholder Needs</p> |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>hazard to stakeholders in a community.</p> <p>Students will analyze historical hazard data to determine what hazards are at highest risk to communities.</p> |  | <p>related geologic forces (Lesson 4)</p> <ul style="list-style-type: none"> <li>• Revisit past lessons in a scientist circle to develop a systems model that identifies the relationship between subsystems and the goals of a community (Lesson 9)</li> <li>• Create a final communication product to warn the community of natural hazards (Lesson 10)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |
| <p><b>Standards</b></p> <p>3.3.6-8.L Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.</p> <p>3.5.6-8.W (ETS) 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.</p> <p>3.5.6-8.P (ETS) Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.</p> <p>3.2.6-8.S Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.</p> |                                                                                                                                                                 |  | <p><b>Science and Engineering Practices</b></p> <p>1.A. Ask questions from careful observation<br/> 1.B Apply scientific ideas to design an object<br/> 2.A Use graphical displays of large data sets<br/> 2.B Use digital tools to analyze large data sets<br/> 2.C Integrate quantitative and qualitative scientific information<br/> 3.A Analyze and interpret data from different wave models<br/> 3.B Evaluate limitations and benefits of different wave models<br/> 4.A Apply scientific ideas to construct an explanation<br/> 4.B Construct an explanation that includes qualitative relationships<br/> 5.A Make an oral argument<br/> 6.A Critically read scientific text<br/> 7.A Integrate written text with multimedia displays<br/> 7.B Evaluate communication systems<br/> 8.A Use digital tools to integrate and synthesize information<br/> 9.A Construct a system model to represent interactions of subsystems<br/> 10.A Use digital tools to analyze patterns<br/> 10.B Critically read scientific texts<br/> 10.C Communicate scientific and technical information in writing or oral presentation</p> |  |  |

## Unit 6 - Earth's Resources and Human Impact

**Timeframe: 33-37 days** (Additional Time may be taken for the culminating project)

**Mandatory Resources:** Customizable OpenSciEd lesson slides, customizable OpenSciEd lesson handouts, customizable OpenSciEd assessments, OpenSciEd ECA kit materials

**Supplemental Resources and Materials:** Table of contents, progress tracker, vocabulary organizer, binder/packet, teacher created student handouts

| Essential Questions                                                                   | Learning Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Vocabulary                                                                                                                                                                                                                                                                                    | Activities & Strategies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Instructional Mode                                                                                                                                                     | Assessment                                                                                                                                                                                                                                                                      |
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| How do changes in Earth's systems impact our communities and what can we do about it? | <p>Students will analyze and interpret data that indicate long-term climate variables (temperature and precipitation) are changing in communities.</p> <p>Students will develop and use models to explain how changing variables in Earth's water and carbon systems are impacting human communities that depend on those systems.</p> <p>Students will construct an explanation for how increased temperatures can cause changes to a community's water resources.</p> <p>Students will argue from evidence that rising temperatures result from an imbalance in Earth's carbon system.</p> | <ul style="list-style-type: none"> <li>• Drought</li> <li>• Flood</li> <li>• Vary</li> <li>• Short-term variability</li> <li>• Long-term trend</li> <li>• Climate change</li> <li>• Greenhouse gases</li> <li>• Per-capita consumption</li> <li>• Combustion</li> <li>• Resilience</li> </ul> | <p>Anchoring Phenomenon Routine</p> <ul style="list-style-type: none"> <li>• Introduce the new phenomena of extreme floods and droughts (Les 1)</li> <li>• Develop a systems model explaining what could be causing warmer temperatures and how warmer temperatures could lead to both droughts and floods (Les 1)</li> <li>• Develop a Driving Question Board (DQB) surrounding the new phenomena (Les 1)</li> </ul> <p>Navigation Routine</p> <ul style="list-style-type: none"> <li>• Brainstorm investigations and sources of data that could help to figure out answers to the questions (Les 1)</li> <li>• Independently or collaboratively update what was figured out in the progress tracker (All lessons)</li> </ul> <p>Investigation Routine</p> <ul style="list-style-type: none"> <li>• Analyze data to determine what is normal and not normal about temperature and precipitation as it relates to floods and droughts for our community and six case sites in the United States. (Les 2)</li> </ul> | <ul style="list-style-type: none"> <li>• Direct Instruction</li> <li>• Classroom discussion</li> <li>• Inquiry-based investigations</li> <li>• Small groups</li> </ul> | <p>Lesson 5: Revised Water Story Explanation</p> <p>Lesson 6: Alaska Wildfires and Sea Ice (CER)</p> <p>Lesson 12: Social Media Post Assessment-Transfer task</p> <p>Lesson 17: Designing a Community Resilience Plan Project</p> <p>Lesson 17: Argue for the Best Solution</p> |

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|  | <p>Students will define the problem as an imbalance in Earth's carbon system due to greenhouse gas accumulation, with no easy solutions to quickly fix it.</p> <p>Students will evaluate a variety of solutions based on how well they meet the criteria of reducing the carbon imbalance given the many societal constraints students identified.</p> <p>Students will communicate about a community resilience designed to account for stakeholders' needs while also correcting carbon imbalances and adapting to current changes experienced in the community.</p> |  | <ul style="list-style-type: none"> <li>• Create bottle setups to test how increased temperatures affect evaporation rates and use visualizations of water vapor movement across the US and ocean temperatures in an open system. (Les 3)</li> <li>• Analyze Earth's water system and how those components are changing as temperatures increase to conclude that all components and processes in the system have been affected by a temperature rise. (Les 4)</li> <li>• Build understanding of parts per million by analyzing data, and figure out how to find the percent change in the quantity of these gases over time. (Les 7)</li> <li>• Physically model molecules to investigate the way molecules move in response to energy transfer. (Les 8)</li> <li>• Investigate with an interactive showing how molecules move when energy is absorbed. (Les 8)</li> <li>• Carry out an investigation to determine if gas can be trapped in ice. (Les 9)</li> <li>• Use a StoryMap to figure out scientists use ice core samples from locations on Earth that have very old ice to determine the amounts of carbon dioxide in the air over time. (Les 9)</li> <li>• Analyze graphs from Earth's history to understand what led to a rapid increase in CO<sub>2</sub> emissions. (Les 10)</li> <li>• Watch a visualization and read about key innovations in</li> </ul> |  |  |
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|  |  |  | <p>human history that transformed the types of energy used to power our communities. (Les 10)</p> <ul style="list-style-type: none"><li>• Simulate processes that move carbon in the air using the Carbon Dice Activity. (Les 11)</li><li>• Calculate our daily carbon footprint and create a class Carbon Scoreboard. (Les 14)</li><li>• Calculate the average carbon footprint for someone in our class and compare it to the average American's footprint. (Les 14)</li><li>• Choose carbon reduction activities and behaviors that would reduce our carbon emissions. (Les 14)</li><li>• Compound the effects of these changes if everyone in the classroom, school, and community are willing to make changes. (Les 14)</li><li>• Use a Design Matrix to organize the different solutions for reducing CO in the atmosphere. (Les 15)</li><li>• Determine constraints for the solutions in trying to meet the criteria of reducing the imbalance of carbon in the air. (Les 15)</li><li>• Reevaluate each solution using our constraints and decide that multiple solutions would need to be implemented to meet the criteria. (Les 15)</li><li>• Obtain information from community plans to determine how the solutions are being used in the communities and how they rebalance carbon</li></ul> |  |  |
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|  |  |  | <p>and/or help the community to become more resilient to changes already occurring in the community and use these plans as examples to help motivate the need to evaluate and/or develop a plan for their own community. (Les 16)</p> <ul style="list-style-type: none"> <li>• Work in groups to design resilience plans that contribute to the long-term rebalancing of carbon and also prepare the community for change.</li> <li>• Provide feedback to other groups and evaluate the plans by asking questions. (Les 17)</li> </ul> <p>Putting the Pieces Together</p> <ul style="list-style-type: none"> <li>• Revise models with new information. (Les 4)</li> <li>• Use the revised model ideas from previous lessons to construct explanations, using evidence, about how changes in temperature are having impacts on the water stories in our case site communities. (Les 5)</li> <li>• Revisit the Alaskan headlines about wildfires and apply key model ideas in a transfer task to explain how an increase in temperature is causing both phenomena to occur. (Les 6)</li> <li>• Modify an Earth's Carbon System model to represent the locations of carbon and processes that move carbon around. (L11)</li> <li>• Model the causal relationship between fossil fuel use and changing water resources.</li> <li>• Review a tweet regarding climate change and the</li> </ul> |  |  |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  | <p>impacts, break the tweet down into claims and apply by completing the transfer task identifying inaccurate claims by providing an explanation of the causal relationships between human activities and climate change. (Les 12)</p> <ul style="list-style-type: none"><li>• Create an argument for the one best solution for our community. (Les 17)</li><li>• Identify the questions from our DQB that we can now answer.(Les 18)</li></ul> <p>Problemizing Routine</p> <ul style="list-style-type: none"><li>• Determine that the problem of increasing temperatures is due to the CO imbalance in the atmosphere caused by human combustion and use a simulation to determine what cuts are needed to emissions rates to reach equilibrium. (Les 13)</li></ul>                                                                                                                                                                                                                                               |  |  |
| <p><b>Standards</b></p> <p>3.3.6-8.K: Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.</p> <p>3.3.6-8.N: Construct an argument supported by evidence for how increases in human population and per capita consumption of natural resources impact Earth's systems.</p> <p>3.3.6-8.M: Apply scientific principles to design a method for monitoring and minimizing human impact on the environment.</p> <p>3.3.6-8.O: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.</p> <p>3.5.6-8.P (ETS): Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.</p> |  |  | <p><b>Science and Engineering Practices</b></p> <p>1.A Develop a model to explain.</p> <p>1.B Ask questions that arise from initial observations.</p> <p>2.A Develop and use a model to describe the components, interactions, and processes.</p> <p>2.B Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify.</p> <p>2.C Analyze and interpret data .</p> <p>3.A Analyze investigation data.</p> <p>3.B Modify a model - based on evidence.</p> <p>4.A Integrate scientific information with media and graphical displays of data to clarify.</p> <p>5.A Construct a scientific explanation based on valid and reliable evidence.</p> <p>6.A Compare graphs and charts looking for similarities and differences.</p> <p>6.B Analyze graphs and charts from multiple claims to identify the similarities and differences in patterns.</p> <p>7.A Apply mathematical concepts of percent to understand the proportion and quantity of and stability and/or change.</p> |  |  |

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|  | <p>8.A Develop and use a model to describe.</p> <p>9.A Analyze and interpret data on graphs to collect evidence.</p> <p>10.A Integrate qualitative and quantitative scientific information in written text with digital tools to analyze trends.</p> <p>10.B Ask questions that require sufficient and appropriate evidence.</p> <p>11.A Apply mathematical concepts to compare.</p> <p>12.A Develop a model to describe.</p> <p>12.B Construct an argument supported by science ideas to refute and clarify claims through an explanation.</p> <p>13.A Use a model to generate data and test ideas.</p> <p>14.A Apply mathematical concepts to calculate.</p> <p>15.A Evaluate competing solutions using a systematic process.</p> <p>16.A Critically read scientific texts to obtain information.</p> <p>17.A Apply scientific principles to design a process/system.</p> <p>17.B Ask questions.</p> <p>17.C Construct an argument grounded in evidence and scientific reasoning.</p> <p>17.D Communicate information.</p> <p>18.A Communicate scientific information.</p> |
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