Science

Unit	Light and Matter
Unit Duration	6 weeks
Unit Goals	
NJSLS	• **MS-PS4-2 D**evelop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. *[Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]* • **MS-LS1-8** Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. *[Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]*
Science & Engineering Practices	• Develop and use a model to describe phenomena. (SEP.MS-PS4.A1) • Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. (SEP.MS-PS4.C1) • Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (SEP.MS-LS1.E1)
Disciplinary Core Ideas	• 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. (DCI.MS-LS1.D1) • A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (DCI.MS-PS4.A1) • A sound wave needs a medium through which it is transmitted. (DCI.MS-PS4.A2)
Cross Cutting Concepts	• Patterns (CCC.MS-PS4.A) • Structure and Function (CCC.MS-PS4.B) • Influence of Science, Engineering, and Technology on Society and the Natural World (CCC.MS-PS4.C) • Cause and Effect (CCC.MS-LS1.A) • Systems and System Models (CCC.MS-LS1.C) • Structure and Function (CCC.MS-LS1.E)

Connections to NJSLS – English Language Arts	● Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia) when useful to aiding comprehension. (W.6.2A) ● Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples. (W.6.2B) ● Use appropriate transitions to clarify the relationships among ideas and concepts. (W.6.2C) ● Use precise language and domain-specific vocabulary to inform about or explain the topic. (W.6.2D) ● Establish and maintain a formal/academic style, approach, and form (W.6.2E) ● Provide a concluding statement or section that follows from the information or explanation presented. (W.6.2F)
Connections to NJSLS - Mathematics	● Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. (6.RP.A.3.D) ● Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. (6.SP.B.5.B)
21st Century and Career Integration	● Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3). (9.4.8.CI.2) ● Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1). (9.4.8.CT.2) ● Ask insightful questions to organize different types of data and create meaningful visualizations. (9.4.8.IML.4) ● Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose (e.g., 1.2.8.C2a, 1.4.8.CR2a, 2.1.8.CHSS/IV.8.AI.1, W.5.8, 6.1.8.GeoSV.3.a, 6.1.8.CivicsDP.4.b, 7.1.NH. IPRET.8). (9.4.8.IML.7)
Computer Science and Design Thinking	● Engineering design is a systematic, creative, and iterative process used to address local and global problems. (1145197) ● The process includes generating ideas, choosing the best solution, and making, testing, and redesigning models or prototypes. (1145198) ● Engineering design requirements and specifications involve making trade-offs between competing requirements and desired design features. (1145199) ● Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer. (8.2.8.ED.1) ● Identify the steps in the design process that could be used to solve a problem. (8.2.8.ED.2) ● Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch). (8.2.8.ED.3) ● Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team. (8.2.8.ED.4)

	● Explain the need for optimization in a design process (8.2.8.ED.5) ● Analyze how trade-offs can impact the design of a product. (8.2.8.ED.6) ● Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches). (8.2.8.ED.7) ● Examine the effects of ethical and unethical practices in product design and development. (8.2.8.EC.2)
Career Ready Practices	● Act as a responsible and contributing citizen and employee. (CRP1) ● Apply appropriate academic and technical skills. (CRP2) ● Communicate clearly and effectively and with reason. (CRP4) ● Demonstrate creativity and innovation. (CRP6) ● Employ valid and reliable research strategies. (CRP7) ● Utilize critical thinking to make sense of problems and persevere in solving them. (CRP8) ● Use technology to enhance productivity. (CRP11) ● Work productively in teams while using cultural global competence. (CRP12)

Resources and Technology Integration
● https://www.openscied.org/instructional-materials/6-1-light-matter/ ● Brain Pop

Assessments

- Ask questions
- Define problems
- Develop and use models
- Plan and carry out investigations
- Analyze and interpret data
- Formative assessment
- Teacher observation
- Class discussion
- Venn diagram

Unit	Thermal energy
Unit Duration	6 weeks
Unit Goals	
NJSLS	• **MS-PS1-4** Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. [*Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]* • **MS-PS3-3** Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. *[Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]* • **MS-PS3-4** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. *[Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of*

	energy is added.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.] ● **MS-PS3-5** 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. *[Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [Assessment Boundary: Assessment does not include calculations of energy.]* ● **MS-PS4-2** Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. *[Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]* ● **MS-ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. ● **MS-ETS1-2** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. ● **MS-ETS1-3** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. ● **MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
Science & Engineering Practices	● Developing and Using Models (SEP.MS-PS1.A) ● Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (SEP.MS-PS3.B1) ● Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (SEP.MS-PS3.D1) ● Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. (SEP.MS-PS3.E1) ● Develop and use a model to describe phenomena. (SEP.MS-PS4.A1) ● Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (SEP.MS-ETS1.B1)
Disciplinary Core Ideas	● 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. (DCI.MS-PS1.C1)

	● 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. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (DCI.MS-PS1.C2) ● Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (DCI.MS-PS3.A1) ● A system of objects may also contain stored (potential) energy, depending on their relative positions. (DCI.MS-PS3.A2) ● 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. (DCI.MS-PS3.A3) ● When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (DCI.MS-PS3.B1) ● 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. (DCI.MS-PS3.B2) ● Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (DCI.MS-PS3.B3) ● When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (DCI.MS-PS3.C1) ● 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. (DCI.MS-PS3.D1) ● A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. (DCI.MS-PS3.E1) ● A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (DCI.MS-PS4.A1) ● A sound wave needs a medium through which it is transmitted. (DCI.MS-PS4.A2) ● 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. (DCI.MS-PS4.B1) ● 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. (DCI.MS-PS4.B2) ● A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (DCI.MS-PS4.B3) ● However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (DCI.MS-PS4.B4) ● Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (DCI.MS-PS4.C1)
Cross Cutting Concepts	● Matter is conserved because atoms are conserved in physical and chemical processes. (CCC.MS-PS1.D1) ● The transfer of energy can be tracked as energy flows through a designed or natural system. (CCC.MS-PS1.D2)

	● Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. (CCC.MS-PS3.A1) ● Systems and System Models (CCC.MS-PS3.B) ● Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems. (CCC.MS-PS3.B1) ● Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). (CCC.MS-PS3.C1) ● The transfer of energy can be tracked as energy flows through a designed or natural system. (CCC.MS-PS3.C2) ● Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (CCC.MS-PS4.B1) ● Structures can be designed to serve particular functions. (CCC.MS-PS4.B2) ● All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (CCC.MS-ETS1.A1)
Connections to NJSLS – English Language Arts	● Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia) when useful to aiding comprehension. (W.6.2A) ● Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples. (W.6.2B) ● Use appropriate transitions to clarify the relationships among ideas and concepts. (W.6.2C) ● Use precise language and domain-specific vocabulary to inform about or explain the topic. (W.6.2D) ● Establish and maintain a formal/academic style, approach, and form (W.6.2E) ● Provide a concluding statement or section that follows from the information or explanation presented. (W.6.2F)
Connections to NJSLS - Mathematics	● Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes." (6.RP.A.1) ● Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship. For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger." (6.RP.A.2) ● Summarize numerical data sets in relation to their context, such as by: (6.SP.B.5)
21st Century and Career Integration	● Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3). (9.4.8.CI.2) ● Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1). (9.4.8.CT.2) ● Ask insightful questions to organize different types of data and create meaningful visualizations. (9.4.8.IML.4)

	● Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose (e.g., 1.2.8.C2a, 1.4.8.CR2a, 2.1.8.CHSS/IV.8.AI.1, W.5.8, 6.1.8.GeoSV.3.a, 6.1.8.CivicsDP.4.b, 7.1.NH. IPRET.8). (9.4.8.IML.7)
Computer Science and Design Thinking	● Engineering design is a systematic, creative, and iterative process used to address local and global problems. (1145197) ● The process includes generating ideas, choosing the best solution, and making, testing, and redesigning models or prototypes. (1145198) ● Engineering design requirements and specifications involve making trade-offs between competing requirements and desired design features. (1145199) ● Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer. (8.2.8.ED.1) ● Identify the steps in the design process that could be used to solve a problem. (8.2.8.ED.2) ● Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch). (8.2.8.ED.3) ● Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team. (8.2.8.ED.4) ● Explain the need for optimization in a design process (8.2.8.ED.5) ● Analyze how trade-offs can impact the design of a product. (8.2.8.ED.6) ● Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches). (8.2.8.ED.7) ● Examine the effects of ethical and unethical practices in product design and development. (8.2.8.EC.2)
Career Ready Practices	● Act as a responsible and contributing citizen and employee. (CRP1) ● Apply appropriate academic and technical skills. (CRP2) ● Communicate clearly and effectively and with reason. (CRP4) ● Demonstrate creativity and innovation. (CRP6) ● Employ valid and reliable research strategies. (CRP7) ● Utilize critical thinking to make sense of problems and persevere in solving them. (CRP8) ● Use technology to enhance productivity. (CRP11) ● Work productively in teams while using cultural global competence. (CRP12)

Resources and Technology Integration
• https://www.openscied.org/instructional-materials/6-2-thermal-energy/ • Brain Pop

Assessments
• Ask questions • Define problems • Develop and use models • Plan and carry out investigations • Analyze and interpret data • Formative assessment • Teacher observation • Class discussion • Venn diagram

Unit	Weather, Climate and Water Cycling
Unit Duration	6 weeks
Unit Goals	
NJSLS	• MS-PS1-1 Develop models to describe the atomic composition of simple molecules and extended structures. *[Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and*

	bonding energy, discussing the ionic nature of subunits of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure.] ● **MS-PS1-4** Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. *[Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]* ● **MS-ESS2-4** Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. *[Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]* ● **MS-ESS2-5** Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. *[Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]* ● **MS-ESS2-6** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. *[Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of New Jersey Department of Education December 2020 Page 133 of 200 Grades 6 through 8: Earth and Space Sciences continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]*
Science & Engineering Practices	● Develop a model to predict and/or describe phenomena. (SEP.MS-PS1.A1) ● Develop a model to describe unobservable mechanisms. (SEP.MS-PS1.A2) ● Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (SEP.MS-PS1.D1)

	● Develop and use a model to describe phenomena. (SEP.MS-ESS2.A1) ● Develop a model to describe unobservable mechanisms. (SEP.MS-ESS2.A2) ● Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (SEP.MS-ESS2.B1) ● Analyze and interpret data to provide evidence for phenomena. (SEP.MS-ESS2.C1)
Disciplinary Core Ideas	● Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (DCI.MS-PS1.A1) ● Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (DCI.MS-PS1.A3) ● 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. (DCI.MS-PS1.A4) ● Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (DCI.MS-PS1.A5) ● The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (DCI.MS-PS1.A6) ● 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. (DCI.MS-PS1.C1) ● 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. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (DCI.MS-PS1.C2) ● Earth's Systems (DCI.MS-ESS2) ● The Roles of Water in Earth’s Surface Processes (DCI.MS-ESS2.D) ● Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (DCI.MS-ESS2.D1) ● 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. (DCI.MS-ESS2.D2) ● Weather and Climate (DCI.MS-ESS2.E) ● 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. (DCI.MS-ESS2.E1) ● Because these patterns are so complex, weather can only be predicted probabilistically. (DCI.MS-ESS2.E2) ● 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. (DCI.MS-ESS2.E3)

	● Natural Hazards (DCI.MS-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. (DCI.MS-ESS3.B1) ● Global Climate Change (DCI.MS-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. (DCI.MS-ESS3.D1)
Cross Cutting Concepts	● Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (CCC.MS-PS1.C1) ● Patterns in rates of change and other numerical relationships can provide information about natural systems. (CCC.MS-ESS2.A1) ● Cause and effect relationships may be used to predict phenomena in natural or designed systems. (CCC.MS-ESS2.B1) ● Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (CCC.MS-ESS2.C1) ● Models can be used to represent systems and their interactions— such as inputs, processes and outputs—and energy, matter, and information flows within systems. (CCC.MS-ESS2.D1) ● Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (CCC.MS-ESS2.E1) ● Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (CCC.MS-ESS2.F1) ● Science findings are frequently revised and/or reinterpreted based on new evidence. (CCC.MS-ESS2.G1) ● Graphs, charts, and images can be used to identify patterns in data. (CCC.MS-ESS3.A1) ● Cause and effect relationships may be used to predict phenomena in natural or designed systems. (CCC.MS-ESS3.B2) ● Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (CCC.MS-ESS3.C1) ● All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (CCC.MS-ESS3.D1)
Connections to NJSLS – English Language Arts	● Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia) when useful to aiding comprehension. (W.6.2A) ● Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples. (W.6.2B) ● Use appropriate transitions to clarify the relationships among ideas and concepts. (W.6.2C) ● Use precise language and domain-specific vocabulary to inform about or explain the topic. (W.6.2D) ● Establish and maintain a formal/academic style, approach, and form (W.6.2E)

	• Provide a concluding statement or section that follows from the information or explanation presented. (W.6.2F)
Connections to NJSLS - Mathematics	• Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed? (6.RP.A.3.B) • Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. (6.SP.B.5.B)
21st Century and Career Integration	• Multiple solutions often exist to solve a problem. (9.4.8.CT.CI.1) • An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful. (9.4.8.CT.CI.2) • Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2). (9.4.8.CT.1) • Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1). (9.4.8.CT.2) • Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome. (9.4.8.CT.3) • Awareness of and appreciation for cultural differences is critical to avoid barriers to productive and positive interaction. (9.4.8.GCA.CI.1) • Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a). (9.4.8.GCA.1) • Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal. (9.4.8.GCA.2) • Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others. (9.4.8.TL.CI.1) • Digital tools allow for remote collaboration and rapid sharing of ideas unrestricted by geographic location or time. (9.4.8.TL.CI.2) • Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4). (9.4.8.TL.2) • Select appropriate tools to organize and present information digitally. (9.4.8.TL.3) • Compare the process and effectiveness of synchronous collaboration and asynchronous collaboration. (9.4.8.TL.5) • Collaborate to develop and publish work that provides perspectives on a real-world problem. (9.4.8.TL.6)
Computer Science and Design Thinking	• Engineering design is a systematic, creative, and iterative process used to address local and global problems. (1145197) • The process includes generating ideas, choosing the best solution, and making, testing, and redesigning models or prototypes. (1145198)

	● Engineering design requirements and specifications involve making trade-offs between competing requirements and desired design features. (1145199) ● Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer. (8.2.8.ED.1) ● Identify the steps in the design process that could be used to solve a problem. (8.2.8.ED.2) ● Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch). (8.2.8.ED.3) ● Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team. (8.2.8.ED.4) ● Explain the need for optimization in a design process (8.2.8.ED.5) ● Analyze how trade-offs can impact the design of a product. (8.2.8.ED.6) ● Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches). (8.2.8.ED.7) ● Examine the effects of ethical and unethical practices in product design and development. (8.2.8.EC.2)
Career Ready Practices	● Act as a responsible and contributing citizen and employee. (CRP1) ● Apply appropriate academic and technical skills. (CRP2) ● Communicate clearly and effectively and with reason. (CRP4) ● Demonstrate creativity and innovation. (CRP6) ● Employ valid and reliable research strategies. (CRP7) ● Utilize critical thinking to make sense of problems and persevere in solving them. (CRP8) ● Use technology to enhance productivity. (CRP11) ● Work productively in teams while using cultural global competence. (CRP12)

Resources and Technology Integration
● https://www.openscied.org/instructional-materials/6-3-weather-climate-water-cycling/ ● Brain Pop

Assessments	
- Ask questions - Define problems - Develop and use models - Plan and carry out investigations - Analyze and interpret data - Formative assessment - Teacher observation - Class discussion - Venn diagram	
Unit	Cells
Unit Duration	6 weeks
Unit Goals	
NJSLS	**MS-LS1-1** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. *[Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.]* **MS-LS1-2** Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. *[Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.]* **MS-LS1-3** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. *[Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.]* [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]

	● **MS-LS1-8** Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. *[Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]*
Science & Engineering Practices	● Develop and use a model to describe phenomena. (SEP.MS-LS1.A1) ● Develop a model to describe unobservable mechanisms. (SEP.MS-LS1.A2) ● Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (SEP.MS-LS1.B1) ● Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (SEP.MS-LS1.D1) ● Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (SEP.MS-LS1.D2) ● Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (SEP.MS-LS1.E1)
Disciplinary Core Ideas	● All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (DCI.MS-LS1.A1) ● Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (DCI.MS-LS1.A2) ● In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (DCI.MS-LS1.A3) ● Animals engage in characteristic behaviors that increase the odds of reproduction. (DCI.MS-LS1.B1) ● Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (DCI.MS-LS1.B2) ● Genetic factors as well as local conditions affect the growth of the adult plant. (DCI.MS-LS1.B3) ● Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (DCI.MS-LS1.C1) ● Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (DCI.MS-LS1.C2) ● 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. (DCI.MS-LS1.D1)

	● The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (DCI.MS-LS1.E1) ● Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (DCI.MS-LS1.E2)
Cross Cutting Concepts	● Cause and effect relationships may be used to predict phenomena in natural systems. (CCC.MS-LS1.A1) ● Phenomena that can be observed at one scale may not be observable at another scale. (CCC.MS-LS1.B1) ● Systems may interact with other systems; they may have subsystems and be a part of larger complex systems. (CCC.MS-LS1.C1) ● Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (CCC.MS-LS1.E1) ● Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (CCC.MS-LS1.F1) ● Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (CCC.MS-LS1.G1)
Connections to NJSLS – English Language Arts	● Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia) when useful to aiding comprehension. (W.6.2A) ● Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples. (W.6.2B) ● Use appropriate transitions to clarify the relationships among ideas and concepts. (W.6.2C) ● Use precise language and domain-specific vocabulary to inform about or explain the topic. (W.6.2D) ● Establish and maintain a formal/academic style, approach, and form (W.6.2E) ● Provide a concluding statement or section that follows from the information or explanation presented. (W.6.2F)
Connections to NJSLS - Mathematics	● Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation $d = 65t$ to represent the relationship between distance and time. (6.EE.C.9) ● Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. (6.SP.A.2)

	● Summarize numerical data sets in relation to their context, such as by: (6.SP.B.5)
21st Century and Career Integration	● Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1). (9.4.8.CT.2) ● Critically curate multiple resources to assess the credibility of sources when searching for information. (9.4.8.IML.1)
Computer Science and Design Thinking	● Identify the steps in the design process that could be used to solve a problem. (8.2.8.ED.2) ● Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch). (8.2.8.ED.3) ● Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team. (8.2.8.ED.4) ● Explain the need for optimization in a design process (8.2.8.ED.5) ● Evaluate the impact of sustainability on the development of a designed product or system. (8.2.8.ITH.3) ● Compare the impacts of a given technology on different societies, noting factors that may make a technology appropriate and sustainable in one society but not in another. (8.2.8.ITH.5)
Career Ready Practices	● Act as a responsible and contributing citizen and employee. (CRP1) ● Apply appropriate academic and technical skills. (CRP2) ● Communicate clearly and effectively and with reason. (CRP4) ● Utilize critical thinking to make sense of problems and persevere in solving them. (CRP8) ● Model integrity, ethical leadership and effective management. (CRP9) ● Use technology to enhance productivity. (CRP11)

Resources and Technology Integration

- https://www.openscied.org/instructional-materials/6-6-cells-systems/
- Brain Pop

Assessments

- Ask questions
- Define problems
- Develop and use models
- Plan and carry out investigations
- Analyze and interpret data
- Formative assessment
- Teacher observation
- Class discussion
- Venn diagram

Unit	Natural Hazards
Unit Duration	6 weeks
Unit Goals	
NJSLS	• **MS-PS4-3** 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. *[Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.] [Assessment Boundary: Assessment does not include binary counting. Assessment does not include the specific mechanism of any given device.]* • **MS-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. *[Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]*

	● **MS-ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. ● **MS-ETS1-2** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. ● **MS-ETS1-3** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. () ● **MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
Science & Engineering Practices	● Use mathematical representations to describe and/or support scientific. (SEP.MS-PS4.B1) ● Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. (SEP.MS-PS4.C1) ● Ask questions to identify and clarify evidence of an argument. (SEP.MS-ESS3.A1) ● Analyze and interpret data to determine similarities and differences in findings. (SEP.MS-ESS3.B1) ● Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (SEP.MS-ESS3.C1) ● Apply scientific principles to design an object, tool, process or system. (SEP.MS-ESS3.C2) ● Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (SEP.MS-ESS3.D1) ● Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (SEP.MS-ETS1.A1) ● Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (SEP.MS-ETS1.B1) ● Analyze and interpret data to determine similarities and differences in findings. (SEP.MS-ETS1.C1) ● Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (SEP.MS-ETS1.D1)
Disciplinary Core Ideas	● 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. (DCI.MS-ESS3.A1) ● 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. (DCI.MS-ESS3.B1) ● 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. (DCI.MS-ESS3.C1)

	● Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (DCI.MS-ESS3.C2) ● 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. (DCI.MS-ESS3.D1) ● The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (DCI.MS-ETS1.A1) ● A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (DCI.MS-ETS1.B1) ● There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (DCI.MS-ETS1.B2) ● Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (DCI.MS-ETS1.B3) ● Models of all kinds are important for testing solutions. (DCI.MS-ETS1.B4) ● Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (DCI.MS-ETS1.C1) ● The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (DCI.MS-ETS1.C2)
Cross Cutting Concepts	● Graphs and charts can be used to identify patterns in data. (CCC.MS-PS4.A1) ● Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (CCC.MS-PS4.C1) ● Graphs, charts, and images can be used to identify patterns in data. (CCC.MS-ESS3.A1) ● Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (CCC.MS-ESS3.B1) ● Cause and effect relationships may be used to predict phenomena in natural or designed systems. (CCC.MS-ESS3.B2) ● Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (CCC.MS-ESS3.C1) ● All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (CCC.MS-ESS3.D1) ● The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus, technology use varies from region to region and over time. (CCC.MS-ESS3.D2)

	● Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (CCC.MS-ESS3.E1) ● All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (CCC.MS-ETS1.A1) ● The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (CCC.MS-ETS1.A2)
Connections to NJSLS – English Language Arts	● Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia) when useful to aiding comprehension. (W.6.2A) ● Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples. (W.6.2B) ● Use appropriate transitions to clarify the relationships among ideas and concepts. (W.6.2C) ● Use precise language and domain-specific vocabulary to inform about or explain the topic. (W.6.2D) ● Establish and maintain a formal/academic style, approach, and form (W.6.2E) ● Provide a concluding statement or section that follows from the information or explanation presented. (W.6.2F)
Connections to NJSLS - Mathematics	● Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set (6.EE.B.6)
21st Century and Career Integration	● Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking. (9.4.8.CI.CI.1) ● Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4). (9.4.8.CI.1) ● Multiple solutions often exist to solve a problem. (9.4.8.CT.CI.1) ● An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful. (9.4.8.CT.CI.2) ● Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose (e.g., 1.2.8.C2a, 1.4.8.CR2a, 2.1.8.CHSS/IV.8.AI.1, W.5.8, 6.1.8.GeoSV.3.a, 6.1.8.CivicsDP.4.b, 7.1.NH. IPRET.8). (9.4.8.IML.7) ● Apply deliberate and thoughtful search strategies to access high-quality information on climate change (e.g., 1.1.8.C1b). (9.4.8.IML.8) ● Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others. (9.4.8.TL.CI.1)

	● Digital tools allow for remote collaboration and rapid sharing of ideas unrestricted by geographic location or time. (9.4.8.TL.CI.2)
Computer Science and Design Thinking	● The accuracy of predictions or inferences made from a computer model is affected by the amount, quality, and diversity of data. (1145083) ● Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems. (1145247) ● Decisions on trade-offs involve systematic comparisons of all costs and benefits, and final steps that may involve redesigning for optimization. (1145248) ● Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints. (1145249) ● Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution. (8.2.12.ETW.3)
Career Ready Practices	● Act as a responsible and contributing citizen and employee. (CRP1) ● Apply appropriate academic and technical skills. (CRP2) ● Communicate clearly and effectively and with reason. (CRP4) ● Consider the environmental, social and economic impacts of decisions. (CRP5) ● Demonstrate creativity and innovation. (CRP6) ● Employ valid and reliable research strategies. (CRP7) ● Utilize critical thinking to make sense of problems and persevere in solving them. (CRP8) ● Use technology to enhance productivity. (CRP11) ● Work productively in teams while using cultural global competence. (CRP12)

Resources and Technology Integration

- https://www.openscied.org/instructional-materials/6-5-natural-hazards/
- Brain Pop

Assessments

- Ask questions
- Define problems
- Develop and use models
- Plan and carry out investigations
- Analyze and interpret data
- Formative assessment
- Teacher observation
- Class discussion
- Venn diagram

Unit	Plate Tectonics & Rock Cycling
Unit Duration	6 weeks
Unit Goals	
NJSLS	• **MS-ESS1-4** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. *[Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]* • **MS-ESS2-1** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. *[Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] [Assessment Boundary: Assessment does not include the identification and naming of minerals.]* • **MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. *[Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes*

	include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.] ● **MS-ESS2-3** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. *[Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] [Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]*
Science & Engineering Practices	● Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (SEP.MS-ESS1.C1) ● Develop and use a model to describe phenomena. (SEP.MS-ESS2.A1) ● Develop a model to describe unobservable mechanisms. (SEP.MS-ESS2.A2) ● Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (SEP.MS-ESS2.B1) ● Analyze and interpret data to provide evidence for phenomena. (SEP.MS-ESS2.C1) ● Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future. (SEP.MS-ESS2.D1) ● Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (SEP.MS-ESS3.C1)
Disciplinary Core Ideas	● The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (DCI.MS-ESS1.C1) ● Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (DCI.MS-ESS2.A1) ● All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (DCI.MS-ESS2.B1) ● 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. (DCI.MS-ESS2.B2) ● 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. (DCI.MS-ESS2.C1)

Cross Cutting Concepts	• Patterns in rates of change and other numerical relationships can provide information about natural systems. (CCC.MS-ESS2.A1) • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (CCC.MS-ESS2.B1) • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (CCC.MS-ESS2.C1) • Models can be used to represent systems and their interactions— such as inputs, processes and outputs—and energy, matter, and information flows within systems. (CCC.MS-ESS2.D1) • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (CCC.MS-ESS2.E1) • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (CCC.MS-ESS2.F1) • Scientific Knowledge is Open to Revision in Light of New Evidence (CCC.MS-ESS2.G) • Science findings are frequently revised and/or reinterpreted based on new evidence. (CCC.MS-ESS2.G1) • Graphs, charts, and images can be used to identify patterns in data. (CCC.MS-ESS3.A1) • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (CCC.MS-ESS3.B1) • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (CCC.MS-ESS3.B2) • Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (CCC.MS-ESS3.C1)
Connections to NJSLS – English Language Arts	• Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia) when useful to aiding comprehension. (W.6.2A) • Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples. (W.6.2B) • Use appropriate transitions to clarify the relationships among ideas and concepts. (W.6.2C) • Use precise language and domain-specific vocabulary to inform about or explain the topic. (W.6.2D) • Establish and maintain a formal/academic style, approach, and form (W.6.2E) • Provide a concluding statement or section that follows from the information or explanation presented. (W.6.2F)
Connections to NJSLS - Mathematics	• Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, “The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak.” “For every vote candidate A received, candidate C received nearly three votes.” (6.RP.A.1) • Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set (6.EE.B.6)
21st Century and Career Integration	• There are government agencies and policies that affect the financial industry and the broader economy. (9.1.8.EG.CI.2)

	● Explain the concept and forms of taxation and evaluate how local, state and federal governments use taxes to fund public activities and initiatives. (9.1.8.EG.3) ● Describe the impact of personal values on various financial scenarios. (9.1.8.FP.1) ● A budget aligned with an individual's financial goals can help prepare for life events. (9.1.8.PB.CI.1) ● Individuals can choose to accept some risk, to take steps to avoid or reduce risk, or to transfer risk to others through the purchase of insurance. (9.1.8.RM.CI.1) ● Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking. (9.4.8.CI.CI.1) ● Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4). (9.4.8.CI.1) ● Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3). (9.4.8.CI.2) ● Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2). (9.4.8.CI.3) ● Explore the role of creativity and innovation in career pathways and industries. (9.4.8.CI.4) ● Multiple solutions often exist to solve a problem. (9.4.8.CT.CI.1) ● An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful. (9.4.8.CT.CI.2) ● Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2). (9.4.8.CT.1) ● Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1). (9.4.8.CT.2) ● Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome. (9.4.8.CT.3) ● Awareness of and appreciation for cultural differences is critical to avoid barriers to productive and positive interaction. (9.4.8.GCA.CI.1) ● Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a). (9.4.8.GCA.1) ● Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal. (9.4.8.GCA.2)
Computer Science and Design Thinking	● People use digital devices and tools to automate the collection, use, and transformation of data. The manner in which data is collected and transformed is influenced by the type of digital device(s) available and the intended use of the data. (1145024) ● Computer models can be used to simulate events, examine theories and inferences, or make predictions. (1145027) ● Engineering design is a systematic, creative, and iterative process used to address local and global problems. (1145197) ● The process includes generating ideas, choosing the best solution, and making, testing, and redesigning models or prototypes. (1145198)

	● Engineering design requirements and specifications involve making trade-offs between competing requirements and desired design features. (1145199) ● Identify the steps in the design process that could be used to solve a problem. (8.2.8.ED.2) ● Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch). (8.2.8.ED.3) ● Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team. (8.2.8.ED.4) ● Explain the need for optimization in a design process (8.2.8.ED.5) ● Analyze how trade-offs can impact the design of a product. (8.2.8.ED.6) ● Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches). (8.2.8.ED.7)
Career Ready Practices	● Act as a responsible and contributing citizen and employee. (CRP1) ● Apply appropriate academic and technical skills. (CRP2) ● Communicate clearly and effectively and with reason. (CRP4) ● Consider the environmental, social and economic impacts of decisions. (CRP5) ● Demonstrate creativity and innovation. (CRP6) ● Employ valid and reliable research strategies. (CRP7) ● Utilize critical thinking to make sense of problems and persevere in solving them. (CRP8) ● Model integrity, ethical leadership and effective management. (CRP9) ● Use technology to enhance productivity. (CRP11) ● Work productively in teams while using cultural global competence. (CRP12)

Resources and Technology Integration

- https://www.openscied.org/instructional-materials/6-4-rock-cycling-plate-tectonics/
- Brain Pop

Assessments

- Ask questions
- Define problems
- Develop and use models
- Plan and carry out investigations
- Analyze and interpret data
- Formative assessment
- Teacher observation
- Class discussion
- Venn diagram

Curriculum Modifications	
Special Education and 504 Students	**General Modifications** • Allow outlining, instead of writing for an essay or major project • Computerized spell-check support • Word bank of choices for answers to test questions • Provision of calculator and/or number line for math tests • Film or video supplements in place of reading text • Reworded questions in simpler language • Projects instead of written reports • Highlighting important words or phrases in reading assignments • Modified workload or length of assignments/tests • Modified time demands • Pass/no pass option • Modified grades based on IEP **Behavioral Modifications** • Breaks between tasks • Cue expected behavior • Daily feedback to student • Use de-escalating strategies • Use positive reinforcement • Use proximity/touch control • Use peer supports and mentoring • Model expected behavior by adults • Have parent sign homework/behavior chart • Set and post class rules • Chart progress and maintain data

Students At Risk of School Failure - Students or groups of students who are considered to have a higher probability of failing academically or dropping out of school.	• Maximize use of community resources • Connect family to school and school activities • Support through transition • Help develop compensating strategies • Increase opportunity for positive peer group influences • Supplemental courses • Placement in small and interactive groups
English Language Learner Students (ELL)	• Alternate Responses • Notes in Advance • Extended Time • Simplified Instruction (written and verbal) • Online Dictionary • Use lots of visuals • Use physical activity; model, role-play • Repeat/Rephrase often • Use lower level materials when appropriate
Gifted & Talented Students (G&T)	**Inclusion, infusion and differentiated instruction across the curriculum meets the individual needs of gifted and talented students. Gifted and talented services include:** • Differentiated curriculum for the gifted learner. • Regular classroom curricula and instruction that is adapted, modified, or replaced. • Educational opportunities consist of a continuum of differentiated curricular options, instructional approaches and materials. • Integrated G&T programming into the general education school day. • Flexible groupings of students to facilitate differentiated instruction and curriculum. **Learning Environments:** • Extensive outside reading • Active classroom discussion • Innovative oral and written presentations • Deductive and inductive reasoning • Independent writing and research • Divergent thinking • Challenging problem solving situations • Interactive, independent and interdisciplinary activities