Science G4

EWING PUBLIC SCHOOLS
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Board Approval Date: January 24, 2022 Michael Nitti
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In accordance with The Ewing Public Schools' Policy 2230, Course Guides, this curriculum has been reviewed and found to be in compliance with all policies and all affirmative action criteria.

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Fourth Grade Science

Course Description and Rationale

Students in this course will learn to explain scientific phenomena. The Next Generation Science Standards (NGSS) performance expectations rely on three dimensions of learning to develop student understanding of scientific concepts. Core conceptual ideas are learned by engaging in scientific and engineering practices and considering crosscutting concepts. These three dimensions support students in developing useable knowledge to explain real world phenomena in the sciences.

In science, performance expectations at the elementary school level use three dimensional learning to foster student understanding of science concepts.

Students will use the following eight NGSS Science and Engineering Practices to demonstrate understanding of the disciplinary core ideas and develop critical thinking skills:

- Asking questions (science) and defining problems (engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using math and computational thinking
- Constructing explanations (science) and designing solutions (engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

The following seven crosscutting concepts support the development of a deeper understanding of the disciplinary core ideas:

- Patterns
- Cause and effect: mechanism and explanation
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter: flows, cycles and conservation
- Structure and function

The course is a year-long course that meets for 45 minutes per day, on average for half the days of each marking period. The course uses a project-based approach to exploring many concepts. Many of the core ideas will be applied to engineering problems, allowing students to also develop an understanding of the engineering design process. This will further develop problem-solving and critical thinking skills as students work to design, test, solve, and revise solutions to problems. The crosscutting concepts of patterns through structure and function are used as organizing concepts for these disciplinary core ideas. These performance expectations focus on students demonstrating proficiency in developing and using models, using mathematical thinking, and obtaining, evaluating and communicating information; and to use these practices to demonstrate understanding of the core ideas.

The course content is arranged into four units of study:

- Energy
- Waves
- Structure, Function, and Information Processing
- Earth's Systems: Processes that Shape the Earth

Career Readiness, Life Literacies, and Key Skills

During this course, students will work on developing, to an age appropriate level, the following Career Readiness, Life Literacies, and Key Skills:

Disciplinary Concepts:

- Career Awareness and Planning
    1. Different types of jobs require different knowledge and skills
- Creativity and Innovation
    1. Brainstorming can create new, innovative ideas.
- Critical Thinking and Problem-solving
    1. Critical thinkers must first identify a problem then develop a plan to address it in order to effectively solve a problem.
- Digital Citizenship
    1. Young people can have a positive impact on the natural world in the fight against climate change.
- Information and Media Literacy
    - Digital tools and media resources provide access to vast stores of information that can be searched.
    - Digital tools can be used to display data in various ways.
    - A variety of diverse sources, contexts, disciplines and cultures provide valuable and necessary information that can be used for different purposes.
    - Information is shared or conveyed in a variety of formats and sources.
- Technology Literacy
    - Digital tools have a purpose.
    - Collaboration can simplify the work an individual has to do and sometimes produce a better product.

Technology Integration

<u>Computer Science and Design Thinking</u>

During this course, students will work on developing, to an age appropriate level, the following Computer Science and Design Thinking Skills:

Disciplinary Concepts and Core Ideas:

- Data & Analysis
  - Individuals collect, use, and display data about individuals and the world around them.
  - Data can be used to make predictions about the world.
- Engineering Design
  - Engineering design is a creative process for meeting human needs or wants that can result in multiple solutions.
  - Limitations (constraints) must be considered when engineering designs.
- Interaction of Technology and Humans
  - Human needs and desires determine which new tools are developed.
  - Technology has changed the way people live and work.
  - Various tools can improve daily tasks and quality of life.
- Effects of Technology on the Natural World
  - The use of technology developed for the human designed world can affect the environment, including land, water, air, plants, and animals.
  - Technologies that use natural sources can have negative effects on the environment, its quality, and inhabitants.
  - Reusing and recycling materials can save money while preserving natural resources and avoiding damage to the environment.

ELA Integration:

- **NJ.SLS.RI.4.1** Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS3-1) (4-PS4-3)
- **NJ.SLS.RI.4.3** Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. (4-PS3-1)
- **NJ.SLS.RI.4.9** Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS3-1) (4-PS4-3)
- **NJ.SLS.SL.4.5** Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-LS1-2) (4-PS4-1) (4-PS4-2)
- **NJ.SLS.W.4.1** Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (4-LS1-1)
- **NJ.SLS.W.4.2** Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (4-PS3-1)
- **NJ.SLS.W.4.7** Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-ESS3-1) (4-PS3-2) (4-PS3-3) (4-PS3-4)
- **NJ.SLS.W.4.8** Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-ESS3-1) (4-PS3-1) (4-PS3-2) (4-PS3-3) (4-PS3-4)
- **NJ.SLS.W.4.9** Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS3-1) (4-PS3-1)

Mathematics Integration:

- **NJ.SLS.MP.2** Reason abstractly and quantitatively. (4-ESS3-1)
- **NJ.SLS.MP.4** Model with mathematics. (4-ESS3-1) (4-PS4-1) (4-PS4-2)
- **NJ.SLS.4.G.A.1** Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. (4-PS4-1) (4-PS4-2)
- **NJ.SLS.4.G.A.3** Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. (4-LS1-1)
- **NJ.SLS.4.OA.A.1** Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-1)
- **NJ.SLS.4.OA.A.3** Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. (4-PS3-4)

Unit 1: Energy

Recommended Pacing - 22 days

Why Is This Unit Important?

This unit targets three major areas of Energy:

- Students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object.
- Students are expected to develop an understanding that energy can be transferred from place to place by sound, light, heat, and electric currents or from object to object through collisions.
- Students apply their understanding of energy to design, test, and refine a device that converts energy from one form to another.

Disciplinary Core Ideas:

- The faster a given object is moving; the more energy it possesses. (4-PS3-1)
- Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2),(4-PS3-3)
- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4-PS3-2), (4-PS3-3)
- Light also transfers energy from place to place. (4-PS3-2)
- Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2), (4-PS3-4)
- When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3- 3)
- The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)
- Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)
- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. *(secondary to 4-PS3-4)*

Science and Engineering Practices:

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3)
- Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2)
- Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1)
- Apply scientific ideas to solve design problems. (4-PS3-4)
- Obtain and combine information from books and other reliable media to explain phenomena. (4-ESS3-1)

Cross Cutting Concepts:

- Energy can be transferred in various ways and between objects. (4-PS3-1),(4-PS3-2),(4-PS3-3),(4-PS3-4)
- Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1)

Enduring Understandings:

- The faster a given object is moving; the more energy it possesses.
- Energy can be moved from place to place by moving objects or through sound, light, or electric currents.
- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.
- Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.
- When objects collide, the contact forces transfer energy so as to change the objects' motions.
- The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use.
- Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.
- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.
- Cause and effect relationships are routinely identified and used to explain change.
- Energy can be transferred in various ways and between objects.
- Knowledge of relevant scientific concepts and research findings is important in engineering.
- Over time, people's needs and wants change, as do their demands for new and improved technologies.
- Engineers improve existing technologies or develop new ones.
- Most scientists and engineers work in teams.
- Science affects everyday life.

Essential Questions:

- What is energy and how is it related to motion?
- How is energy transferred?
- How can energy be used to solve a problem?

Acquired Knowledge:

- Definition of energy
- Types of energy
- Energy transformation
- Conservation of energy
- Energy sources – stored energy
- Renewable energy

Acquired Skills:

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
- Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- Use evidence (e.g., measurements, observations, patterns) to construct an explanation.
- Apply scientific ideas to solve design problems.
- Obtain and combine information from books and other reliable media to explain phenomena.

Assessments:

Formative Assessments:

- Group discussions/presentations:
  - Propose higher order questions
  - Present information to students and ask a question
  - Have students discuss their answers with their peers at their table and discuss together as a group

Summative Assessments:

- Project:
  - Design, Test, and Refine a Device

Benchmarks:

- Students will be assessed on their ability to use evidence to construct an explanation relating the speed of an object to the energy of that object. [Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.]
- Students will be assessed on their ability to make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. [Assessment Boundary: Assessment does not include quantitative measurements of energy.]
- Students will be assessed on their ability to ask questions and predict outcomes about the changes in energy that occur when objects collide. [Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.] [Assessment Boundary: Assessment does not include quantitative measurements of energy.]
- Students will be assessed on their ability to apply scientific ideas to design, test, and refine a device that converts energy from one form to another. [Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.]
- Students will be assessed on their ability to obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]

Alternative Assessments:

- Modified project requirements and rubrics

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- Batter Up!

In-Class Activities and Laboratory Experiences:

- Speed
- Motion
- Sound
- Light
- Heat
- Electric Circuits

Closure and Reflection Activities:

- Obtain and Combine Information

Instructional Materials:

Exploring Science Cengage & National Geographic Learning; 2016

Technology Connections:

- https://www.ck12.org/book/ck-12-fourth-grade-science/section/1.1/
- http://ngss-k-5-ausd.weebly.com/4energy-part-1.html
- http://ngss-k-5-ausd.weebly.com/4energy-part-2.html

Unit 2: Waves: Waves and Information

Recommended Pacing - 22 days

Why Is This Unit Important?

This unit targets a major area of Waves: Waves and Information:

- Students are able to use a model of waves to describe patterns of waves in terms of amplitude and wavelength, and that waves can cause objects to move.

Disciplinary Core Ideas:

- Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. *(Note: This grade band endpoint was moved from K–2.)* (4-PS4-1)
- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1)
- Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. (4-PS4-3)
- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. *(secondary to 4-PS4-3)*

Science and Engineering Practices:

- Develop a model using an analogy, example, or abstract representation to describe a scientific principle. (4-PS4-1)
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-PS4-3)

Cross Cutting Concepts:

- Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena. (4-PS4-1)
- Similarities and differences in patterns can be used to sort and classify designed products. (4-PS4-3)

Enduring Understandings:

- Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach.
- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).
- Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa.
- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.
- Similarities and differences in patterns can be used to sort and classify natural phenomena.
- Similarities and differences in patterns can be used to sort and classify designed products.
- Knowledge of relevant scientific concepts and research findings is important in engineering
- Science findings are based on recognizing patterns.

Essential Questions:

- What are waves and what are some things they can do?
- What starts a wave?
- How do waves travel?
- What are the properties of waves?
- What can waves transmit?

Acquired Knowledge:

- Definition of waves
- Wavelength
- Amplitude
- How waves move; what they really move.

Acquired Skills:

- Develop a model using an analogy, example, or abstract representation to describe a scientific principle.
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

Assessments:

Formative Assessments:

- Group discussions/presentations:
  - Propose higher order questions
  - Present information to students and ask a question
  - Have students discuss their answers with their peers at their table and discuss together as a group

Summative Assessments:

- Project:
  - Compare Multiple Solutions

Benchmarks:

- Students will be assessed on their ability to develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]
- Students will be assessed on their ability to generate and compare multiple solutions that use patterns to transfer information. [Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.]

Alternative Assessments:

- Modified project requirements and rubrics

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- Waves

In-Class Activities and Laboratory Experiences:

- Wavelength and Amplitude
- How waves Move Objects
- Use a Code

Closure and Reflection Activities:

- Career Exploration: Animal Tracker

Instructional Materials:

Exploring Science Cengage & National Geographic Learning; 2016

Technology Connections:

- http://ngss-k-5-ausd.weebly.com/4waves-waves-and-information.html
- https://sqworl.com/oaj1b4
- https://betterlesson.com/lesson/628342/what-are-waves

Unit 3: Structure, Function, and Information Processing

Recommended Pacing - 22 days

Why Is This Unit Important?

This unit targets two major areas of Structure, Function, and Information Processing:

- Students are expected to develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- By developing a model, they describe that an object can be seen when light reflected from its surface enters the eye.

Disciplinary Core Ideas:

- An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2)
- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)
- Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4-LS1-2)

Science and Engineering Practices:

- Develop a model to describe phenomena. (4-PS4-2)
- Use a model to test interactions concerning the functioning of a natural system. (4-LS1-2)
- Construct an argument with evidence, data, and/or a model. (4-LS1-1)

Cross Cutting Concepts:

- Cause and effect relationships are routinely identified. (4-PS4-2)
- A system can be described in terms of its components and their interactions. (4-LS1-1),(4-LS1-2)

Enduring Understandings:

- An object can be seen when light reflected from its surface enters the eyes.
- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
- Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.
- Cause and effect relationships are routinely identified.
- A system can be described in terms of its components and their interactions.

Essential Questions:

- How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals?
- What external structures do all or most plants have? What do these structures do?
- What external structures do groups of plants have that others do not? What do these structures do?
- What internal structures do plants have?
- What external structures do all or most animals have? What do these structures do?
- What external structures do groups of animals have that others do not? What do these structures do?
- What internal structures do animals have?
- What senses do animals have?
- How does an eye work?

Acquired Knowledge:

- Plant external structures and functions
- Animal external structures and functions
- Plant internal structures and functions
- Animal internal structures and functions
- The senses
- The structure and function of a human eye

Acquired Skills:

- Develop a model to describe phenomena.
- Use a model to test interactions concerning the functioning of a natural system.
- Construct an argument with evidence, data, and/or a model.

Assessments:

Formative Assessments:

- Group discussions/presentations:
  - Propose higher order questions
  - Present information to students and ask a question
  - Have students discuss their answers with their peers at their table and discuss together as a group

Summative Assessments:

- Project:
  - Use a Model

Benchmarks:

- Students will be assessed on their ability to develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. [Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.]
- Students will be assessed on their ability to construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]
- Students will be assessed on their ability to use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. [Clarification Statement: Emphasis is on systems of information transfer.] [Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.]

Alternative Assessments:

- Modified project requirements and rubrics

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- Structure of a Wild Rose

In-Class Activities and Laboratory Experiences:

- Construct an Argument
- How We See

Closure and Reflection Activities:

- Career Exploration: Dog Whisperer

Instructional Materials:

Exploring Science Cengage & National Geographic Learning; 2016

Technology Connections:

- http://ngss-k-5-ausd.weebly.com/4structure-function-and-information-processing.html
- https://www.ck12.org/book/ck-12-fourth-grade-science/section/3.10/
- http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=17

Unit 4: Earth's Systems: Processes that Shape the Earth

Recommended Pacing - 22 days

Why Is This Unit Important?

This unit targets three major areas of Earth's Systems: Processes that Shape the Earth:

- Students are expected to develop understanding of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- Students apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of such processes on humans.
- In order to describe patterns of Earth's features, students analyze and interpret data from maps.

Disciplinary Core Ideas:

- Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4-ESS1-1)
- Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-1)
- The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4-ESS2-2)
- Living things affect the physical characteristics of their regions. (4-ESS2-1)
- A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. (4-ESS3-2) *(Note: This Disciplinary Core Idea can also be found in 3.WC.)*
- Testing a solution involves investigating how well it performs under a range of likely conditions. *(secondary to 4-ESS3-2)*

Science and Engineering Practices:

- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4-ESS2-1)
- Analyze and interpret data to make sense of phenomena using logical reasoning. (4-ESS2-2)
- Identify the evidence that supports particular points in an explanation. (4-ESS1-1)
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-ESS3-2)

Cross Cutting Concepts:

- Patterns can be used as evidence to support an explanation. (4-ESS1-1),(4-ESS2-2)
- Cause and effect relationships are routinely identified, tested, and used to explain change. (4- ESS2-1),(4-ESS3-2)

Enduring Understandings:

- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.
- An object can be seen when light reflected from its surface enters the eyes.
- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
- Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.
- Cause and effect relationships are routinely identified.
- A system can be described in terms of its components and their interactions.

Essential Questions:

- How can water, ice, wind and vegetation change the land?
- How are weathering and sediment related?
- What patterns of Earth's features can be determined with the use of maps?
- What are natural hazards?
- How do natural hazards impact land changes?

Acquired Knowledge:

- Erosion and deposition
- The role of the following in changing the land:
  - Water
  - Ice
  - Wind
  - Vegetation
- Types of Earth features and their patterns based on locations
- How the following natural hazards impact land change:
  - Earthquakes
  - Tsunamis
  - Volcanoes

Acquired Skills:

- Develop a model to describe phenomena.
- Use a model to test interactions concerning the functioning of a natural system.
- Construct an argument with evidence, data, and/or a model.

Assessments:

Formative Assessments:

- Group discussions/presentations:
  - Propose higher order questions
  - Present information to students and ask a question
  - Have students discuss their answers with their peers at their table and discuss together as a group

Summative Assessments:

- Project:
  - Identify Evidence

Benchmarks:

- Students will be assessed on their ability to identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. [Clarification Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.] [*Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.*]
- Students will be assessed on their ability to make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. [Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.] [*Assessment Boundary: Assessment is limited to a single form of weathering or erosion.*]
- Students will be assessed on their ability to analyze and interpret data from maps to describe patterns of Earth's features. [Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.]
- Students will be assessed on their ability to Generate and compare multiple solutions to reduce the impacts of natural Earth processes and climate change have on humans. [Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.] [*Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.*]

Alternative Assessments:

- Modified project requirements and rubrics

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- United States: Regions versus Rainfall

In-Class Activities and Laboratory Experiences:

- Weathering and Erosion
- Make Observations
- Earthquakes
- Analyze and Interpret Data
- Building for the Future
- Sustainability Project: Generate and Compare Solutions

Closure and Reflection Activities:

- Career Exploration: Crisis Mapper

Instructional Materials:

Exploring Science Cengage & National Geographic Learning; 2016

Technology Connections:

- https://betterlesson.com/lesson/636200/the-marshmallow-challenge
- http://ngss-k-5-ausd.weebly.com/4-earth-systems-processes-that-shape-the-earth-part-1.html
- http://ngss-k-5-ausd.weebly.com/4earth-systems-processes-that-shape-the-earth-part-2.html
- http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=18

Career Readiness, Life Literacies, and Key Skills

9.4.5.CI.1:

For example, in Unit 1, students need to obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

9.4.5.CI.2:

For example, in Unit 1, students apply scientific ideas to design, test, and refine a device that converts energy from one form to another

9.4.5.CT.1:

For example, in Unit 2, students will generate and compare multiple solutions that use patterns to transfer information.

9.4.5.CT.4:

For example, in Unit 3, students will have to construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

9.4.5.IML.2:

For example, in Unit 4, students will use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

8.1 Computer Science and Design Thinking

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.

For example, in Unit 3, students will access, manage, evaluate, and synthesize information to develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

Interdisciplinary Connections

NJ.SLS.RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS3-1) (4-PS4-3)

NJ.SLS.RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. (4-PS3-1)

NJ.SLS.RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS3-1) (4-PS4-3)

NJ.SLS.SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-LS1-2) (4-PS4-1) (4-PS4-2)

NJ.SLS.W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (4-LS1-1)

NJ.SLS.W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (4-PS3-1)

NJ.SLS.W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-ESS3-1) (4-PS3-2) (4-PS3-3) (4-PS3-4)

NJ.SLS.W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-ESS3-1) (4-PS3-1) (4-PS3-2) (4-PS3-3) (4-PS3-4)

NJ.SLS.W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS3-1) (4-PS3-1)

These standards are met through the completion of the benchmark performances in all 3 units. For example, in Unit 1, students will read texts and use media to obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

NJ.SLS.MP.2 Reason abstractly and quantitatively. (4-ESS3-1)

NJ.SLS.MP.4 Model with mathematics. (4-ESS3-1) (4-PS4-1) (4-PS4-2)

These standards are met through the completion of the benchmark performances in all 3 units. For example, in Unit 2, students will have to reason both abstractly and quantitatively to develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

NJ.SLS.4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. (4-PS4-1) (4-PS4-2)
NJ.SLS.4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. (4-LS1-1)

These standards are met through the completion of the benchmark performances in all 3 units. For example, in Unit 3, students will develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

NJ.SLS.4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-1)

NJ.SLS.4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. (4-PS3-4)

These standards are met through the completion of the benchmark performance in Unit 3; students will generate and compare multiple solutions that use patterns to transfer information.