Allamuchy Township School District
Allamuchy, NJ

Science
Grade 4

CURRICULUM GUIDE
FINAL DRAFT

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This curriculum may be modified through varying techniques, strategies and materials, as per an individual student's Individualized Education Plan (IEP).

Approved by the Allamuchy Board of Education
At the regular meeting held on
And
Aligned with the New Jersey Core Curriculum Content Standards
And Common Core Content Standards

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Philosophy and Rationale

Science, engineering, and technology influence and permeate every aspect of modern life. Some knowledge of science and engineering is required to engage with the major public policy issues of today as well as to make informed everyday decisions, such as selecting among alternative medical treatments or determining how to invest public funds for water supply options. In addition, understanding science and the extraordinary insights it has produced can be meaningful and relevant on a personal level, opening new worlds to explore and offering lifelong opportunities for enriching people's lives. In these contexts, learning science is important for everyone, even those who eventually choose careers in fields other than science or engineering.

Mission Statement

The mission of the Allamuchy Township District, in partnership with the larger community, is to provide a comprehensive, caring program for all of our students which:

*Nurtures the unique talents and interests of each individual
*Supports social responsibility and a love of learning
*Embraces the total development of each student intellectually, morally and physically
*Develops confidence, creativity and skills necessary to face the challenges of a technologically advanced and ever-changing society
*Promotes a culture of mutual respect with all other community members
*Supports the attainment of the New Jersey Core Curriculum Content Standards

The District seeks to exceed objective standards of achievement set by both the State and Federal government and to provide an educational experience beyond the boundaries established by the Core Curriculum Standards.

Unit 1 - Using Engineering Design with Force and Motions Systems

Scope and Sequence

Time Frame: Approximately 24 days
In this unit of study, students use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students develop and understanding that energy can be transferred from place to place by sound, light, heat, and electrical currents or from objects through collisions. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. The crosscutting concepts of energy and matter and the influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas.

Corresponds to Unit 1 in textbook

Stage 1: Desired Results

Content Standards:

- **4-PS3-4:** Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- **3-5ETS1-1:** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- **3-5ETS1-2:** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- **3-5ETS1-3:** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Essential Questions:

- How can scientific ideas be applied to design, test, and refine a device that converts energy from one form to another?

Enduring Understandings:

- Scientific affects everyday life.
- Most scientists and engineers work in teams.
- Engineers improve existing technologies or develop new ones.
- People's needs and wants change over times, as do their demands for new and improved technologies.
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- Energy can be transferred in various ways and between objects.
- 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 expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use.
- 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 solutions (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.
- Research on a problem should be carried out before beginning to design a solution.
- Testing a solution involves investigating how well it performs under a range of likely conditions.

- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Knowledge and Skills (SWBAT embedded course proficiencies)

Students who understand the concepts are able to:

- Describe the various ways that energy can be transferred between objects.
- Apply scientific ideas to solve design problems.
- Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.
- Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.
- Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
- Plan and carry out fair tests in which variables are controlled and failure points are considered to identify of a model or prototype that can be improved.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods: Formative, Summative, Observations, Anecdotal Notes, Interactive Notebooks, Experiments, STEM Projects, Science Exploration Labs/ Performance Tasks, Quizzes, and Tests.

Stage 3: Learning Plan

In this unit, students will apply scientific ideas about force, motion, and energy in order to design, test, and refine a device that converts energy from one form to another. Through this process, students will learn that science affects everyday life and that engineers often work in teams, using scientific ideas, in order to meet people's needs for a new or improved technologies.

To begin the engineering design process, students must be presented with the problem of designing a device that converts energy from one form to another. This process should include the following steps:

- As a class, students should create a list of all the concepts that they have learned about force, motion, and energy.
    - The faster a given object is moving, the more energy it possesses.
    - Energy is present whenever there are moving objects, sound, light, or heat.
    - Energy can be transferred in various ways and between objects.
    - Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

    - 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.
    - When objects collide, the contact forces transfer energy so as to change the objects' motions.

- Have students brainstorm examples of simple devices that convert energy from one form to another. AS students give examples, the teacher should draw one or two and have students describe how each device convert motion energy to electric energy or that use stored energy to cause motion or produce light or sound.
- Next, the teacher can present a "Design Challenge" to students: Design and build a simple device that converts energy from one form to another. Please note that teachers should limit the devices to those that convert motion energy to electric energy or that use stored energy to cause motion or produce light or sound.
- Small groups of students should conduct research, using several sources of information, to build understanding of "stored energy." Students can look for examples of objects that have stored energy. Stretched rubber bands, compressed springs, wound or twisted rubber bands, batteries, wind-up toys, and objects at the top of a ramp or held at a height above the ground all have stored energy.
- As a class, determine criteria and possible constraints on the design solutions. For example, devices are only required to performer a single energy conversion, and devices must transfer stored energy motions, light, or sound. Constraints could include the use of material readily available in the classroom or provided by the teacher. A time constraint could also be set, if desired. All criteria should be posted on chart paper so that groups can refer to them as needed.
- Students should work in small, collaborative groups to design and build their device.
- Students should create a poster that includes a diagram of the device and a description of how the device transfers energy from one form to another. Every group should have the opportunity to present their device and explain how it works.
- As a class, students compare each of the design solutions based on how well they meet criteria and constraints, giving evidence to support their thinking. When giving feedback to the groups, students should identify which criteria were/were not met, and how the design might be improved.
- Small groups should then have the opportunity to refine their designs based on the feedback from the class.
- At every stage, communicating with peers is an important part of the design process, because shared ideas can lead to improved designs. It is also important that students describe the ways in which energy is transferred between objects and from one form to another.

Suggested Activities: Paper building; tissue rope

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

Students conduct research that build their understanding of energy transfer. They will gather relevant information from their investigations and from multiple print or digital sources, take notes, categorize their findings. They should use this information to construct explanations and support their thinking.

Mathematics

Students can:

- Solve multistep word problems, using the four operations.
- Represent these problems using equations with a letter standing for the unknown quantity.
- Assess the reasonableness of answers using mental computation and estimating strategies, including rounding.

Students can also analyze constraints on materials, time, or cost to determine what implications the constraints have for design solutions. For example, if a design calls for 20 screws and screws are sold in boxes of 150, how many copies of the design can be made?

Modifications:

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide opportunities for students to connect with people of similar backgrounds.
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures.
- Restructure lessons using UDL principles (http://www.cast.org/our-work/about-udl.html#.VXmoScf).
- Structure the learning around explaining or solving a social or community-based issue.

Resources:

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

Unit 2- Force and Motion

Scope and Sequence

Time Frame: Approximately 19 days
In this unit of study, 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, and are expected to develop an understanding that energy can be transferred from object to object through collisions.

Suggested resource sites:

- Newton's Law of Motion http:www.watchknowlearn.org/Video.aspx?VideoID=30312
- Science of Disney Imagineering: Newton's Law of Motion Classroom Edition http:/www.youtube.com/watch?v=QpF3m02GI
- Study Jams http://studyjams.scholastic.com/studyjams
- Online Circuit Simulator http://phet.colorado.edu/en/simulation/circuitconstructionkitdc
- http://sciencenetlinks.com/tools

Stage 1: Desired Results

Content Standards:

- **4-PS3-1:** Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- **4-PS3-3:** Ask questions and predict outcomes about the changes in energy that occur when objects collide.

Essential Questions:

- What is the relationship between the speed of an object and the energy of that object?

Enduring Understandings:

- Energy can be transferred in various ways and between objects.
- The faster a given object is moving, the more energy it possesses.
- Energy can be transferred in various ways and between objects.
- 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.
- When objects collide, the contact forces transfer energy so as to change the objects' motions.

Knowledge and Skills (SWBAT embedded course proficiencies)

Students who understand the concepts are able to:

- Describe various ways that energy can be transferred between objects.
- Use evidence to construct an explanation.
- Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- Describe the various ways that energy can be transferred between objects.
- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.

- Ask questions and predict outcomes about the changes in energy that occur when objects collide. Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods: Formative, Summative, Observations, Anecdotal Notes, Interactive Notebooks, Experiments, STEM Projects, Science Exploration Labs/ Performance Tasks, Quizzes, and Tests.

Stage 3: Learning Plan

In order to understand and explain the relationship between objects' speed and its energy, students need multiple opportunities to observe objects in motion. Students can roll balls down ramps, build and race rubber band cars, or build roller coasters. As they observe the motion of objects, they should collect data about the relative speed of objects in relation to the strength of the force applied to them. For example, when a ball is placed at the top of a ramp, it has stored energy, due to the force of gravity acting on it. When the ball is released, that stored energy is changed (transferred) into motion energy. Increasing the height of a ramp also increases the amount of stored energy in the ball at the top of the ramp. If the ball is released from a higher starting point, it rolls faster and farther. As students investigate these types of force and motion systems, they should conduct multiple trials, increasing and decreasing the amount of energy, then collect quantitative data as they observe the impact differing amounts of energy have on the relative speed of the object in motion. Students should then use their data as evidence to support their explanation of the relationship between the relative speed of an object and its energy.

Once students understand that the faster an object moves, the more energy it possesses, they can begin to explore ways in which energy can be transferred. As they investigated the relationship between speed and energy, students learned that stored energy was changed, or transferred, into motion energy. To broaden their understanding of energy transfer, students should be provided with opportunities to observe objects colliding and should be encouraged to ask questions that lead to further investigation. For example, if students roll a ball towards a wall, or roll two balls so that they collide, they may observe any or all of the following:

- Change (s) in the direction of motion
- Change (s) in the speed
- Change (s) in the type of energy
- Change (s) in the type of motion

As student continue to investigate interactions between moving objects, they should notice that when a moving object collides with a stationary object, some of the motion energy of one is transferred to the other. In addition, some of the motion energy is changed, or transferred to the surrounding air, and as a result, the air gets heated and sound is produced. Likewise, when two moving objects collide, they transfer motion energy to one another and to the surrounding environment as sound and heat. It is important that as students observe these types of interactions, they collect observational data, document that types of changes they observe, look for patterns of change in both the motion of objects and in the types of energy transfer that occur, and make predictions about the future motion of objects. Their investigations will help them understand that:

- Energy can be transferred in various ways and between objects.
- Energy is present whenever there are moving objects.
- Energy can be moved, or transferred, from place to place by moving objects.
- When objects collide, some energy may be changed or transferred into other types of energy.

Suggested Activity: A slide is a simple machine - take students outside for this activity

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

Students will conduct a short research project to build their understanding of the transfer of energy (motion, heat, and sound) in force and motion systems. They will need access to a variety of texts and should use information from their class experiences and from print and digital sources to write informative/explanatory texts. As students gather information, they should take notes and categorize information. In their writings, students should detail what they observed as they investigated simple force and motions systems, describe procedures they followed as they conducted investigations, and use information from their observations and research to explain the patterns of change that occur when objects move and collide. As students participate in discussions and write explanations, they should refer specifically to text, when appropriate.

Mathematics

- Reason abstractly and quantitatively.
- Use appropriate tools strategically

Modifications:

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide opportunities for students to connect with people of similar backgrounds.
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures.
- Structure the learning around explaining or solving a social or community-based issue.

Resources:

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

Unit 3 - Transfer of Energy

Scope and Sequence

Time Frame: Approximately 24 Days
In this unit, fourth-grade students develop an understanding that energy can be transferred from place to place by sound, light, heat, and electrical current. Students also obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment.

Corresponds to Unit 2 in textbook

Stage 1: Desired Results

Content Standards:

- **4-PS3-1:** Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- **4-PS3-2:** Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- **4-PS3-3:** Ask questions and predict outcomes about the changes in energy that occur when objects collide.
- **4-PS3-4:** Apply scientific ideas to design, test, and revine a device that converts energy from one form to another.
- **4-EES3-1:** Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Essential Questions:

- Where do we get the energy need for modern life?

Enduring Understandings:

- Energy can be transferred in various ways and between objects.
- Energy can be moved from place to place through sound, light, or electric currents.
- Energy is present whenever there are sounds, light, or heat.
- Light also transfers energy from place to place.
- Energy can also be transferred from place to place by electric currents; the currents may have been produced to begin with by transforming the energy of motion into electrical energy.
- Cause-and-effect relationships are routinely identified and used to explain change.
- Knowledge of relevant scientific concepts and research finding is important in engineering.
- Over time, people's needs and wants change, as do their demands for new and improved technologies.
- Energy and fuels that humans use are derived from natural sources.
- The use of energy and fuels from natural sources affects the environment in multiple ways.
- Some resources are renewable over time, and others are not.

Knowledge and Skills (SWBAT embedded course proficiencies)

Students who understand the concepts are able to:

- Make observations to produce data that can serve as the basis for evidence for an explanation of a phenomenon or for a test of a design solution.
- Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- Identify cause-and-effect relationships in order to explain change.
- Obtain and combine information from books and other reliable media to explain phenomena.
- Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
    - Examples of renewable energy resources could include:
        - Wind Energy
        - Water behind dams
        - Sunlight

    - Examples of nonrenewable energy resources are:
        - Fossil fuels
        - Fissile materials

    - Examples of environmental effects could include:
        - Loss of habitat due to dams
        - Loss of habitat due to surface mining
        - Air pollution from burning of fossil fuels

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods: Formative, Summative, Observations, Anecdotal Notes, Interactive Notebooks, Experiments, STEM Projects, Science Exploration Labs/ Performance Tasks, Quizzes, and Tests.

Stage 3: Learning Plan

In this unit of study, fourth-grade students develop an understanding that energy can be transferred from place to place by sound, light, heat, and electrical currents. Students also obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment. The crosscutting concepts of cause and effect, energy and matter, and the interdependence of science, engineering, and technology, and influence of science, engineering, and technology on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations and obtaining, evaluating, and communicating information. Students are also expected to use these practices to demonstrate understanding of the core ideas.

In this unit of study, 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, and are expected to develop an understanding that energy can be transferred from object to object through collisions. The crosscutting concept of energy and matter is called out as an organizing concept. Students are expected to demonstrate grade-appropriate proficiency in asking questions, defining problems, and constructing explanations, and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.

In this unit of study, students use evidence to construct an explanation of the relationship between the speed of

an object and the energy of that object. Students develop an understanding that energy can be transferred from place to place by sound, light, heat, and electrical currents or from objects through collisions. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. The crosscutting concepts of energy and matter and the influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in asking questions and defining problems, planning and carrying out investigations, constructing explanations, and designing solutions. Students are also expected to use these practices to demonstrate their understanding of the core ideas.

Suggested Activity: Moving pennies

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

Students will conduct research to build their understanding of energy, transfer of energy, and natural sources of energy. Students will recall relevant information from in-class investigations and experiences and gather relevant information from print and digital sources. They should take notes and categorize information and provide a list of sources. Students also draw evidence from literary and informational texts in order to analyze and reflect on their findings. Students can also read, take notes, and construct responses using text and digital resources such as Scholastic News, Nat Geo Kids, Study-Jams (Scholastic), Reading A–Z.com, NREL.com, switchenergyproject.com, and NOVA Labs by PBS.

Mathematics

Students reason abstractly and quantitatively as they gather and analyze data during investigations and while conducting research about transfer of energy and energy sources. Students model with mathematics as they represent and/or solve word problems. As students research the environmental effects of obtaining fossil fuels, they might be asked to represent a verbal statement of multiplicative comparison as a multiplication equation. For example, students might find information about a spill that was 5 million gallons of oil and was 40 times larger that a previous oil spill in the same location. They can be asked to represent this mathematically using an equation to determine the number of gallons of oils that were spilled in the previous event.

Modifications:

- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Provide project-based science learning to connect science with observable phenomena.

Resources:

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

Unit 4- Waves and Information

Scope and Sequence

Time Frame: Approximately 24 days
In this unit of study, students use a model of waves to describe patterns of waves in terms of amplitude and wavelength and to show that waves can cause objects to move. The crosscutting concepts of patterns, interdependence of science, engineering, and technology.

Corresponds to Unit 3 in textbook

Stage 1: Desired Results

Content Standards:

- **4-PS4-1:** Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
- **4-PS4-2:** Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
- **4-PS4-3:** Generate and compare multiple solutions that use patterns to transfer information.
- **3-5-EST-1-2:** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- **3-5EST-1-3:** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Essential Questions:

- How can we use waves to gather and transmit information?

Enduring Understandings:

- Science findings are based on recognizing patterns.
- Similarities and differences in patterns can be used to sort and classify natural phenomena.
- 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 waves) and wavelength (spacing between wave peaks)
- Knowledge of relevant scientific concepts and research findings is important in engineering.
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- 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.
- Different solutions need to be tested in order to determine which of them best solve the problem, given the criteria and the constraints.

Knowledge and Skills (SWBAT embedded course proficiencies)

Students who understand the concepts are able to:

- Sort and classify natural phenomena using similarities and differences in patterns.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle.
- Develop a model of waves to describe patterns in terms of amplitude and wavelength, and the waves can cause objects to move.
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.
- Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints to a problem.
- Generate and compare multiple solutions that use patterns to transfer information. Examples of solutions could include:
    - Drums sending coded information through sound waves
    - Using a grid of ones and zeros representing black and white to send
    - Information about a picture
    - Using Morse code to send text

- Plan and conduct an investigation collaboratively to produce data that can serve as the basis for evidence, using fair test in which variables are controlled and the number of trails considered.
- Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods: Formative, Summative, Observations, Anecdotal Notes, Interactive Notebooks, Experiments, STEM Projects, Science Exploration Labs/ Performance Tasks, Quizzes, and Tests.

Stage 3: Learning Plan

In this unit of study, students plan and carry out investigations, analyze and interpret data, and construct explanations. They also develop and use models to describe patterns of waves in terms of amplitude and wavelength and to show that waves can cause objects to move.

Waves, which are regular patterns of motion, can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). Students can model the properties of waves by disturbing the surface of water in a variety of pans and buckets. Students should make observations as they strike the surface of the water with small and large objects, such as marbles and rocks. In addition, smaller pans can be titles in different directions in order to observe the effects on the wave patterns created on the surface of the water. Students should observe and describe a number of similarities and differences in the wave patterns created, including the following:

- When an object hits the surface of water, waves move across the surface.
- Waves move up and down across the surface of the water away from the point of contact.
- Waves on the surface of the water move away from the point of contact in increasingly larger circles.
- When waves hit another surface, the waves change direction and move away from the surface with which they come into contact.
- The height of the wave (amplitude) and the distance between the peaks of waves (wavelength) varies depending upon the intensity of the disturbance, and/or the size (mass,volume) of the object disturbing the surface of the water.

When describing the properties of waves, students should also develop a model using drawings, diagrams, or physical models (such as a slinky or jump rope) to show the basic properties of waves (amplitude and wavelength). In addition, the class should discuss other real-world examples of waves , including sound and light waves, using understandings develop in prior units of study.

To begin the engineering design process, students are challenged to design a way to use patterns to transfer information. The process should include the following steps:

- As a class, brainstorm a list of ways in which patterns have been used in the past to communicate over distance. Some examples include the use of smoke signals, drums, and Morse code on a telegraph.
- Small group collaboratively conduct research to determine other possible ways of communicating using patterns over distances.
- As a class, determine criteria and possible constraints on the design solutions.
- Small groups work collaboratively to design and build a device or design a process for communicating information over a distance. (e.g. drums sending coded information through sound waves, use a flashlight to convey information using patterns of on and off).
- After small groups finish designing and building, they should put together a presentation that includes a written description/explanation of how patterns are used to communicate information.

Throughout this process, communicating with peers is important, and can lead to better designs. After completing engineering design process, students should discuss ways in which we use patterns in today's technology to communicate over long distances and how engineers have improved existing technologies over time in order to increase benefits, decrease known risks, and meet societal demands.

Suggested Activity: Breaking the sound barrier (ngss.nsta.org)

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

To support integration of English Language Arts into this unit, students conduct short research projects, using both print and digital sources, to build their understanding of wave properties and of the use of waves to communicate over a distance. Students should take notes, categorize information collected, and document a list of the sources used. Using the information they collect during research, as well as information from their experiences with waves, sound and light, students integrate the information and use it to design a device or process that can be used to communicate over a distance using patterns. As students create presentations that detail how their design solutions can be used to communicate, they should use details and examples from both their research and experiences to explain how patterns are used in their design to communicate over a distance. They can include audio or video recordings and visual displays to enhance their presentations.

Mathematics

To support the integration of the CCSS for mathematics into this unit of study, students should have opportunities to draw points, lines, line segments, rays, angles, and perpendicular and parallel lines, and identify these in two-dimensional drawings as they identify rays and angles in drawings of the ways in which waves move. Students should also have opportunities to use the four operations to solve problems. Students can analyze constraints on materials, times, or cost to draw implications for design solutions. For example, if a design calls for 20 screws and screws sold in boxes of 150, how many copies of the design could be made?

As students represent and solve word problems, such as these, they reason abstractly and quantitatively and model with mathematics. As students create models of waves and engage in engineering design, they have opportunities to use tools strategically while measuring, drawing, and building.

Modifications:

- Structure lesson around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.b. multisensory techniques - auditory/visual aides; pictures, illustrations, charts, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tools such as SKYPE, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.

Resources:

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

Unit 5 - Structure and Functions

Scope and Sequence

Time Frame: Approximately 15 days
In this unit of study, students develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. The crosscutting concepts of system and system models are called out as organizing concepts for this disciplinary core idea.

Corresponds to Unit 4 in textbook

Stage 1: Desired Results

Content Standards:

- **4-LS1-1:** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Essential Questions:

- How do the internal and external parts of plants and animals support their survival, growth, behavior, and reproduction.

Enduring Understandings:

- A system can be described in terms of its components and their interactions.
- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

Knowledge and Skills (SWBAT embedded course proficiencies)

Students who understand the concepts are able to:

- Describe a system in terms of its components and their interactions.
- Construct an argument with evidence, data, and/or a model.
- Construct an argument to support the claim that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. Examples of structures could include:
    - Colored petals
    - Stems
    - Roots
    - Stomach
    - Brain
    - Skin

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)
Assessment Methods: Formative, Summative, Observations, Anecdotal Notes, Interactive Notebooks, Experiments, STEM Projects, Science Exploration Labs/ Performance Tasks, Quizzes, and Tests.

Stage 3: Learning Plan

In this unit of study, students spend time observing plants and animals in order to gather evidence that organisms are living systems. A system is made up of structures and processes that interact and enable the system to function. Every plant and animal can be described in terms of its internal and external structures and their interactions, and these structures each have specific functions that support survival, growth, behavior, and reproduction of the organism.

Use a variety of plants and animals as examples, students need multiple opportunities to:

- Describe the internal and external structures of a plant or animal and the function of each of those structures. Description should explain how each structure serves various functions in growth, survival, behavior, and/or reproduction.
- Describe the interactions that occur among the structures within the plant or animal system.

As students observe the structures of an animal or plant, explain the function of each, and describe how these structures help the animal grow, survive, and/or reproduce, they should use evidence from their observations to support their explanations.

Suggested Activity: Seed dispersal (ngss.nsta.org).**Project Learning Tree:** Tree Factory, activity 63.

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

Students use the evidence from their observations of plants and animals to support the claim that all organisms are systems with structures that function in growth, survival, behavior, and/or reproduction. Students need opportunities to observe plants and animals closely, taking notes and drawing pictures, so that they can describe various structures and their functions.

Mathematics

Students describe the symmetry that can be observed in an organism's structures. For example, the leaves of many plants and the bodies of many animals display bilateral symmetry. Students should be encouraged to draw each organism that they observe, pointing out any structures that are symmetrical. Students should also trace lines of symmetry in their drawings to support their thinking. In addition, students can conduct research to determine whether the symmetry serves a function in the growth, reproduction, or survival of the organism.

Modifications:

- Provide students with multiple choices of how they can represent their understandings
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena
- Structure the learning around explaining or solving a social or community-based issue.

Resources:

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

Unit 6: - How Organisms Process Information

Scope and Sequence

Time Frame: Approximately 17 days
In this unit of study, students are expected to develop an understanding 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.

Corresponds to Unit 5 in textbook

Stage 1: Desired Results

Content Standards:

- **4-LS1-1:** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- **4-LS1-2:** 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.

Essential Questions:

- How do animals use their perceptions and memories to make decisions?

Enduring Understandings:

- A system can be described in terms of its components and its interactions.
- 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.

Knowledge and Skills (SWBAT embedded course proficiencies)

Students who understand the concepts are able to:

- Describe a system in terms of its components and their interactions.
- Use a model to test interactions concerning the functioning of a natural system.
- 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.
- Identify cause-and-effect relationships.
- Develop a model to describe phenomena.
- Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)
Assessment Methods: Formative, Summative, Observations, Anecdotal Notes, Interactive Notebooks, Experiments, STEM Projects, Science Exploration Labs/ Performance Tasks, Quizzes, and Tests.

Stage 3: Learning Plan

In this unit of study, students use the concept of systems to understand that every animal has internal and external structures that allow it to take in information from the environment in which it lives, process that information, and respond in ways that increase its chances to grow, reproduce, and survive.

The way in which an organism gathers information will depend on the organism and the body structures that pick up signals from the environment. Many animals, like humans, have sense organs that gather information from the environment through seeing, hearing, feeling, smelling, and tasting. Some animals have sensory receptors or other mechanisms that allow them to sense such things as light, temperature, moisture, and movement. Students need to understand that all animals pick up information from their environment through senses or sensory receptors. In many animals, nerves or neurons then transfer that information to a centralized place (the brain) where it is processed; then, through reflex reactions or learned behaviors, the organism responds in ways that will help it survive and reproduce. In addition, animals often store this information in their brains as memories and use these memories to guide future actions. As students observe animals, either through direct observation or using text and digital resources, they should use models, such as drawings, diagrams, and pictures, to describe the ways that animals receive, process, store, and respond to information from the environment in order to survive, grow, and reproduce.

Suggested Activity: Macro-structures of animals - quadra-peds (betterlessons.com). **Project Wild:** Thicket Game, pg 114, Seeing is Believing!, pg 116.**Project Learning Tree:** Earth Manners, activity 87.

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

Students should use text and online media resources when appropriate to help them understand how animals receive and process information they receive from the environment, and to develop a conceptual understanding of what happens when light reflects off objects and enters the eye. They should also use visual displays to enhance their observations and explanations of the concepts in this unit of study.

Mathematics

Students should model with mathematics as they draw points, lines, line segments, and angles to describe how light behaves when coming into contact with lenses, mirrors, and other objects. Students will also use points, lines, and angles when drawing pictures and diagrams that show how light reflects off objects and into the pinhole viewer of into the human eye.

Modifications:

- Provide students with multiple choices of how they can represent their understandings
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Have struggling readers find the vocabulary words within the unit. Have students use context clues to infer definitions and then share with a partner.

Resources:

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

Unit 7 - Earth Processes
Changes to Earth's Surface

Scope and Sequence

Time Frame: Approximately 27 days
In this unit of study, students apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. In order to describe patterns of Earth's features, students analyze and interpret data from maps.

Corresponds to Unit 6 in textbook

Stage 1: Desired Results

Content Standards:

- **4-ESS2-1:** Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind or vegetation.
- **4-ESS2-2:** Analyze and interpret data from maps to describe patterns of Earth's features.
- **3-5-ETS1-2:** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- **3-5-ETS1-3:** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Essential Questions:

- Is it possible to engineer ways to protect humans from natural Earth?

Enduring Understandings:

- Patterns can be used as evidence to support an explanation.
- Maps can help locate the different land and water features of Earth.
- 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 the edges.
- Cause-and-effect relationships are routinely identified, tested, and used to explain change.
- Engineers improve existing technologies or develop new ones to increase benefits, decrease known risks, and meet societal demands.
- A variety of hazards result from natural processes.
- Humans cannot eliminate the hazards, but they can take steps to reduce their impacts.
- Research on a problem should be carried out before beginning to design a solution.
- Testing a solution involves investigating how well it performs under a range of likely conditions.
- At whatever stage, communicating with peers about proposed solutions to a problem is an important part of the design process, and shared ideas can lead to improved designs.
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Knowledge and Skills (SWBAT embedded course proficiencies)

Students who understand the concepts are able to:

- Support an explanation using patterns as evidence.
- Analyze and interpret data to make sense of phenomena using logical reasoning.
- Analyze and interpret data from maps to describe patterns of Earth's features. Maps can include:
    - Topographic maps of Earth's land
    - Topographic maps of Earth's ocean floor
    - Locations of mountains
    - Locations of continental boundaries
    - Locations of volcanoes and earthquakes

- Identify and test cause-and-effect relationships in order to explain change.
- Generate multiple solutions to a problem and compare them based on how well they meet the criteria and constraints of the design solution.
- Generate multiple solutions to a problem and compare them based on how well they meet the criteria and constraints of the design solution.
- Generate and compare solutions to reduce the impacts of natural Earth processes on humans. Examples of solutions could include:
    - Designing an earthquake-resistant building
    - Improving monitoring of volcanic activity

- Generate multiple possible solutions to a problem and compare them based on how well each is likely to meet the criteria and constraints of the problem.
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
- Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model of prototype that can be improved.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods: Formative, Summative, Observations, Anecdotal Notes, Interactive Notebooks, Experiments, STEM Projects, Science Exploration Labs/ Performance Tasks, Quizzes, and Tests.

Stage 3: Learning Plan

In this unit of study, students analyze and interpret data from maps to describe patterns of Earth's features. Students can use topographic maps of Earth's land and ocean floor in order to locate features such as mountains, mountain ranges, deep ocean trenches, and other floor structures. As students analyze and interpret these types of maps, they begin to notice patterns in the types of structures and where these structures are found. Students learn that major mountain chains often form along or near the edge of continents. Once students locate continental boundaries, a further analysis of data can show students that there is a noticeable pattern of earth events, including volcanoes and earthquakes, which occur along these boundaries.

During this unit, students also learn that engineers develop or improve technologies to solve societal problems. A variety of hazards result from natural processes. Although we cannot eliminate the hazards, we can take steps to reduce their impacts. Students must have the opportunity to engage in the engineering design process in order to generate and compare multiple solutions that reduce the impacts of natural Earth processes on human. This process should include the following steps:

- Students brainstorm possible problems that Earth processes can cause for humans.
- Either as a class or in small groups, have students select one problem to research.
- Small groups conduct research to determine possible solutions that reduce the impacts of the chosen Earth process on humans.
- As a class, determine criteria and possible constraints on the design solution. Criteria might include: saving lives and/or reducing property loss.
- Small groups investigate how well the solutions perform under a range of likely conditions. This may involve additional research and analysis of available data or planning and conducting investigations to produce data that will serve as the basis for evidence. During this process, students should plan and carry out fair tests in which variables are controlled and failure points are considered in order to identify elements of the design solution that do and do not meet criteria.
- Students compare the solutions based on how well they meet criteria and constraints, using data as evidence to support their thinking. At every stage, communicating with peers is an important part of the design process, because shared ideas can lead to improved designs. Students should routinely identify and test cause-and-effect relationships and use these relationships to explain the changes that they observe as they test design solutions.

At every stage, communicating with peers is an important part of the design process, because shared ideas can lead to improved designs. Students should routinely identify and test cause-and-effect relationships and use these relationships to explain the changes that they observe as they design solutions.

Engineering design performance expectations are an integral part of this unit of study. Students are expected to research a problem, generate and compare possible design solutions, and test the design solutions to determine how well each performs under a range of likely conditions. Using data as evidence, students identify elements of each design that need improvement and determine which design solution best solves the problem, given the criteria and the constraints. This process is outlined in greater detail in the previous section.

Suggested Activity: Skittles water erosion (ngss-k-5-ausb.weebly.com)

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

To support integration of the CCSS for English Language Arts in this unit, students should have access to multiple sources of information about Earth's features and earth processes. Students should have opportunities to read, analyze, and interpret information from nonfiction text, charts, graphs, diagrams, timelines, and interactive elements on the internet. Students use this information, along with data they collect during investigations, to help explain, both orally and in writing, the patterns they observe in the features of the Earth and in the natural hazards that occur on the Earth.

As the students engage in the engineering design process, they need opportunities to conduct research to build their understanding of how earth processes affect humans and to find examples of ways in which engineers reduce the effect of volcanic eruptions, earthquakes, floods, and tsunamis. Students should take notes as they read and summarize or paraphrase their notes to support their work throughout the engineering design process.

In addition, students should provide a list of sources when using this type of information.

Mathematics

- Use measurements to determine how far earthquakes and volcanoes tend occur from continental boundaries.
- Analyze data to determine patterns of change that occur in areas where volcanoes erupt, earthquakes occur, and in flood zones.
- Reason abstractly and quantitatively to draw diagrams to build scale models.
- Analyze timelines, charts, and graphs to determine patterns in Earth's features and patterns of change caused by earth processes.
- Reason abstractly and quantitatively when discussing the effects of an earth process on humans. For examples, on average, 3,000 lives are lost every year due to tsunamis. When early warning systems are in place, fewer than 1,000 lives are lost annually.
- Analyze constraints on materials, times, or cost to in order to determine criteria for design solutions.

Modifications:

- Structure the learning around explaining or solving a social or community-based issue.
- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings.
- Use project-based science learning to connect science with observable phenomena.

Resources:

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

Unit 8: - Weathering and Erosion
Rocks and Fossils

Scope and Sequence

Time Frame: Approximately 20 days
In this unit of study, students develop understandings of the effects of weathering and the rate of erosion by water, ice, wind, or vegetation.

Corresponds to Unit 7 in textbook

Stage 1: Desired Results

Content Standards:

- **4-ESS2-1:** Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- **4-ESS1-1:** Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

Essential Questions:

- What do the shapes of landforms and rock formations tell us about the past?

Enduring Understandings:

- Cause-and-effect relationships are routinely identified, tested, and used to explain change.
- Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.
- Rainfall helps to shape the land and affects the types of living things found in a region.
- Living things affect the physical characteristics of their regions.
- Science assumes consistent patterns in natural systems.
- Patterns can be used as evidence to support an explanation.
- 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.

Knowledge and Skills (SWBAT embedded course proficiencies)

Students who understand the concepts are able to:

- Identify, test, and use cause-and-effect relationships in order to explain change.
- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.
- Make observations and/or measurements to produce evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. Examples of variables to test could include:
    - Angle of slope in a downhill movement of water
    - Amount of vegetation
    - Speed of the wind
    - Cycles of freezing and thawing of water
    - Cycles of heating and cooling
    - Volume of water flow

- Support explanations using patterns as evidence.
- Identify the evidence that supports particular points in an explanation.
- Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. 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.
    - 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.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods: Formative, Summative, Observations, Anecdotal Notes, Interactive Notebooks, Experiments, STEM Projects, Science Exploration Labs/ Performance Tasks, Quizzes, and Tests.

Stage 3: Learning Plan

In this unit of study, students are expected to develop understanding of the effects of weathering and the rate of erosion by water, ice, wind, or vegetation. As students plan and carry out investigations using models and observe the effects of earth processes in the natural environment, they learn to identify patterns of change; recognize cause-and-effect relationships among the forces that cause change in rocks, soil, and landforms; and construct explanations of changes that occur over time to earth materials.

In the first portion of the unit, fourth graders develop an understanding of cause-and-effect relationships when studying physical weathering and the rate of erosion by water, wind, ice, or vegetation. Students learn that rainfall helps to shape the land and affects the types of living things found in a region, and that living things affect the physical characteristics of a region. Students should make observations of their local environment to observe the types of living things that are common in the region, and they should look at evidence that water, ice, wind, organisms, and gravity have broken down rocks, soils, and sediments into smaller pieces and have moved them from one place to another.

In the classroom, students should build and use models that demonstrate how wind, water, and ice cause change to the surface of the earth. Students should use stream tables, soil, sand, and water to simulate the effects of moving water (rain,rivers) on rocks and soil. Following these types of experiences, students need opportunities to ask questions that will lead to further investigations. They can change a variable - such as the type of earth material, the angle of hill's slope, the volume of water flow, and the relative rate of deposition - then collect and analyze data in order to determine the effects.

In addition to using models to understand the effect of water and ice on land, students should build and use models to simulate the effects of wind on earth materials. Students also need opportunities to observe ways in which plants affect weathering and erosion of earth material. Plants often slow or stop the effects of moving wind and water on land. In addition to slowing or preventing erosion, plants can cause weathering on rocks.

In the second portion of this unit, students learn that patterns can be used as evidence to explain changes to the earth's landforms and rock formations, and that local, regional, and global patterns of rock formations reveal changes over time due to earth forces. As students collect evidence, either from firsthand observations or from media resources, they should attempt to explain the changes that have occurred over time in each of the landscapes observed.

Suggested Activity: Soil erosion experiment (can use greenhouse or go outside to picnic tables) (lifeisagarden.co.za). **Globe Module:** Soils: The Scoop on Soils.

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

To support integration of the language arts standards in this unit, students can read content-specific tests to deepen their understanding of the cause-and-effect relationships within earth systems. As they read, students should take notes, which can be used to help them understand and explain how earth processes affect the world around them. They should ask questions, such as,

- What types of soil erode faster?
- Why do some rocks weather more easily or more quickly than others?
- What patterns of change can be observed using models?

As they attempt to answer these questions, students can cite evidence from observations and from texts to support their thinking. In addition, students can conduct short research projects that will help them gather additional evidence to support explanations. Throughout this unit, student should collect and record data in science journals and analyze the data to identify patterns of change.

Mathematics

To support integration of the Mathematics standards into this unit, students are expected to use mathematics when analyzing quantitative data to identify patterns, explain cause-and-effect relationships, and make predictions. Students need opportunities to measure earth materials using tools, such as balances and graduated cylinders, and to measure distances and heights using rulers or tape measures. Students should also be required to solve problems involving measurements and data.

Modifications:

- Provide students with multiple choices for how they can represent their understandings.
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures.
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.

Resources:

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

Unit 9 - Natural Resources and Hazards

Scope and Sequence

Time Frame: Approximately 27 days
In this unit of study, students are able to explore how renewable and nonrenewable resources are used for energy and discover how people can reduce land - and water-based hazards and their impacts.

Corresponds to Unit 8 in textbook

Stage 1: Desired Results

Content Standards:

- **4-ESS3-1:** Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
- **E-SS3-2:** Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Essential Questions:

- What are some of the advantages/disadvantages of renewable/nonrenewable energy sources?

Enduring Understandings:

- Cause-and-effect relationships are routinely identified, and used to explain change.
- People's needs and wants changes, as do their demands for new and improved technologies.
- Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands.
- 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.

Knowledge and Skills (SWBAT embedded course proficiencies)

Students who understand the concepts are able to:

- Understand that humans use energy and fuels derived from natural resources.
- Obtain and evaluate information about renewable resources. Apply knowledge of the interdependence of science and technology to draw conclusions about electrical energy systems.
- Describe a variety of Earth processes on land that can be hazardous to humans and how the impact of these processes can be lessened.
- Obtain and communicate information about how maps can be used to assess the risk of natural hazards.
- Analyze and describe a variety of water-based processes that can be hazardous to humans and design and test multiple solutions to lessen the impact of these natural Earth processes on humans.
- Evaluate information about their influence on society and the world.
- Recognize that some resources are renewable and other are not.
- Analyze how people's wants and needs change due to the environment and other circumstances.

Stage 2: Evidence of Understanding, Learning Objectives and Expectations

Benchmarks (embedded student proficiencies)

Assessment Methods: Formative, Summative, Observations, Anecdotal Notes, Interactive Notebooks, Experiments, STEM Projects, Science Exploration Labs/ Performance Tasks, Quizzes, and Tests.

Stage 3: Learning Plan

In this unit of study, students are expected to develop understanding of the how renewable and nonrenewable resources are used for energy. As students plan and carry out investigations using models and observe the effects of resource use in the natural environment, they learn to identify patterns of change; recognize cause-and-effect relationships and how people can reduce hazardous impacts on the environment.

In the first portion of the unit, fourth graders develop an understanding of cause-and-effect relationships when studying renewable and nonrenewable resources and how they are used for energy. In the classroom students should research, plan, and write down the pros and cons of renewable and nonrenewable energy sources. They will need to identify the ones that are better for the environment.

In the second portion of this unit, students discover how people can reduce their impact on land- and water-based hazards (e.g. volcanic eruptions, earthquakes, hurricane, tsunami). As students collect evidence, either from firsthand observations or from media resources, they learn how engineers and scientists develop strategies to reduce the impact of these events.

Suggested Activities: Reading a resource map (nationalgeographic.org)

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

Compare and contrast the most important points and key details presented in two texts on the same topic. 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. Conduct short research projects that build knowledge through investigation of different aspects of a topic. Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

Mathematics

Reason abstractly and quantitatively. Interpret a multiplication equation as a comparison. Represent verbal statements of multiplicative comparisons as multiplication equations.

Modifications:

- Provide students with multiple choices for how they can represent their understandings.
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures.
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.

Resources:

- District approved science textbook
- Websites
- Videos
- Nonfiction/fiction sources

New Jersey Core Curriculum and Common Core Content Standards

http://www.state.nj.us/education/cccs/

Integration of 21st Century Theme(s)

The following websites are sources for the following 21st Century Themes and Skills:
http://www.nj.gov/education/code/current/title6a/chap8.pdf
http://www.p21.org/about-us/p21-framework .
http://www.state.nj.us/education/cccs/standards/9/index.html

21st Century Interdisciplinary Themes (into core subjects)

- **Global Awareness**
- **Financial, Economic, Business and Entrepreneurial Literacy**
- **Civic Literacy**
- **Health Literacy**
- **Environmental Literacy**

Learning and Innovation Skills

- **Creativity and Innovation**
- **Critical Thinking and Problem Solving**
- **Communication and Collaboration**

Information, Media and Technology Skills

- **Information Literacy**
- **Media Literacy**
- **ICT (Information, Communications and Technology) Literacy**

Life and Career Skills

- **Flexibility and Adaptability**
- **Initiative and Self-Direction**
- **Social and Cross-Cultural Skills**
- **Productivity and Accountability**
- **Leadership and Responsibility**

Integration of Digital Tools

- **Classroom computers/laptops/Chromebooks**
- **Technology Lab**
- **Voice amplification device**
- **Other software programs**