Lakewood Public School District Curriculum Guide

Grade: 4	Content Area: Science

Original Adoption: Original Adoption: 2023 NJSLS English Language Arts and English as a Second Language (8-21-24); Math NJSLS Mathematics (8-21-24); 2020 NJSLS Science, Social Studies, Career Readiness, Life Literacies & Key Skills, Computer Design & Thinking, Visual & Performing Arts, World Language, Comprehensive Health and Physical Education (5-11-22)
Created By:

Recommended Pacing Guide	
Unit 1: Energy Conversion	45 days
Unit 2: Vision and Light	45 days
Unit 3: Earth's Features	45 days
Unit 4: Waves, Energy, and Information	45 days

Alignment with State Mandates

The following colors are used throughout this document to indicate areas in which the curriculum is aligned with the following NJSA requirements:

- Holocaust and genocides (N.J.S.A. 18A:35-28)
- History and contributions of African-Americans (Amistad Law) (N.J.S.A. 18A:35-4.43)
- Highlight and promote diversity and inclusion (Diversity & Inclusion Law) (N.J.S.A. 18A:35-4.36a)
- History of disabled and LGBT persons included in middle and high school curriculum (Section 18A:35-4.35)
- Climate Change - to prepare students to understand how and why climate change happens, the impact it has on our local and global communities and to act in informed and sustainable ways. Please click here for specific examples (by subject).

Unit 1: Energy Conversions	Duration: 45 days

New Jersey Student Learning 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.

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4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
4-ESS3-1	Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
3-5-ETS1-1	Define a simple problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
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.
4-PS3-3	Ask questions and predict outcomes about the changes in energy that occur when objects collide.
4-ESS3-2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Science and Engineering Practices	Discipline Core Ideas/Unit Enduring Understandings	Crosscutting Concepts
● **Practice 6: Constructing Explanations and Designing Solutions:** Throughout the unit, students are introduced to various design problems and the criteria for each associated solution. Students consider these criteria as they design solutions for improving Ergstown's electrical system. At one point in the unit, students have the opportunity to step through each of the four phases of the iterative design cycle as they learn about, design, build, and test wind-energy converters. ● **Practice 7: Engaging in Argument from Evidence:** Students learn that engineers argue for one solution over other solutions based on how well a solution meets specific	**PS3.A: Definitions of Energy** ● 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) **PS3.B: Conservation of Energy and Energy Transfer:** ● 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.	**Energy and Matter** ● 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** ● Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) ● Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS32) ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Engineering, Technology, and Science on Society and the Natural World** ● Engineers improve existing technologies or

criteria. Students consider criteria and trade-offs as they design and argue for improvement solutions to Ergstown's electrical system. Students receive explicit instruction in formulating their own evidence-based arguments, and, they write three arguments during the course of the unit. Students synthesize evidence gathered from throughout the unit in order to design a final, culminating solution for which they argue in a town-hall-meeting forum. ● **Practice 8: Obtaining, Evaluating, and Communicating Information:** Throughout the unit, students have several opportunities to use the reading comprehension and inquiry strategy of synthesizing as they engage with the custom-written books for this unit. Synthesizing helps students connect information from a variety of sources including texts, previous findings, computer simulations, and observations in order to arrive at new ideas or to refine their understanding. The evidence that students gather from the texts about electrical systems and energy conversion is synthesized with firsthand evidence and becomes central to their design arguments throughout the unit. ● **Practice 2: Developing and Using Models:** Students receive explicit instruction and opportunities to create and explore models of electrical systems	(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) **PS3.D: Energy in Chemical Processes and Everyday Life:** ● The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4) **ESS3.A: Natural Resources:** ● 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) **ETS1.A: Defining and Delimiting Engineering Problems:** ● 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. (3-5-ETS1-1) **ETS1.B: Developing Possible Solutions:** ● Research on a problem should be carried out before beginning to design a	develop new ones. (4-PS3-4) ● Over time, people's needs and wants change, as do their demands for new and improved technologies. (4-ESS3-1) ● Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2) ● People's needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1) ● Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2) **Interdependence of Science, Engineering, and Technology** ● Knowledge of relevant scientific concepts and research findings is important in engineering. (4-ESS31) ***Connections to Nature and Science*** **Science is a Human Endeavor** ● Most scientists and engineers work in teams. (4-PS3-4) Science affects everyday life. (4PS3-4)

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as they investigate the function of each part of the system and consider possible causes of system failure. Students also use diverse energy sources to run the systems—sunlight, water, wind, and their own fingers—and explore what makes some systems succeed in functioning while others fail. ● **Practice 4: Analyzing and Interpreting Data:** Students have multiple opportunities to analyze the data they have collected from firsthand investigations with electrical systems, energy sources, energy converters, and energy transfer to determine the best design for an improved electrical system for the citizens of Ergstown. ● **Practice 1: Asking Questions:** Throughout the unit, students work to better define and understand the problems causing the blackouts in Ergstown. ● **Practice 5: Using Mathematics and Computational Thinking:** Students have multiple opportunities to use computational thinking as they use the graphs in the Energy Conversions Simulation to compare design solutions. ● **Practice 3: Planning and Carrying Out Investigations:** Students conduct investigations in the Energy Conversions Simulation to create and test systems and investigate what devices use electrical energy to function.	solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2) ● 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. (3-5-ETS1-2) ● Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3) **ETS1.C: Optimizing the Design Solution:** ● Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3) **ESS3.B: Natural Hazards:** ● 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)	

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New Jersey Social and Emotional Competencies and Sub-Competencies	
Self-Awareness	● Recognize one's feelings and thoughts. ● Recognize the impact of one's feelings and thoughts on one's own behavior. ● Recognize one's personal traits, strengths, and limitations. ● Recognize the importance of self-confidence in handling daily tasks and challenges.
Self-Management	● Understand and practice strategies for managing one's own emotions, thoughts, and behaviors. ● Recognize the skills needed to establish and achieve personal and educational goals. ● Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals.
Social Awareness	● Recognize and identify the thoughts, feelings, and perspectives of others. ● Demonstrate an awareness of the differences among individuals, groups, and others' cultural backgrounds. ● Demonstrate an understanding of the need for mutual respect when viewpoints differ. ● Demonstrate an awareness of the expectations for social interactions in a variety of settings.
Responsible Decision Making	● Develop, implement, and model effective problem-solving and critical thinking skills. ● Identify the consequences associated with one's actions in order to make constructive choices. ● Evaluate personal, ethical, safety, and civic impact of decisions.
Relationship Skills	● Establish and maintain healthy relationships. ● Utilize positive communication and social skills to interact effectively with others. ● Identify ways to resist inappropriate social pressure. ● Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. ● Identify who, when, where, or how to seek help for oneself or others when needed.

Interdisciplinary Connections	
ELA Standards	
RI.CR.4.1	Refer to details and examples as textual evidence when explaining what an informational text says explicitly and make relevant connections when drawing inferences from the text.
RI.IT.4.3	Describe the impact of individuals and events throughout the course of a text, explaining events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on evidence in the text.

RI.PP.4.5	Compare and contrast multiple accounts of the same event or topic; noting important similarities and differences in the point of view they represent.
RI.MF.4.6	Use evidence to show how graphics and visuals (e.g., illustrations, charts, graphs, diagrams, timelines, animations) support central ideas.
W.AW.4.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information. opportunity to integrate climate change education. **A.** Introduce a topic or text clearly, state an opinion, and create an organizational structure in which related ideas are grouped to support the writer's purpose. **B.** Provide reasons that are supported by facts from texts and/or other sources. **C.** Link opinion and reasons using words and phrases (e.g., for instance, in order to, in addition). **D.** Provide a conclusion related to the opinion presented.
W.IW.4.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly. **A.** Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), text features (e.g., illustrations, diagrams, captions) and multimedia when useful to aid in comprehension. **B.** Develop the topic with facts, definitions, concrete details, text evidence, or other information and examples related to the topic. **C.** Link ideas within paragraphs and sections of information using words and phrases (e.g., another, for example, also, because). **D.** Use precise language and domain-specific vocabulary to inform about or explain the topic. **E.** Provide a conclusion related to the information or explanation presented.
W.WR.4.5	Conduct short research projects that use multiple reference sources (print and non-print) and build knowledge through investigation of different aspects of a topic.
W.SE.4.6	Gather relevant information from multiple print and digital sources; take notes, prioritize and categorize information; provide a list of sources.
W.RW.4.7	Write routinely over extended time frames (with time for research and revision) and shorter time frames (a single sitting) for a range of tasks, purposes, and audiences.
SL.PE.4.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly. A. Explicitly draw on previously read text or material and other information known about the topic to explore ideas under discussion. B. Follow agreed-upon rules for discussions and carry out assigned roles. C. Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.

	D. Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.
SL.PI.4.4	Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace
SL.AS.4.6	Differentiate between contexts that call for formal English (e.g., presenting ideas) and situations where informal discourse is appropriate (e.g., small-group discussion); use formal English when appropriate to task and situation.
L.RF.4.3	Know and apply grade-level phonics and word analysis skills in decoding and encoding words; use combined knowledge of all letter-sound correspondences, syllabication patterns, and morphology (e.g., roots and affixes) to read accurately unfamiliar multisyllabic words in context and out of context.
L.RF.4.4	Read with sufficient accuracy and fluency to support comprehension. **A.** Read grade-level text with purpose and understanding. **B.** Read grade-level text orally with accuracy, appropriate rate, and expression. **C.** Use context to confirm or self-correct word recognition and understanding, rereading as necessary.
L.KL.4.1	Use knowledge of language and its conventions when writing, speaking, reading, or listening. **A.** Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases.
L.VL.4.2	Determine or clarify the meaning of unknown and multiple-meaning academic and domain-specific words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies. **A.** Use context (e.g., definitions, examples, or restatements in text) as a clue to the meaning of a word or phrase. **B.** Use common, grade-appropriate Greek and Latin affixes and roots as clues to the meaning of a word (e.g., telegraph, photograph, autograph). **C.** Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation and determine or clarify the precise meaning of key words and phrases.
Mathematics Standards	
MP1	Make sense of problems and persevere in solving them.
MP2	Reason abstractly and quantitatively.
MP4	Model with mathematics.
MP5	Use appropriate tools strategically.
MP6	Attend to precision.

4.OA.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.NBT.2	Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons. (Grade 4 expectations in this domain are limited to whole numbers less than or equal to 1,000,000.)
4.NBT.4	With accuracy and efficiency, add and subtract multi-digit whole numbers using the standard algorithm. (Grade 4 expectations in this domain are limited to whole numbers less than or equal to 1,000,000. A range of algorithms may be used.)
4.M.4a	Understand that an angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a “one-degree angle,” and can be used to measure angles.
4.M.5	Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.

Computer Science & Design Thinking	
8.2.5.ED.1	Explain the functions of a system and its subsystems.
8.2.5.ED.2	Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3	Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4	Explain factors that influence the development and function of products and systems
8.2.5.ED.5	Describe how specifications and limitations impact the engineering design process.
8.2.5.ED.6	Evaluate and test alternative solutions to a problem using the constraints and tradeoffs identified in the design process.
8.2.5.ITH.2	Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
8.2.5.ITH.4	Describe a technology/tool that has made the way people live easier or has led to a new business or career.

8.2.5.NT.1	Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.ETW.1	Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.

Career Readiness, Life Literacies & Key Skills	
9.2.5.CAP.3	Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.
9.4.5.CI.3	Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity
9.4.5.CI.4	Research the development process of a product and identify the role of failure as a part of the creative process
9.4.5.CT.1	Identify and gather relevant data that will aid in the problem-solving process
9.4.5.CT.3	Describe how digital tools and technology may be used to solve problems.
9.4.5.CT.4	Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global
9.4.5.IML.2	Create a visual representation to organize information about a problem or issue
9.4.5.IML.6	Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions
9.4.5.IML.7	Evaluate the degree to which information meets a need including social emotional learning, academic, and social
9.4.5.TL.4	Compare and contrast artifacts produced individually to those developed collaboratively
9.4.5.TL.5	Collaborate digitally to produce an artifact

Career Readiness, Life Literacies, and Key Skills Practices	
CLKS.1	Act as a responsible and contributing community member and employee.
CLKS.2	Attend to financial well-being.
CLKS.3	Consider the environmental, social and economic impacts of decisions.
CLKS.4	Demonstrate creativity and innovation.

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CLKS.5	Utilize critical thinking to make sense of problems and persevere in solving them.
CLKS.6	Model integrity, ethical leadership and effective management.
CLKS.7	Plan education and career paths aligned to personal goals.
CLKS.8	Use technology to enhance productivity, increase collaboration and communicate effectively.
CLKS.9	Work productively in teams while using cultural/global competence.

Evidence of Student Learning	
Formative Tasks: ● Teacher observations ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker	**Alternative Assessments:** ● Oral assessments ● Student Self-Assessments ● Pre-Unit Assessments ● 3-D Assessments
Summative Assessments: ● End of Unit Assessment	**Benchmark Assessments:** ● Benchmark 4A

Knowledge & Skills	
Enduring Understandings: ● A system is a collection of interacting parts that work together. Each part in the system plays a role to perform an overall system function. ● Light, motion, sound, and thermal energy are all forms of energy. You can observe evidence of these different forms as outputs of electrical devices. ● Energy can change from one form to another form. One way energy can change is through an electrical device. ● Devices will not have energy to function if they need more energy from the system than is put into the system. ● Engineers argue for one solution over others based on how well it meets criteria.	**Essential Questions:** ● What is a system? ● What can electrical energy in a system be used for? ● How do devices have so many different output energy forms when they are plugged into the same electrical system? ● Why would electrical devices stop converting energy? ● Where does energy come from? ● How does energy get from energy sources to the rest of the electrical system? ● Why might a system fail? ● How does energy get from the source to a device?

● Energy never just appears. It comes from a source. ● Some energy converters are designed to convert energy from sources to electrical energy that goes into the electrical system. ● Wires can transfer electrical energy from place to place. ● The parts of a system need to interact correctly to make it work.	
Content *Students will know…* ● Systems engineers design and improve systems. ● There are many kinds of systems in the world around us. ● A system is a collection of interacting parts that work together. Each part in the system plays a role to perform an overall function. ● Simple electrical systems and larger electrical systems have commonalities. ● Many devices that people use every day have electrical energy as an energy input. ● Energy moves in and out of the parts of systems. ● When things start moving or changing, it is because of energy. ● Energy is the ability to make things move or change. ● Some forms of energy are light, sound, motion, electrical, thermal, and chemical. ● Electrical devices need electrical energy to function. ● Claims in science and engineering are supported with evidence. ● An argument uses evidence to explain why one idea is the best. ● Electrical devices convert electrical energy to other energy forms. ● The function of an energy converter is to convert electrical energy into other forms of energy. ● Examples of energy converters include lamps, fans, radios, and toasters.	**Skills** *Students will be able to …* ● Reflect on what they do and do not understand to prepare for learning new things. ● Synthesize information they gathered from building their simple electrical systems with ideas from the reference book to come to a new understanding about forms of energy. ● Gather information from books. ● Observe the cherry pitter system to identify the parts of the system and their functions. ● Use text features to help navigate an informational text. ● Build a simple electrical system (a simple circuit) powered by a solar panel. ● Identify possible parts and functions of the simple electrical system and then connect them to those of the larger electrical energy system. ● Identify devices for which electrical energy is the energy input. ● Support or refute a claim using evidence. ● Using the Energy Conversions Simulation, create systems with light and sound as output energy forms. ● Observe energy input and output graphs as their systems function. ● Correlate the amounts of energy entering and leaving the systems in different forms and come to a deeper understanding of the concept of energy conversion. ● Use ideas from a text to answer investigative questions. ● Write about the energy conversion that takes place in a common electrical device, the hair dryer.

● Energy can change from one form to another form. One way energy can change is through an electrical device. ● In the past, people didn't have electrical devices. They found other ways to do many of the things we use devices for today. ● If an object does not have an output energy form that is different from its input energy form, then the object is not an energy converter. ● Over time, people's needs and wants change, as do their demands for new and improved technologies. ● Devices will not have energy to function if they need more energy from the system than is put into the system. ● Criteria are the things that engineers think about and use to test how well something solves a problem. ● Engineers argue for one solution over others based on how well it meets criteria. ● Certain devices are made to be energy efficient—they use less electrical energy than other devices to produce the same amount of the output energy that we want. ● An LED is an energy efficient light. ● Energy never just appears. It comes from a source. ● Sun, wind, water, geothermal and nuclear energy, biofuels, and fossil fuels are some sources of energy. ● Some energy converters are designed to convert energy from sources to electrical energy that goes into the electrical system. ● Solar panels, fuel burning power plants, and wind turbines are some examples of converters. ● Engineers go through a multi-step design process in order to design solutions to problems. ● Students engage in many of the same engineering practices as those employed by engineers.	● Test energy systems in the Energy Conversions Simulation to gather evidence that replacing old lights in streetlights with LEDs will use less energy and help reduce blackouts in Ergstown. ● Write a design argument in which they support a claim about a solution to reduce blackouts. ● Complete a digital card sort designed to promote their thinking about the function and the output energy forms of different converters. ● Identify what source of energy might be the most appropriate as a backup energy source for the school. ● Write an explanation of how the energy source will be converted into electrical energy. ● Engage in a student-driven learning sequence (learn, plan, make, test) in which they design their wind turbines. ● Provide and receive peer feedback on their wind turbine designs and incorporate the feedback to make design improvements. ● Draw a diagram of their completed wind turbine in which they identify each of its parts and their functions. ● Participate in a roundtable discussion to identify the advantages and limitations of different design proposals. ● Write an argument defending the best solution, considering the audience as they write. ● Build a simple electrical system and cause it to fail; then identify the part that caused the failure of another group's system. ● Prepare for and write a design argument about a proposed improvement to Ergstown's electrical grid by reviewing and analyzing evidence. ● Write to explain why a tree falling on wires in Ergstown's electrical grid caused the system to fail. ● Present claims and evidence to their peers. ● Consider the arguments of others and recognize that engineers may change their minds about a solution if they have been presented with more convincing evidence

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● Men and women from all cultures and backgrounds choose careers as scientists and engineers. ● Most scientists and engineers work in teams. ● Science affects everyday life. ● Creativity and imagination are important to science. ● Generators function to convert energy from a source into electrical energy. ● Generators and motors serve different functions, but have similar parts. ● The faster something moves, the more energy it possesses. ● The design cycle has several phases including Learn, Plan, Make, and Test. ● The design cycle is an iterative process: engineers redesign and retest their designs based on test feedback. ● Engineers work in teams and engage in peer review. ● It is often not possible to meet all of the criteria for a given design solution or to meet all of the criteria equally well. ● Engineers must consider both the advantages and the limitations of each solution. ● There are many possible reasons that a system might fail. ● It is unlikely that too many devices or not enough energy in the electrical system could be a reason for a nighttime blackout. ● Wires can transfer electrical energy from place to place. ● The electrical grid is the wires that transfer electrical energy from many sources to many other places. ● The parts of a system need to interact correctly to make it work. ● Problems with the wires in an electrical system can cause the system to fail. ● Cost can be something important to consider when designing a solution to a problem.	

• Different solutions have different costs associated with them. • There are many possible solutions to electrical system failures. • Energy efficient devices produce more of the desired form of energy output than inefficient devices. • There are many factors to consider when designing a solution to a problem.. • Scientists and engineers use scientific language when making arguments. • You can figure out problems by using science.	

Core Instructional & Supplemental Materials

Suggested Activities/Resources:

- Books in This Unit
  - *Systems*
  - *Energy Past and Present*
  - *Sunlight and Showers*
  - *Blackout!*
  - *It's All Energy*
- *Energy Conversions* Kit

Supplemental Materials

- *Eliciting and Leveraging Students' Prior Knowledge, Personal Experiences, and Cultural Backgrounds* PDF
- Digital Resources included in each unit
  - Energy Conversions Simulation
  - Energy Conversions Sorting Tool
- Flextensions: Energy Conversion Stations
- Multi-language glossary
- *George's Energy Adventure* by North American Young Generation in Nuclear
- *Milkweed* by Jerry Spinelli

Suggested Accommodations

English Language Learners:

- Multi-sensory instruction
- Flexible grouping
- Small group instruction
- Provide peer tutoring
- Use a strong student as a "buddy" (does not necessarily have to speak the primary language)
- Chunking information
- Scaffolded questioning
- Academic language support
- Vocabulary support
- Co-Constructed Word Banks
- Anchor charts
- Gradual release model
- Visual models
- Native language support when possible (Multi-language glossary)

- Sheltered English Instruction Strategies
- Sentence starters

Special Education/Students with Disabilities:
- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Follow all IEP modifications
- Calculators
- Manipulatives/concrete models
- Directions repeated, clarified, and reworded
- Breakdown task into manageable parts

504 Plans:
- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Calculators
- Manipulatives/concrete models
- Follow all 504 modifications

Gifted and Talented:
- Higher level questioning
- Enriched assignments
- Tiered assignments
- Choice board to extend learning

Students at Risk of Failure:
- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment
- Provide visuals
- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning
- Tiered activities
- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:
- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go

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- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

Unit 2: Vision and Light	Duration: 45 days

New Jersey Student Learning 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 brains, and respond to the information in different ways.
4-PS4-2	Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

Science and Engineering Practices	Discipline Core Ideas/Unit Enduring Understandings	Crosscutting Concepts
• **Practice 1: Asking Questions:** Students receive explicit instruction about asking questions in order to improve their facility with and understanding of this practice. Students ask questions and think about how their questions can be answered when reading informational text and when conducting firsthand investigations. Students also	**LS1.A: Structure and Function** • Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1) **LS1.D: Information Processing:** • Different sense receptors are specialized for particular kinds of information, which may be then processed by	**Systems and System Models** • A system can be described in terms of its components and their interactions. (4-LS1-1), (4-LS1-2) **Cause and Effect** • Cause and effect relationships are routinely identified. (4-PS4-2)

ask new questions after both reading and investigating. Students learn that scientists investigate some questions directly, while other questions can be researched through secondhand sources such as reference books. In addition, students learn that reading, discussing, and investigating can all lead to new questions. ● **Practice 2: Developing and Using Models:** Students use the Vision and Light Modeling Tool to represent their ideas about the role of both light and animals' structures in vision. Through using the Modeling Tool, students have multiple opportunities to identify the path of light required for an animal to be able to see an object. Students also identify which of an animal's structures are involved in vision as well as the functions of these structures. ● **Practice 3: Planning and Carrying Out Investigations:** Students receive explicit instruction and opportunities to practice controlling variables as they conduct investigations. Over the course of several investigations in the Vision and Light Simulation, students become more independent in changing only one variable at a time in order to see what makes a difference. In addition, students read about examples of real investigations that required changing only one variable at a time. At the end of the unit, students plan and carry	the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4-LS1-2) **PS4.B: Electromagnetic Radiation:** ● An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2) **ESS2.E: Biogeology:** ● Living things affect the physical characteristics of their regions. (4-ESS2-1)	

out their own investigations, paying particular attention to the variables involved and which single variable they will change. ● **Practice 4: Analyzing and Interpreting Data:** As students read books about others' investigations and focus on controlling variables in their own investigations, they learn that changing only one variable at a time allows them to draw conclusions from data by revealing whether that variable made a difference. ● **Practice 6: Constructing Explanations and Designing Solutions:** Students learn about the purpose that scientific explanations serve in the scientific community and have multiple opportunities to write increasingly complex explanations over the course of the unit. To write these explanations, students must answer scientific questions by using the evidence they have gathered and ensure that their explanations describe the role that both light and animals' internal structures play in vision—processes that are either difficult or impossible to see. ● **Practice 8: Obtaining, Evaluating, and Communicating Information:** Just as students ask questions as they investigate, they receive explicit instruction and have multiple opportunities to use the sense-making strategy of asking questions as they engage with the five		

informational texts in the unit. Students gather evidence through firsthand and secondhand sources, as well as participate in various discourse routines that help them communicate about and make sense of science ideas, using key vocabulary.		

New Jersey Social and Emotional Competencies and Sub-Competencies	
Self-Awareness	● Recognize one's feelings and thoughts. ● Recognize the impact of one's feelings and thoughts on one's own behavior. ● Recognize one's personal traits, strengths, and limitations. ● Recognize the importance of self-confidence in handling daily tasks and challenges.
Self-Management	● Understand and practice strategies for managing one's own emotions, thoughts, and behaviors. ● Recognize the skills needed to establish and achieve personal and educational goals. ● Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals.
Social Awareness	● Recognize and identify the thoughts, feelings, and perspectives of others. ● Demonstrate an awareness of the differences among individuals, groups, and others' cultural backgrounds. ● Demonstrate an understanding of the need for mutual respect when viewpoints differ. ● Demonstrate an awareness of the expectations for social interactions in a variety of settings.
Responsible Decision Making	● Develop, implement, and model effective problem-solving and critical thinking skills. ● Identify the consequences associated with one's actions in order to make constructive choices. ● Evaluate personal, ethical, safety, and civic impact of decisions.
Relationship Skills	● Establish and maintain healthy relationships. ● Utilize positive communication and social skills to interact effectively with others. ● Identify ways to resist inappropriate social pressure. ● Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. ● Identify who, when, where, or how to seek help for oneself or others when needed.

Grade: 4	Content Area: Science

Interdisciplinary Connections	
ELA Standards	
RI.CR.4.1	Refer to details and examples as textual evidence when explaining what an informational text says explicitly and make relevant connections when drawing inferences from the text.
RI.IT.4.3	Describe the impact of individuals and events throughout the course of a text, explaining events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on evidence in the text.
RI.MF.4.6	Use evidence to show how graphics and visuals (e.g., illustrations, charts, graphs, diagrams, timelines, animations) support central ideas.
W.IW.4.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly. **B.** Develop the topic with facts, definitions, concrete details, text evidence, or other information and examples related to the topic. **D.** Use precise language and domain-specific vocabulary to inform about or explain the topic.
W.WR.4.5	Conduct short research projects that use multiple reference sources (print and non-print) and build knowledge through investigation of different aspects of a topic.
W.SE.4.6	Gather relevant information from multiple print and digital sources; take notes, prioritize and categorize information; provide a list of sources.
W.RW.4.7	Write routinely over extended time frames (with time for research and revision) and shorter time frames (a single sitting) for a range of tasks, purposes, and audiences.
SL.PE.4.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly. **B.** Follow agreed-upon rules for discussions and carry out assigned roles. **C.** Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others. **D.** Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.
SL.II.4.2	Paraphrase portions of a text read aloud or information presented in diverse media and formats (e.g., visually, quantitatively, and orally).
SL.PI.4.4	Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace

L.RF.4.3	Know and apply grade-level phonics and word analysis skills in decoding and encoding words; use combined knowledge of all letter-sound correspondences, syllabication patterns, and morphology (e.g., roots and affixes) to read accurately unfamiliar multisyllabic words in context and out of context.
L.RF.4.4	Read with sufficient accuracy and fluency to support comprehension. **A.** Read grade-level text with purpose and understanding. **B.** Read grade-level text orally with accuracy, appropriate rate, and expression. **C.** Use context to confirm or self-correct word recognition and understanding, rereading as necessary.
L.KL.4.1	Use knowledge of language and its conventions when writing, speaking, reading, or listening. **A.** Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases.
L.VL.4.2	Determine or clarify the meaning of unknown and multiple-meaning academic and domain-specific words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies. **A.** Use context (e.g., definitions, examples, or restatements in text) as a clue to the meaning of a word or phrase. **B.** Use common, grade-appropriate Greek and Latin affixes and roots as clues to the meaning of a word (e.g., telegraph, photograph, autograph). **C.** Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation and determine or clarify the precise meaning of key words and phrases.
Mathematics Standards	
MP1	Make sense of problems and persevere in solving them.
MP2	Reason abstractly and quantitatively.
MP5	Use appropriate tools strategically.
4.M.4	Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement.
4.M.5	Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.
4.G.1	Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

Computer Science & Design Thinking	
8.2.5.ED.1	Explain the functions of a system and its subsystems.

8.2.5.ED.2	Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3	Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4	Explain factors that influence the development and function of products and systems
8.2.5.ED.5	Describe how specifications and limitations impact the engineering design process.
8.2.5.ED.6	Evaluate and test alternative solutions to a problem using the constraints and tradeoffs identified in the design process.
8.2.5.ITH.2	Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
8.2.5.ITH.4	Describe a technology/tool that has made the way people live easier or has led to a new business or career.
8.2.5.NT.1	Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.ETW.1	Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.

Career Readiness, Life Literacies & Key Skills	
9.2.5.CAP.3	Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.
9.4.5.CI.31	Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity
9.4.5.CT.1	Identify and gather relevant data that will aid in the problem-solving process
9.4.5.CT.3	Describe how digital tools and technology may be used to solve problems.
9.4.5.CT.4	Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global
9.4.5.IML.2	Create a visual representation to organize information about a problem or issue
9.4.5.IML.6	Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions

Grade: 4	**Content Area: Science**

9.4.5.IML.7	Evaluate the degree to which information meets a need including social emotional learning, academic, and social
9.4.5.TL.4	Compare and contrast artifacts produced individually to those developed collaboratively

Career Readiness, Life Literacies, and Key Skills Practices	
CLKS.1	Act as a responsible and contributing community member and employee.
CLKS.2	Attend to financial well-being.
CLKS.3	Consider the environmental, social and economic impacts of decisions.
CLKS.4	Demonstrate creativity and innovation.
CLKS.5	Utilize critical thinking to make sense of problems and persevere in solving them.
CLKS.6	Model integrity, ethical leadership and effective management.
CLKS.7	Plan education and career paths aligned to personal goals.
CLKS.8	Use technology to enhance productivity, increase collaboration and communicate effectively.
CLKS.9	Work productively in teams while using cultural/global competence.

Evidence of Student Learning	
Formative Tasks: ● Teacher observations ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker	**Alternative Assessments:** ● Oral assessments ● Student Self-Assessments ● Pre-Unit Assessments ● 3-D Assessments
Summative Assessments: ● End of Unit Assessment	**Benchmark Assessments:** ● Benchmark 4B

Knowledge & Skills	
Enduring Understandings:	**Essential Questions:**

Grade: 4	**Content Area: Science**

● Animals have different structures that allow them to get information from their environment. ● Sound and scent can carry information about the environment to an animal. ● Animals have different structures that allow them to get information from their environment, which helps them survive. ● Light, sound, and scent can carry information about the environment to an animal. ● Light needs to get to an object for an animal to see the object. ● Light needs to reflect off an object and get to the eye for an animal to see the object. ● When scientists change only one variable in an investigation, they can figure out if it makes a difference. ● Light receptors in the eye respond to light and send information to the brain. The brain processes this information to form an image. ● After forming an image, the brain compares the image to memories. Then an animal can make a decision that could help it survive. ● Different animals can have light receptors with different sensitivities. The brain cannot form a clear image if there is too much or too little light for the type of receptors an animal has.	● How do animals use their senses to get information about their environment? ● How does light allow an animal to see something? ● How do an animal's structures allow it to see its prey? ● How do animals know how to react when they get information about their environment? ● Why do different animals need different amounts of light to see well?
Content *Students will know…* ● Animals use their senses to get information from their environment. ● Conservation biologists study plants and animals in an environment in order to make sure they are surviving. ● People and other animals use their senses to get information about what is in their environment. ● People and other animals have body structures that function to get information from their environment.	**Skills** *Students will be able to …* ● Ask questions as they read to better understand the text. ● Observe videos of animals and plants using certain structures to get information about their environment, which helps them survive; use observations to discuss plant and animal reproduction. ● Make observations about the role that light plays in allowing an animal to get information from its environment. ● Use a model to show ideas. ● Identify science practices used during the investigation.

● Sound and scent can carry information about the environment to an animal. ● Animals have different structures that allow them to get information from their environment. ● In an investigation, you should only change one thing in order to tell what makes a difference. ● The methods scientists use are determined by the questions they are investigating. ● Science theories are based on a body of evidence and many tests. ● Science findings are limited to what can be answered with evidence. ● Science is a way of knowing that is used by many people. ● Animals and plants have different structures that allow them to get information from their environment, which helps them survive. ● Plants have different structures that allow them to grow and reproduce. ● Light can carry information about the environment to an animal. ● Light allows an animal to get information from its environment using its eyes. ● Scientists change one thing at a time during their investigations so they can tell what change makes a difference. ● Cross-section diagrams allow us to see what is happening inside a structure, such as the eye. ● Scientists use models to help them to understand things that are difficult to see and to communicate their ideas to others. ● Light needs to get to an object for an animal to see the object. ● Light needs to reflect off an object and get to the eye for an animal to see the object. ● Changing more than one variable at a time can make it hard to figure out what made a difference in an investigation. ● Just seeing or hearing something may not be enough to identify what it is.	● Ask questions and then read information to to help answer them in order to understand the science text. ● Refute inaccurate ideas in order to demonstrate their understanding of how light actually allows animals to see something. ● Write a scientific explanation to answer a question about how or why something happens, describe things that are not easy to observe, and are based on ideas from investigations and text. ● Use evidence to support an answer. ● Identify the structures that are involved in vision. ● Use the *Vision and Light* Sorting Tool to show ideas about how animals see and react to something in their environment. ● Critique sample scientific explanations to see how well they meet specified guidelines, as well as how they could be improved. ● Write a scientific explanation using scientific language, with the audience in mind. ● Use the Modeling Tool to show that some animals see differently in bright light. ● Participate in a jigsaw activity to share information read in a text with peers. ● For an animal to see well, its receptors need to respond and send the right amount of information to the brain. ● An animal doesn't see well when its receptors don't respond enough or respond too much for the brain to process information and form an image. ● Design a model that demonstrates their understanding of the structure of an eye and the function of its parts. ● Engage in a student-driven learning sequence in which they explore one of their own senses in order to understand how humans use their sensory structures to help gather information about their environment. ● Use provided materials to design an investigation about their structures and receptors that are involved in one sense. ● Complete designed investigations and record their results before summarizing their methods and findings to share with the class.

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● Different structures have particular functions that together allow an animal to know what it is looking at. ● When scientists change only one variable in an investigation, they can figure out if it makes a difference. ● Thinking about other ways to investigate questions you have from reading can help you better understand science texts. ● Thinking about and discussing questions about science texts often leads to new questions. ● Science findings are based on recognizing patterns. ● Science assumes consistent patterns in natural systems. ● Scientists use a variety of methods, tools, and techniques when they conduct investigations. ● Light receptors in the eye respond to light and send information to the brain. The brain processes this information to form an image. ● Animals use information from the environment and memories from the brain in order to determine what they are looking at. ● After learning something new, scientists often have more questions and new ideas for what they want to investigate. ● After forming an image, the brain compares the image to memories. Then an animal can make a decision that could help it survive. ● Animals can react in different ways to the same amount of information from the environment. ● Some animals have a more sensitive sense of hearing, touch, smell, taste, or vision, than other animals. ● Different animals have different kinds of receptors. ● Some animals see well in bright light while others see well in low light.	

● An animal's light receptor sensitivity corresponds to whether it needs to be able to see in conditions with high or low light. ● Animals that look for food at night need to be able to see well in low light; animals that look for food during the day need to be able to see well in high light. ● People use their senses of smell, hearing, and touch to gather information about their environment. ● Scientists consider carefully which variable will be the one they will change in an investigation. ● Humans get information from their environment when their sense receptors get the right amount of information. ● Repeating an investigation makes scientists more sure of the evidence they observe.	

Core Instructional & Supplemental Materials	
Suggested Activities/Resources: ● Books in This Unit ○ *Investigating Animal Senses* ○ *I See What You Mean* ○ *Crow Scientist* ○ *Seeing Like a Shrimp and Smelling Like a Snake* ○ *Handbook of Animal Eyes* ● *Vision and Light* Kit	**Supplemental Materials** ● *Eliciting and Leveraging Students' Prior Knowledge, Personal Experiences, and Cultural Backgrounds* PDF ● Digital Resources included in each unit ○ *Vision and Light* Simulation ○ *Vision and Light* Modeling Tool ● Flextensions: ○ Designing Ear Structures ● Multi-language glossary ● *My Three Best Friends and Me, Zuley* by Cari Best ● *Homeland* by Hannah Moushabeck ● *My Five Senses* by Aliki

Suggested Accommodations
English Language Learners: ● Multi-sensory instruction ● Flexible grouping ● Small group instruction ● Provide peer tutoring ● Use a strong student as a "buddy" (does not necessarily have to speak the primary language)

- Chunking information
- Scaffolded questioning
- Academic language support
- Vocabulary support
- Co-Constructed Word Banks
- Anchor charts
- Gradual release model
- Visual models
- Native language support when possible (Multi-language glossary)
- Sheltered English Instruction Strategies
- Sentence starters

Special Education/Students with Disabilities:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Follow all IEP modifications
- Calculators
- Manipulatives/concrete models
- Directions repeated, clarified, and reworded
- Breakdown task into manageable parts

504 Plans:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Calculators
- Manipulatives/concrete models
- Follow all 504 modifications

Gifted and Talented:

- Higher level questioning
- Enriched assignments
- Tiered assignments
- Choice board to extend learning

Students at Risk of Failure:

- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment
- Provide visuals
- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning

Grade: 4	Content Area: Science

- Tiered activities
- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

Unit 3: Earth's Features	Duration: 45 days

New Jersey Student Learning Standards	
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.
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.
4-ESS3-2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Science and Engineering Practices	Discipline Core Ideas/Unit Enduring Understandings	Crosscutting Concepts
• **Practice 7: Engaging in Argument from Evidence:** At the end of each chapter, students engage in an Evidence Circle to weigh	**ESS1.C: The History of Planet Earth** • Local, regional, and global patterns of rock formations reveal changes over time	**Patterns** • Patterns can be used as evidence to support an explanation. (4-ESS1-1), (4-ESS2-2)

Grade: 4	Content Area: Science

evidence in support of claims. They then write scientific arguments, using evidence about the fossils and kinds of rock present at Desert Rocks National Park. Students also read the book Arguing to Solve a Mystery, which provides profiles of real scientists engaging in the practice of arguing from evidence.

- **Practice 2: Developing and Using Models:** Students receive explicit instruction and opportunities to practice using models, developing models, and revising models by creating digital models of the process of rock formation. They also use a physical model to show how lower rock layers form first and are, therefore, older than upper layers in a rocky outcrop.
- **Practice 8: Obtaining, Evaluating, and Communicating Information:** Students receive explicit instruction and have multiple opportunities to use the sense-making strategy of making inferences as they engage with the texts and investigations in the unit. Students gather evidence through firsthand and secondhand sources, as well as participate in various discourse routines that help them communicate about and make sense of science ideas, using key vocabulary.
- **Practice 4: Analyzing and Interpreting Data:** While students are investigating fossils, rock formation, and erosion, they are making and recording observations to help draw conclusions

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)

ESS2.A: Earth Materials and Systems:

- 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)

ESS2.B: Plate Tectonics and Large-Scale System Interactions

- 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)

ESS2.E: Biogeology:

- Living things affect the physical characteristics of their regions. (4-ESS2-1)

ESS3.B: Natural Hazards:

- 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)

Cause and Effect

- Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS2-1)
- Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS32)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering and Technology on Society and the Natural World

- Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2)

Connection to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes consistent patterns in natural systems. (4ESS1-1)

about these processes. ● **Practice 6: Constructing Explanations and Designing Solutions:** Students have multiple opportunities to construct increasingly complex explanations over the course of the unit. They learn that they must use observations about the present to make inferences about phenomena that occurred over a very long timescale in the past. ● **Practice 3: Planning and Carrying Out Investigations:** Students conduct various firsthand investigations to demonstrate how rock forms. Students also carry out investigations about rock formation and erosion over time, using the Earth's Features Simulation and the Earth's Features Modeling Tool. ● **Practice 1: Asking Questions:** Students ask questions when reading informational text, analyzing data, conducting firsthand investigations, and participating in group discussions.		

New Jersey Social and Emotional Competencies and Sub-Competencies	
Self-Awareness	● Recognize one's feelings and thoughts. ● Recognize the impact of one's feelings and thoughts on one's own behavior. ● Recognize one's personal traits, strengths, and limitations. ● Recognize the importance of self-confidence in handling daily tasks and challenges.
Self-Management	● Understand and practice strategies for managing one's own emotions, thoughts, and behaviors. ● Recognize the skills needed to establish and achieve personal and educational goals.

	• Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals.
Social Awareness	• Recognize and identify the thoughts, feelings, and perspectives of others. • Demonstrate an awareness of the differences among individuals, groups, and others' cultural backgrounds. • Demonstrate an understanding of the need for mutual respect when viewpoints differ. • Demonstrate an awareness of the expectations for social interactions in a variety of settings.
Responsible Decision Making	• Develop, implement, and model effective problem-solving and critical thinking skills. • Identify the consequences associated with one's actions in order to make constructive choices. • Evaluate personal, ethical, safety, and civic impact of decisions.
Relationship Skills	• Establish and maintain healthy relationships. • Utilize positive communication and social skills to interact effectively with others. • Identify ways to resist inappropriate social pressure. • Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. • Identify who, when, where, or how to seek help for oneself or others when needed.

Interdisciplinary Connections	
ELA Standards	
RI.CR.4.1	Refer to details and examples as textual evidence when explaining what an informational text says explicitly and make relevant connections when drawing inferences from the text.
RI.IT.4.3	Describe the impact of individuals and events throughout the course of a text, explaining events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on evidence in the text.
RI.MF.4.6	Use evidence to show how graphics and visuals (e.g., illustrations, charts, graphs, diagrams, timelines, animations) support central ideas.
RI.CT.4.8	Compare and contrast the treatment of similar themes, topics and patterns of events in informational texts from authors of different cultures.
W.AW.4.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information. **B.** Provide reasons that are supported by facts from texts and/or other sources.

Grade: 4	**Content Area: Science**

W.IW.4.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly. **A.** Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), text features (e.g., illustrations, diagrams, captions) and multimedia when useful to aid in comprehension. **C.** Link ideas within paragraphs and sections of information using words and phrases (e.g., another, for example, also, because).
W.WR.4.5	Conduct short research projects that use multiple reference sources (print and non-print) and build knowledge through investigation of different aspects of a topic.
W.SE.4.6	Gather relevant information from multiple print and digital sources; take notes, prioritize and categorize information; provide a list of sources.
W.RW.4.7	Write routinely over extended time frames (with time for research and revision) and shorter time frames (a single sitting) for a range of tasks, purposes, and audiences.
SL.PE.4.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly. **A.** Explicitly draw on previously read text or material and other information known about the topic to explore ideas under discussion. **B.** Follow agreed-upon rules for discussions and carry out assigned roles. **C.** Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others. **D.** Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.
SL.II.4.2	Paraphrase portions of a text read aloud or information presented in diverse media and formats (e.g., visually, quantitatively, and orally).
L.RF.4.3	Know and apply grade-level phonics and word analysis skills in decoding and encoding words; use combined knowledge of all letter-sound correspondences, syllabication patterns, and morphology (e.g., roots and affixes) to read accurately unfamiliar multisyllabic words in context and out of context.
L.RF.4.4	Read with sufficient accuracy and fluency to support comprehension. A. Read grade-level text with purpose and understanding. B. Read grade-level text orally with accuracy, appropriate rate, and expression. C. Use context to confirm or self-correct word recognition and understanding, rereading as necessary.
L.KL.4.1	Use knowledge of language and its conventions when writing, speaking, reading, or listening. **A.** Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases.

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L.VL.4.2	Determine or clarify the meaning of unknown and multiple-meaning academic and domain-specific words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies. **A.** Use context (e.g., definitions, examples, or restatements in text) as a clue to the meaning of a word or phrase. **B.** Use common, grade-appropriate Greek and Latin affixes and roots as clues to the meaning of a word (e.g., telegraph, photograph, autograph). **C.** Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation and determine or clarify the precise meaning of key words and phrases.
Mathematics Standards	
MP1	Make sense of problems and persevere in solving them.
MP2	Reason abstractly and quantitatively.
MP5	Use appropriate tools strategically.
4.OA.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.OA.5	Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself.
4.M.2	Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

Computer Science & Design Thinking	
8.2.5.ED.1	Explain the functions of a system and its subsystems.
8.2.5.ED.2	Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3	Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4	Explain factors that influence the development and function of products and systems
8.2.5.ED.5	Describe how specifications and limitations impact the engineering design process.

8.2.5.ED.6	Evaluate and test alternative solutions to a problem using the constraints and tradeoffs identified in the design process.
8.2.5.ITH.2	Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
8.2.5.ITH.4	Describe a technology/tool that has made the way people live easier or has led to a new business or career.
8.2.5.NT.1	Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.ETW.1	Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.

Career Readiness, Life Literacies & Key Skills	
9.2.5.CAP.3	Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.
9.4.5.CI.31	Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity
9.4.5.CT.1	Identify and gather relevant data that will aid in the problem-solving process
9.4.5.CT.3	Describe how digital tools and technology may be used to solve problems.
9.4.5.CT.4	Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global
9.4.5.IML.2	Create a visual representation to organize information about a problem or issue
9.4.5.IML.6	Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions
9.4.5.IML.7	Evaluate the degree to which information meets a need including social emotional learning, academic, and social
9.4.5.TL.4	Compare and contrast artifacts produced individually to those developed collaboratively

Career Readiness, Life Literacies, and Key Skills Practices	
CLKS.1	Act as a responsible and contributing community member and employee.

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CLKS.2	Attend to financial well-being.
CLKS.3	Consider the environmental, social and economic impacts of decisions.
CLKS.4	Demonstrate creativity and innovation.
CLKS.5	Utilize critical thinking to make sense of problems and persevere in solving them.
CLKS.6	Model integrity, ethical leadership and effective management.
CLKS.7	Plan education and career paths aligned to personal goals.
CLKS.8	Use technology to enhance productivity, increase collaboration and communicate effectively.
CLKS.9	Work productively in teams while using cultural/global competence.

Evidence of Student Learning	
Formative Tasks: ● Teacher observations ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker	**Alternative Assessments:** ● Oral assessments ● Student Self-Assessments ● Pre-Unit Assessments ● 3-D Assessments
Summative Assessments: ● End of Unit Assessment	**Benchmark Assessments:** ● Benchmark 4C

Knowledge & Skills	
Enduring Understandings: ● A fossil forms when an organism dies and is covered with sediment that turns into rock. ● A sedimentary rock layer forms when sediment sinks and builds up in water, compacts under more sediment, and cements over time. ● Over time, a rock layer becomes thicker as sediment continues to build up.	**Essential Questions:** ● How do fossils form? ● How does sedimentary rock form? ● How do geologists learn what a place was like in the past? ● How do rocks provide information about what an environment was like in the past? ● How can there be different sedimentary rock layers in the same place? ● How can geologists tell what order rock layers formed in?

● Geologists use observations of and ideas about rocks and fossils to make inferences about past environments. ● Different sediments build up in different environments. Therefore, different kinds of sedimentary rock form in different environments. ● Different sedimentary rock layers in a place mean that the environment in that place has changed. ● New rock layers form on top of existing rock layers. Therefore, lower rock layers are older than the layers above them. ● New rock layers form on top of existing rock layers. Therefore, the environments that lower rock layers formed in came earlier. ● Geologists observe the order of rock layers to infer the order of past environments. ● Rock can be broken down and eroded by things in the environment, such as wind, water, plants, and ice. ● The speed of water and amount of time it flows affect how much rock it erodes.	● How can geologists figure out the order of past environments? ● How does rock get exposed? ● What affects the amount of rock that water can erode?
Content *Students will know…* ● A geologist is a scientist who studies the materials and processes that form the solid part of Earth. ● Rocks and fossils can provide clues about the way Earth changes over time. ● An observation is something you notice using any of the five senses. ● Geologists use observations of fossils to make inferences about organisms that lived long ago. ● Making inferences when reading can help you understand informational text. ● Scientists use a variety of methods, tools, and techniques when they conduct investigations. ● Science findings are limited to what can be answered with evidence.	**Skills** *Students will be able to …* ● Reflect on what they understand and don't understand, allowing them to prepare for learning new things. ● Make inferences based on observations and known information. ● Gather information from images of fossils, the Simulation, and a book to help them answer the investigation question. ● Draw on information they gathered throughout the lesson to complete a reflective writing activity about how an unfamiliar fossil may have formed. ● Record their observations by making a detailed drawing, as a geologist would. ● Analyze and interpret maps to describe patterns of Earth's features. ● Use their observations of rocks to make inferences about how they could have formed. ● Create models to show the process of sedimentary rock formation.

● A fossil forms when an organism dies and is covered with sediment that turns into rock. ● Sedimentary rock forms from sediment. ● Sedimentary rock forms when sediment builds up in water and is covered with more sediment. ● A sedimentary rock layer forms when sediment sinks and builds up in water, compacts under more sediment, and cements over time. ● Over time, a rock layer becomes thicker as sediment continues to build up. ● Models show some parts of the real world well, and others less well. ● As scientists learn more and investigate more, they answer some questions and generate even more questions. ● Both data and scientific ideas are kinds of evidence that can be used to support a claim. ● Science theories are based on a body of evidence and many tests. ● Geologists can use differences between rocks to figure out what environment they formed in. ● Different sediments build up in different environments. Therefore, different kinds of sedimentary rock form in different environments. ● Different sedimentary rock layers in a place mean that the environment in that place has changed. ● Any place may appear to be stable day by day, but over a long period of time it can change. ● In a scientific argument, data and ideas are connected as evidence to support a claim. ● Geologists make claims about what the environment of a place was like in the past. These claims are based on evidence. ● The environment of a place can change multiple times over millions of years.	● Identify the claim and the supporting evidence in a scientific argument. ● Discuss scientific arguments with peers in order to determine how evidence supports a claim. ● Use observations of and ideas about rocks and fossils to make inferences about past environments. ● Make inferences based on observations combined with scientific ideas. ● Collect data about rock samples, read about the rock types they've observed, and use the Simulation to respond to a scientific question. ● Use reference books for many purposes, including to help them identify types of rock. ● Gather scientific ideas about the rocks from two layers of the rocky outcrop to prepare to make inferences about the past environments of Desert Rocks National Park. ● Summarize what they know about the rocky outcrop by completing a diagram showing sedimentary rock type, fossils, and environments. ● Complete a diagram in order to consolidate information about the rocky outcrop. ● Engage in a student-driven learning sequence in which they analyze and discuss evidence about the rocky outcrop. ● Make inferences about what the environment was like when the upper layer of the rocky outcrop formed using data and ideas about sedimentary rock and fossils found in the rock layer. ● Use scientific language in scientific arguments. ● Write a scientific argument about the past environment using the claim and supporting evidence they discussed in Evidence Circles. ● New rock layers form on top of existing rock layers. Therefore, lower rock layers are older than the layers above them. ● Gather evidence from multiple sources in order to construct a convincing argument. ● Make arguments based on evidence and then revise those arguments as more evidence is gathered.

● Newer rock layers form on top of layers that have already formed. ● Geologists are still studying rock layers to get more evidence to support their claims about what happened to the dinosaurs. ● Science explanations describe the way natural events happen. ● Science is both a body of knowledge and processes that add new knowledge. ● Men and women from all cultures and backgrounds choose careers as scientists and engineers. ● New rock layers form on top of existing rock layers. Therefore, the environments that lower layers formed in came earlier. ● Geologists observe the order of rock layers to infer the order of past environments. ● Erosion is the process in which rock breaks down and wears away. ● Rock can be broken down and eroded by things in the environment such as wind, water, plants, and ice. ● A river that has flowed over rock for a longer period of time will erode more rock than a river that has flowed over rock for less time. ● A variety of hazards result from natural processes involving water, such as flash floods and large waves. ● Within a set amount of time, a faster river erodes more sediment than a slower river. ● The speed of water and amount of time it flows affect how much rock it erodes.	● Make inferences in order to comprehend an informational text. ● Write an environment description and create a diagram of rocky layers that corresponds to that description. ● Write for an audience about how Desert Rocks National Park has changed over time which includes a scientific argument using the claim and supporting evidence they discussed in the Evidence Circles as well as a description of the order of all three past environments students have been investigating. ● Use maps to understand what might have happened in a place in the past. ● Run the Erosion Model to test how the amount of time affects the amount of rock that water can erode; record observations. ● Make drawings of the model and reflect on the information they have gathered from it. ● Summarize their understanding by completing two activities in the Earth's Features Modeling Tool, one showing the effect of the speed of a river on erosion and one showing the effect of the amount of time a river has been flowing. ● Analyze and interpret a world map, which shows the locations of volcanoes and earthquakes, and shows the elevation of the land, in order to identify patterns in where earthquakes, volcanoes, mountain ranges, ocean ridges, and ocean trenches occur, and how these relate to the shape of Earth's surface ● Apply their understanding to answer questions about the natural world.

Core Instructional & Supplemental Materials	
Suggested Activities/Resources: ● Books in This Unit ○ *Clue from the Past* ○ *Through the Eyes of a Geologist* ○ *Arguing to Solve a Mystery* ○ *Rocky Wonders* ○ *Fossil Hunter's Handbook* ● *Earth's Features* Kit	**Supplemental Materials** ● *Eliciting and Leveraging Students' Prior Knowledge, Personal Experiences, and Cultural Backgrounds* PDF ● Digital Resources included in each unit ○ *Earth's Features* Simulation ○ *Earth's Features* Modeling Tool ● Flextensions: ○ Rock Layer Mysteries

	● Multi-language glossary

Suggested Accommodations

English Language Learners:
- Multi-sensory instruction
- Flexible grouping
- Small group instruction
- Provide peer tutoring
- Use a strong student as a “buddy” (does not necessarily have to speak the primary language)
- Chunking information
- Scaffolded questioning
- Academic language support
- Vocabulary support
- Co-Constructed Word Banks
- Anchor charts
- Gradual release model
- Visual models
- Native language support when possible (Multi-language glossary)
- Sheltered English Instruction Strategies
- Sentence starters

Special Education/Students with Disabilities:
- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Follow all IEP modifications
- Calculators
- Manipulatives/concrete models
- Directions repeated, clarified, and reworded
- Breakdown task into manageable parts

504 Plans:
- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Calculators
- Manipulatives/concrete models
- Follow all 504 modifications

Gifted and Talented:
- Higher level questioning
- Enriched assignments
- Tiered assignments
- Choice board to extend learning

Students at Risk of Failure:

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- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment
- Provide visuals
- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning
- Tiered activities
- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

Unit 4: Waves, Energy, and Information	Duration: 45 days

New Jersey Student Learning Standards	
4-PS3-2	Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electrical currents.
4-PS3-3	Ask questions and predict outcomes about the changes in energy that occur when objects collide.
4-PS4-1	Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

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4-PS4-3	Generate and compare multiple solutions that use patterns to transfer information.
4-ESS3-2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
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.
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.

Science and Engineering Practices	Discipline Core Ideas/Unit Enduring Understandings	Crosscutting Concepts
• **Practice 2: Developing and Using Models:** Students receive explicit instruction and opportunities to practice developing models a) with diagrams to represent the sound energy traveling from source to listener through materials at the particulate level, and b) with physical materials to show and provide a basis for comparison of how different types of waves move. Students also make extensive use of the Sound Waves Simulation, a computer model that enables students to describe and predict phenomena and to test cause-and-effect relationships. • **Practice 6: Constructing Explanations and Designing Solutions:** Students learn about scientific explanations and have multiple opportunities to write increasingly complex explanations over the course of the unit as they explain how a mother dolphin communicates with	**PS3.A: Definitions of Energy** • Energy can be moved from place to place by moving objects or through sound, light, or electrical currents. (4-PS3-2) (4-PS3-3) **PS3.B: Conservation of Energy and Energy Transfer** • 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 transferred to surrounding air; as a result, the air gets heated and sound is produced. (4-PS3-2) (4-PS3-3) **PS3.C: Relationship Between Energy and Force** • When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3) **PS4.A: Wave Properties:** • Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves	**Energy and Matter** • Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2), (4-PS3-3), (4-PS3-4) **Patterns** • Similarities and differences in patterns can be used to sort and classify natural phenomena. (4PS4-1) • Similarities and differences in patterns can be used to sort and classify designed products. (4PS4-3) **Cause and Effect** • Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS32) **Systems and System Models** • A system can be described in terms of its components and their interactions. (4-LS1-1), (4-LS1-2) ***Connections to Engineering, Technology, and Applications of Science***

her calf when they are separated in the fictional Blue Bay. ● **Practice 8: Obtaining, Evaluating, and Communicating Information:** ● **Practice 7: Engaging in Argument from Evidence:** Throughout the unit, students refer to the reference book and read other informational texts to collect evidence to help them plan and construct their explanations. Each reading activity offers students the opportunity to practice the reading comprehension strategy of visualizing. ● **Practice 4: Analyzing and Interpreting Data:** Students have multiple opportunities to analyze the data they have collected from firsthand investigations with sound waves, including analyses of waveforms. ● **Practice 3: Planning and Carrying Out Investigations:** Students have multiple opportunities to engage in investigations that help them construct the key ideas of the unit, including hands-on investigations of waves, collisions and energy transfer, and communication by using digitized information. ● **Practice 5: Using Mathematics and Computational Thinking:** Throughout the unit, students use digital apps to develop an understanding of the relationship between amplitude and volume and between wavelength and pitch as they analyze	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. (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) **PS4.C: Information Technologies and Instrumentation:** ● 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) **ESS3.B: Natural Hazards** ● 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) **LS1.D: Information Processing:** ● 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) **ETS1.B: Developing Possible Solutions:** ● Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how	**Interdependence of Science, Engineering, and Technology** ● Knowledge of relevant scientific concepts and research findings is important in engineering. (4-PS4-3) **Influence of Science, Engineering and Technology on Society and the Natural World** ● Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2) ***Connection to Nature of Science*** **Scientific Knowledge is Based on Empirical Evidence** ● Science findings are based on recognizing patterns. (4-PS4-1), (3-5-ETS1-2)

various waveforms. In the final chapter of the unit, students also create and decode binary codes generated from simple algorithms. ● **Practice 1: Asking Questions:** Students engage with ideas that help the frame, design, and solve the problem. ● **Practice 7: Engaging in Argumentation:** Students bring evidence to bear in discussions with their peers, that involve sharing and supporting their claims about how dolphins communicate.	well it performs under a range of likely conditions. (3-5-ETS1-2) ● 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. (3-5-ETS1-2) ● Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3) **ETS1.C: Optimizing the Design Solution:** ● 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)	

New Jersey Social and Emotional Competencies and Sub-Competencies	
Self-Awareness	● Recognize one's feelings and thoughts. ● Recognize the impact of one's feelings and thoughts on one's own behavior. ● Recognize one's personal traits, strengths, and limitations. ● Recognize the importance of self-confidence in handling daily tasks and challenges.
Self-Management	● Understand and practice strategies for managing one's own emotions, thoughts, and behaviors. ● Recognize the skills needed to establish and achieve personal and educational goals. ● Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals.
Social Awareness	● Recognize and identify the thoughts, feelings, and perspectives of others. ● Demonstrate an awareness of the differences among individuals, groups, and others' cultural backgrounds. ● Demonstrate an understanding of the need for mutual respect when viewpoints differ. ● Demonstrate an awareness of the expectations for social interactions in a variety of settings.

Responsible Decision Making	• Develop, implement, and model effective problem-solving and critical thinking skills. • Identify the consequences associated with one's actions in order to make constructive choices. • Evaluate personal, ethical, safety, and civic impact of decisions.
Relationship Skills	• Establish and maintain healthy relationships. • Utilize positive communication and social skills to interact effectively with others. • Identify ways to resist inappropriate social pressure. • Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways. • Identify who, when, where, or how to seek help for oneself or others when needed.

Interdisciplinary Connections	
ELA Standards	
RI.CR.4.1	Refer to details and examples as textual evidence when explaining what an informational text says explicitly and make relevant connections when drawing inferences from the text.
RI.IT.4.3	Describe the impact of individuals and events throughout the course of a text, explaining events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on evidence in the text.
RI.PP.4.5	Compare and contrast multiple accounts of the same event or topic; noting important similarities and differences in in the point of view they represent.
RI.MF.4.6	Use evidence to show how graphics and visuals (e.g., illustrations, charts, graphs, diagrams, timelines, animations) support central ideas.
W.IW.4.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly. **A.** Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), text features (e.g., illustrations, diagrams, captions) and multimedia when useful to aid in comprehension. **B.** Develop the topic with facts, definitions, concrete details, text evidence, or other information and examples related to the topic. **C.** Link ideas within paragraphs and sections of information using words and phrases (e.g., another, for example, also, because).
W.WR.4.5	Conduct short research projects that use multiple reference sources (print and non-print) and build knowledge through investigation of different aspects of a topic.
W.SE.4.6	Gather relevant information from multiple print and digital sources; take notes, prioritize and categorize information; provide a list of sources.

W.RW.4.7	Write routinely over extended time frames (with time for research and revision) and shorter time frames (a single sitting) for a range of tasks, purposes, and audiences.
SL.PE.4.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly. **A.** Explicitly draw on previously read text or material and other information known about the topic to explore ideas under discussion. **B.** Follow agreed-upon rules for discussions and carry out assigned roles. **C.** Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others. **D.** Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.
SL.II.4.2	Paraphrase portions of a text read aloud or information presented in diverse media and formats (e.g., visually, quantitatively, and orally).
SL.PI.4.4	Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
SL.AS.4.6	Differentiate between contexts that call for formal English (e.g., presenting ideas) and situations where informal discourse is appropriate (e.g., small-group discussion); use formal English when appropriate to task and situation.
L.RF.4.3	Know and apply grade-level phonics and word analysis skills in decoding and encoding words; use combined knowledge of all letter-sound correspondences, syllabication patterns, and morphology (e.g., roots and affixes) to read accurately unfamiliar multisyllabic words in context and out of context.
L.RF.4.4	Read with sufficient accuracy and fluency to support comprehension. **A.** Read grade-level text with purpose and understanding. **B.** Read grade-level text orally with accuracy, appropriate rate, and expression. **C.** Use context to confirm or self-correct word recognition and understanding, rereading as necessary.
L.KL.4.1	Use knowledge of language and its conventions when writing, speaking, reading, or listening. **A.** Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases.
L.VL.4.2	Determine or clarify the meaning of unknown and multiple-meaning academic and domain-specific words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies. **A.** Use context (e.g., definitions, examples, or restatements in text) as a clue to the meaning of a word or phrase. **B.** Use common, grade-appropriate Greek and Latin affixes and roots as clues to the meaning of a word (e.g., telegraph, photograph, autograph).

	C. Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation and determine or clarify the precise meaning of key words and phrases.
Mathematics Standards	
MP1	Make sense of problems and persevere in solving them.
MP2	Reason abstractly and quantitatively.
MP4	Model with mathematics.
MP5	Use appropriate tools strategically.
MP6	Attend to precision.
MP7	Look for and make use of structure.
4.OA.5	Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself.
4.M.2	Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

Computer Science & Design Thinking	
8.2.5.ED.1	Explain the functions of a system and its subsystems.
8.2.5.ED.2	Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3	Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4	Explain factors that influence the development and function of products and systems
8.2.5.ED.5	Describe how specifications and limitations impact the engineering design process.
8.2.5.ED.6	Evaluate and test alternative solutions to a problem using the constraints and tradeoffs identified in the design process.
8.2.5.ITH.2	Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.

8.2.5.ITH.4	Describe a technology/tool that has made the way people live easier or has led to a new business or career.
8.2.5.NT.1	Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.ETW.1	Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.

Career Readiness, Life Literacies & Key Skills	
9.2.5.CAP.3	Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.
9.4.5.CI.31	Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity
9.4.5.CT.1	Identify and gather relevant data that will aid in the problem-solving process
9.4.5.CT.3	Describe how digital tools and technology may be used to solve problems.
9.4.5.CT.4	Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global
9.4.5.IML.2	Create a visual representation to organize information about a problem or issue
9.4.5.IML.6	Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions
9.4.5.IML.7	Evaluate the degree to which information meets a need including social emotional learning, academic, and social
9.4.5.TL.4	Compare and contrast artifacts produced individually to those developed collaboratively

Career Readiness, Life Literacies, and Key Skills Practices	
CLKS.1	Act as a responsible and contributing community member and employee.
CLKS.2	Attend to financial well-being.
CLKS.3	Consider the environmental, social and economic impacts of decisions.
CLKS.4	Demonstrate creativity and innovation.
CLKS.5	Utilize critical thinking to make sense of problems and persevere in solving them.

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CLKS.6	Model integrity, ethical leadership and effective management.
CLKS.7	Plan education and career paths aligned to personal goals.
CLKS.8	Use technology to enhance productivity, increase collaboration and communicate effectively.
CLKS.9	Work productively in teams while using cultural/global competence.

Evidence of Student Learning	
Formative Tasks: ● Teacher observations ● Class discussions ● Whiteboard/Communicators ● On-the-Fly Assessments ● Daily classwork ● Checks for understanding ● Clipboard Assessment Tool ● Critical Juncture Assessment ● Crosscutting Concept Tracker	**Alternative Assessments:** ● Oral assessments ● Student Self-Assessments ● Pre-Unit Assessments ● 3-D Assessments
Summative Assessments: ● End of Unit Assessment	**Benchmark Assessments:** ● Benchmark 4D

Knowledge & Skills	
Enduring Understandings: ● A wave is a pattern of motion that travels away from a source. ● Sound energy travels as a wave. The thing it travels through moves only a little. ● Materials are made of particles that are too small to see. ● Sounds can travel through different kinds of materials. ● Scientists make models to help them answer questions and visualize things that are difficult to see. ● Sound energy travels as a wave. The particles of the material it travels through move only a little. ● Sound travels as a series of collisions between particles. ● When particles collide they transfer energy, and that changes how they move.	**Essential Questions:** ● How does sound get from one place to another? ● What can sound travel through? ● How does sound energy travel through a material? ● Why are some sounds different from other sounds? ● How can dolphins use different sounds to communicate with one another? ● How can humans use patterns to communicate?

● When sound waves have different amplitudes, we hear sounds with different volumes. ● When sound waves have different wavelengths, we hear sounds with different pitches. ● Humans use patterns to communicate information and use technology to communicate those patterns across long distances.	
Content *Students will know…* ● Dolphins communicate through sound. ● Something we observe to be similar over and over again is called a pattern. ● Sound travels as a wave. ● A pattern of motion that travels away from a source is called a wave. ● Tsunami waves have a pattern of up-and-down motion. ● A wave is a pattern of motion that travels away from a source. ● Science affects everyday life. ● The energy that travels in a sound wave is sound energy. ● Sound energy travels as a wave. The thing it travels through moves only a little. ● Everything is made of materials. ● It is possible to hear sounds underwater. ● Animals use sound to communicate in different ways. ● Materials are made of particles that are too small to see. ● Sounds can travel through different kinds of materials. ● Sound waves are patterns of motion that occur when particles collide and spread apart. ● Sound energy travels as a wave. The particles of the material it travels through move only a little. ● Sound travels as a series of collisions between particles. ● When particles collide, they transfer energy.	**Skills** *Students will be able to …* ● Reflect on what they understand and don't understand in order to prepare to learn new things. ● Gather information by making observations. ● Make and record observations to identify patterns. ● Use scientific language to talk about scientific work. ● Visualize before and during reading to better understand the ideas in a text. ● Use a variety of methods, tools, and techniques when they conduct investigations. ● Use tools and technologies to make accurate measurements and observations. ● Using the reference book, gather information about how mother dolphins communicate across a distance with their calves. ● Complete a diagramming and writing activity to show their ideas about how sound travels from a mother dolphin to her calf. ● Create and revise sound diagrams to convey important information. ● Make models to answer questions and visualize things that are difficult to see. ● Analyze visual representations of sound waves to determine the properties of sound. ● Analyze graphs for patterns that help people better understand sound. ● Use visual representations to support research and investigations. ● Write a scientific explanation to describe ideas clearly and completely for the

● Different models can be used to represent the same phenomenon. ● When particles collide they transfer energy, and that changes how they move. ● Amplitude refers to the height of a wave. ● When sound waves have different amplitudes, we hear sounds with different volumes. ● A curved line that shows the pattern of a wave is called a waveform. Scientists use waveforms to represent sound properties. ● One way in which sounds can be different from one another is they can have different pitches. ● Wavelength refers to the distance from one peak of a wave to the next. ● Sounds that are high-pitched have short wavelengths. Sounds that are low-pitched have longer wavelengths. ● When sound waves have different wavelengths, we hear sounds with different pitches. ● Sounds can differ in volume and in pitch. ● When a sound changes, the shape of its waveform changes, too. ● Many animals communicate using sounds that can differ in pitch and/or in amplitude. ● Dolphins can recognize one another by the changes in pitch in their whistles. ● The methods scientists use are determined by the questions they are investigating. ● Science findings are based on recognizing patterns. ● Science assumes consistent patterns in natural systems. ● Science theories are based on a body of evidence and many tests. ● Science findings are limited to what can be answered with evidence. ● Dolphin signature whistles have patterns of pitch changes, and the waveforms that represent those whistles have patterns of wavelength changes.	audience; revise and update explanations as new evidence is gathered. ● Make and encode an image in the Code Communicator Tool. They then record the binary code for that image in their notebooks. ● Engage in a student-driven learning sequence in which they send and receive messages for the purpose of learning about how digital devices use binary code to transmit information.

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• Dolphins can use signature whistles to find one another when they are separated. • Humans have used many different methods to communicate across short and long distances. • All communication methods rely on patterns. • A code is a pattern of symbols. • Binary code can be used to transmit information easily because it only has two symbols. • Digital devices use binary code. • Binary code is a quick and efficient way to transmit information across a distance. • Humans use patterns to communicate information and use technology to communicate those patterns across long distances.	

Core Instructional & Supplemental Materials

Suggested Activities/Resources:

- Books in This Unit
  - *Warning: Tsunami!*
  - *Sound on the Move*
  - *Seeing Sound*
  - *The Scientist Who Cracked the Dolphin Code*
  - *Patterns in Communication*
- *Earth's Features* Kit

Supplemental Materials

- *Eliciting and Leveraging Students' Prior Knowledge, Personal Experiences, and Cultural Backgrounds* PDF
- Digital Resources included in each unit
  - Sound Waves Simulation
  - Code Communicator Tool
  - Sound Waves Diagramming Tool Activity
  - Sound Waves Sorting Tool Activities
- Flextensions:
  - Designing Musical Instruments
- Multi-language glossary
- *Tsunami!* by Kimiko Kajikawa
- *All the Ways I Hear You* by Stephanie Marrufo
- *Sasha Tech Savvy Loves to Code* by Sasha Ariel Alston

Suggested Accommodations

English Language Learners:

- Multi-sensory instruction
- Flexible grouping

- Small group instruction
- Provide peer tutoring
- Use a strong student as a “buddy” (does not necessarily have to speak the primary language)
- Chunking information
- Scaffolded questioning
- Academic language support
- Vocabulary support
- Co-Constructed Word Banks
- Anchor charts
- Gradual release model
- Visual models
- Native language support when possible (Multi-language glossary)
- Sheltered English Instruction Strategies
- Sentence starters

Special Education/Students with Disabilities:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Follow all IEP modifications
- Calculators
- Manipulatives/concrete models
- Directions repeated, clarified, and reworded
- Breakdown task into manageable parts

504 Plans:

- Allow extra time to complete assignments or tests
- Work in a small group
- Allow answers to be given orally or dictated
- Calculators
- Manipulatives/concrete models
- Follow all 504 modifications

Gifted and Talented:

- Higher level questioning
- Enriched assignments
- Tiered assignments
- Choice board to extend learning

Students at Risk of Failure:

- Provide peer tutoring
- Use a strong student as a “buddy”
- Allow extra time to complete assignments or tests
- Work in a small group
- One on one instruction
- Provide immediate praise and feedback
- Create a nurturing environment
- Provide visuals

- Be flexible with assignments and time frames
- Provide needed academic resources
- Chunking information
- Scaffolded questioning
- Tiered activities
- Manipulatives/concrete models
- Modified assignments
- Brain breaks

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create an emotionally positive classroom climate.
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background