Moonachie School District
Science Curriculum:
Grade 4

New Jersey Student Learning Standards for Science

Born On: August 23, 2022
Re-Adopted: August 26, 2025

Unit 1 Overview
Unit 1: Weather and Erosion
Grade: 4
Content Area: Earth Science
Pacing: 10 Instructional Days
Essential Question
What do the shapes of landforms and rock formations tell us about the past?
Student Learning Objectives (Performance Expectations)
4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering of the rate of erosion by water, ice, wind or vegetation.
4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
Unit Summary
In this unit of study, students develop understandings of the effects of weathering and the rate of erosion by water, ice, wind, or vegetation. The crosscutting concepts of patterns and cause and effect are called out as organizing concepts. Students demonstrate grade-appropriate proficiency in planning and carrying out investigations and constructing explanations. Students are also expected to use these practices to demonstrate understanding of the core ideas.
Technical Terms
Weather, Erosion, Deposition, Decomposition, Abrasion, Vegetation, Wind Speed, Cycles of Freezing, Cycles of Thawing, Cycles of Heating, Cycles of Cooling, Waterflow, Rock Layers, Plate Tectonics, Geosphere, Hydrosphere, Atmosphere, Biosphere, Mechanical Weathering, Chemical Weathering, Sedimentary Rock, Geologist, Volcanic Eruptions, Earthquakes, Craters, Glaciers, Mesas, Plateaus, Canyons, The Three Layer Cake, "The Half Eaten Cake", The Rock Cycle, Constructive Forces, Deconstructive Forces, Stalactites, Stalagmites, Lichen
Formative Assessment Measures
Part A: How can evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation be observed or measured?
Students who understand the concepts are able to: Identify, test, and use cause-and-effect relationships in order to explain change. Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. Make observations and/or measurements to produce evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (Note: Assessment is limited to a single form of weathering or erosion.) Examples of variables to test could include: Angle of slope in the downhill movement of water Amount of vegetation Speed of the wind Relative rate of deposition Cycles of freezing and thawing of water Cycles of heating and cooling Volume of water flow
Part B: What can rock formations tell us about the past?
Students who understand the concepts can: Support explanations using patterns as evidence. Identify the evidence that supports particular points in an explanation. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. (Note: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time. Examples of evidence from patterns could include Rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time. A canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.

Interdisciplinary Connections	
NJSLS- ELA	**NJSLS- Mathematics**
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. 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.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 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	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. 4.M.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. 4.M.A.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.

Core Instructional Materials	Textbooks Series, Lab Materials, etc.
Career Readiness, Life Literacies and Key Skills	9.4.5.IML.2: Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3). 9.4.5.IML.3: Represent the same data in multiple visual formats in order to tell a story about the data. 9.4.5.IML.6: Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions (e.g., RI.5.7, 6.1.5.HistoryCC.7, 7.1.NM. IPRET.5).
Computer Science and Design Thinking	8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim. 8.1.5.DA.3: Organize and present collected data visually to communicate insights gained from different views of the data. 8.1.5.DA.5: Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

Modifications				
Multilingual Learners	**Special Education**	**At Risk for School Failure**	**Gifted and Talented**	**504**
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting	Word walls
Word walls	Visual aides	Peer tutoring	Challenge assignments	Visual aides
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities	Graphic organizers
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities	Multimedia
Think alouds	Leveled readers	Extended time	Independent research/inquiry	Leveled readers
Read alouds	Assistive technology	Parent communication	Collaborative teamwork	Assistive technology
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning	Notes/summaries
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks	Extended time
Think-pair- share	Answer masking		Self-directed activities	Answer masking
Visual aides	Answer eliminator			Answer eliminator
Modeling	Highlighter			Highlighter

Cognates	Color contrast			Color contrast Parent communication Modified assignments Counseling

Grade 4 Unit 1: Weathering and Erosion		
4-ESS2-1 Earth's Systems		
4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering of the rate of erosion by water, ice, wind or vegetation.		
Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of decomposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.		
Assessment Boundary: Assessment is limited to a single form of weathering or erosion.		
Evidence Statements: 4-ESS2-1		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3-5 builds on K-2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.	**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. **ESS2.E: Biogeology** Living things affect the physical characteristics of their regions.	**Cause and Effect** Cause and effect relationships are routinely identified, tested, and used to explain change.
Connections to other DCIs in this grade-band: N/A		
Articulation of DCIs across grade-bands: 2.ESS1.C ; 2.ESS2.A ; 5.ESS2.A		

5E Model	
4-EES2-1. Make observations and/or measurements to provide evidence of the effects of weathering of the rate of erosion by water, ice, wind or vegetation.	
Engage **Anticipatory Set**	Crash Course Kids: Weather and Erosion https://www.youtube.com/watch?v=R-Iak3Wvh9c Bill Nye Erosion Video https://www.youtube.com/watch?v=J-ULcVdeggE Erosion, Weathering, and Deposition Slideshow http://www.slideshare.net/MMoiraWhitehouse/weathering-erosion-and-depositioneasier Weathering & Erosion Video http://studyjams.scholastic.com/studyjams/jams/science/rocks-minerals-landforms/weathering-and-erosion.htm

	Earth Science: Weathering and Erosion https://www.youtube.com/watch?v=2ZdQYINDljA Shape It Up: An Earth Changing Erosion Activity http://sciencenetlinks.com/interactives/shapeitup_final.swf
Exploration **Student Inquiry**	What is Weathering? A Study of Australia's Twelve Apostles In this lesson, students will use technology to explore the impacts of weathering on an Australian coastline. http://betterlesson.com/lesson/635342/what-is-weathering-a-study-of-australia-s-twelve-apostles Buckling and Bending the Earth's Surface - Weathering In this two day lesson, students will explore and understand that the crust of the earth is constantly moving and changing over time due to weathering processes. http://betterlesson.com/lesson/614984/buckling-and-bending-the-earth-s-surface-weathering-day-1 http://betterlesson.com/lesson/617365/buckling-and-bending-the-earth-s-surface-weathering-day-2 Dig This! Erosion Investigation Students will be able to identify and observe real life erosion within their environment through observation and explanation. http://www.cas.miamioh.edu/scienceforohio/Erosion/L.html Glaciers on the Move http://science-live.org/teachers/GlaciersMove.html
Explanation **Concepts and Practices**	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): 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. ESS2.E: Biogeology Living things affect the physical characteristics of their regions.
Elaboration **Extension Activity**	Making Connection Through a Written Assessment http://betterlesson.com/lesson/634788/making-connections-through-a-written-assessment Vanishing Craters http://wonderwise.unl.edu/02teach/spaceact.pdf#page=15 Jeopardy: Weathering and Erosion https://jeopardylabs.com/play/weathering-erosion-and-deposition5

	Related Resources on Weathering and Erosion http://science-class.net/archive/science-class/Geology/weathering_erosion.htm
Evaluation Assessment Tasks	Assessment Task A: Discussion Questions Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. Students will answer the discussion questions following the investigation to make observations to provide evidence of the effects of weathering. Assessment Task B: Buckling and Bending the Earth's Surface - Weathering Students will construct their own understanding of mechanical and chemical weathering. They will write their own definition of mechanical and chemical weathering. Assessment Task C: Dig This! Erosion Investigation Students will complete Think Sheets and Data Sheets that correspond with activities. Think sheets and data sheets

Grade 4 Unit 1: Weathering and Erosion		
4-ESS1-1: Earth's Place in the Universe		
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.		
Clarification Statement: Examples of evidence from patterns could include rock layers with marine fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.		
Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.		
Evidence Statement: 4-ESS1-1		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Constructing Explanations and Design Solutions Constructing explanations and design solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Identify the evidence that supports particular points in an explanation.	**ESS1.C: The History of Planet Earth** The local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.	**Patterns** Patterns can be used as evidence to support an explanation. **Connections to Nature of Science** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** Science assumes consistent patterns in natural systems.
Connections to other DCIs in this grade-band: N/A		
Articulation of DCIs across grade-bands: 2.ESS1.C ; 3.LS4.A ; MS.LS4.A ; MS.ESS1.C ; MS.ESS2.A ; MS.ESS2.B		
5E Model		

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.	
Engage **Anticipatory Set**	The Grand Canyon! https://www.youtube.com/watch?v=oZZEJMtLOKU Informational Text: Chapter 1- Rocks and the Rock Cycle http://betterlesson.com/lesson/resource/3138826/rocks-and-the-rock-cycle\
Exploration **Student Inquiry**	Fossils, Rocks, and Time: Rocks and Layers https://pubs.usgs.gov/gip/fossils/rocks-layers.html Rock Layers: Timeline of Life on Earth http://www.prehistoricplanet.com/news/index.php?id=48 http://necsi.edu/projects/evolution/evidence/layers/evidence_layers.html Secrets of the Past Students will be able to describe how the Badlands rock layers were deposited over time by ancient environments. Students will match ancient environments and fossilized animals to the correlating rock layer/time period in Earth's history. Students will be able to describe how the modern processes of weathering and erosion shape the Badlands. https://www.nps.gov/teachers/classrooms/secpas.htm
Explanation **Concepts and Practices**	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): ESS1.C: The History of Planet Earth The local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.
Elaboration **Extension Activity**	Solve a Sedimentary Layer Puzzle http://www.amnh.org/content/download/1742/24677/file/dinoactivity_layers.pdf
Evaluation **Assessment Tasks**	Assessment Task A Identify the evidence that supports particular points in an explanation. Teacher will guide students through the various resources in the exploration section. After collecting evidence, they will create an explanation for changes in landscape over time. Assessment Task B: Secrets of the Past Students will create a flipbook of rock layers on their own and identify the animals that belong to each rock layer. Assessment tasks materials, rubric and answer key and additional resources available at https://www.nps.gov/teachers/classrooms/secpas.htm

Unit 2 Overview
Unit 2: Earth Processes

Grade: 4

Content Area: Earth Science

Pacing: 10 Instructional Days

Essential Question

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

Student Learning Objectives (Performance Expectations)

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 and climate change have on humans.

Unit Summary

In this unit of study, students apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. In order to describe patterns of Earth's features, students analyze and interpret data from maps. The crosscutting concepts of patterns, cause and effect, and the influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations, analyzing and interpreting data, and constructing explanations and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Technical Terms

Topological Map, Fault Map, Continental Boundaries, Ocean Trenches, Earth Processes, Twist, Flex, Earthquake Resistant, Base Isolation, Shake Table, Geotechnical Engineer, Layers of the Earth, Seismologist, Seismic Waves, Earthquake Epicenter, Earthquake Hypocenter, Richter Scale, Mantle, Core, Foreshocks, Aftershocks

Formative Assessment Measures

Part A: What can maps tell us about the features of the world?

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

Part B: In what ways can the impacts of natural Earth processes on humans be reduced?

Students who understand the concepts are able to:
Identify and test cause-and-effect relationships in order to explain change.
Generate multiple solutions to a problem and compare them based on how well they meet the criteria and constraints of the design solution.
Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans (Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.) Examples of solutions could include: Designing an earthquake-resistant building Improving monitoring of volcanic activity.
Generate multiple possible solutions to a problem and compare them based on how well each is likely to meet the criteria and constraints of the problem.Plan and 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.
Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics

RL.CR.4.1. Refer to details and examples as textual evidence when explaining what a literary text says explicitly and make relevant connections when drawing inferences from 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.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. 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	4.M.A.1 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. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. 4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

Core Instructional Materials	Textbooks Series, Lab Materials, etc.
Career Readiness, Life Literacies and Key Skills	9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2). 9.4.5.CT.2: Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem (e.g., 2.1.5.CHSS.1, 4-ESS3-1). 9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3). 9.4.5.IML.2: Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3). 9.4.5.TL.2: Sort and filter data in a spreadsheet to analyze findings.
Computer Science and Design Thinking	8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim. 8.1.5.DA.3: Organize and present collected data visually to communicate insights gained from different views of the data. 8.1.5.DA.5: Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

Modifications				
Multilingual Learners	**Special Education**	**At Risk for School Failure**	**Gifted and Talented**	**504**
Scaffolding Word walls Sentence/paragraph frames	Word walls Visual aides Graphic organizers	Teacher tutoring Peer tutoring Study guides	Curriculum compacting Challenge assignments Enrichment activities	Word walls Visual aides Graphic organizers

Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides Think-pair- share Visual aides Modeling Cognates	Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Graphic organizers Extended time Parent communication Modified assignments Counseling	Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities	Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast Parent communication Modified assignments Counseling

Grade 4 Unit 2: Earth Processes		
4-ESS2-2 Earth's Systems		
4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.		
Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.		
Assessment Boundary: N/A		
Evidence Statements: 4-ESS2-2		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Analyzing and Interpreting Data Analyzing data in 3-5 builds on K-2 experiences and progresses to introduce quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. Analyze and interpret data to make sense of phenomena using logical reasoning.	**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.	**Patterns** Patterns can be used as evidence to support an explanation.
Connections to other DCIs in this grade-band: N/A		
Articulation of DCIs across grade-bands: 2.ESS2.B ; 2.ESS2.C ; 5.ESS2.C ; MS.ESS1.C ; MS.ESS2.A ; MS.ESS2.B		
4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.		
Engage **Anticipatory Set**	Crash Course Kids: Landforms https://www.youtube.com/watch?v=FN6QX43QB4g Examine Earth from a New Perspective	

	The following website includes animations of Earth from various perspectives, including the locations on earthquakes and volcanos. http://www.classzone.com/books/earth_science/terc/content/visualizations/es0101/es0101page01.cfm?chapter_no=visualization%0D BrainPOP Videos: Reading Maps, Landforms, Land Changes, Earthquakes, Volcanos https://www.brainpop.com/science/earthsystem/earthquakes/ https://www.brainpop.com/science/earthsystem/volcanoes/
Exploration **Student Inquiry**	Map: Largest Earthquakes in the United States Have students examine maps to determine patterns in location of historically significant Earthquakes. http://earthquake.usgs.gov/earthquakes/ Interpreting Live Data In this lesson, students will interpret real time data regarding geological events. http://betterlesson.com/lesson/637340/interpreting-live-data
Explanation **Concepts and Practices**	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): 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.
Elaboration **Extension Activity**	Predicting Earthquakes http://www.ck12.org/earth-science/Predicting-Earthquakes/lesson/Predicting-Earthquakes-HS-ES/ Plate Tectonics (Great Resource) https://ees.as.uky.edu/sites/default/files/elearning/module04swf.swf Measuring and Predicting Earthquakes http://www.ck12.org/book/CK-12-Earth-Science-For-Middle-School/section/7.3/
Evaluation **Assessment Tasks**	Assessment Task A: Interpreting Live Data Assessment Analyze and interpret data to make sense of phenomena using logical reasoning. Use the questions in this activity to assess students' understanding of content. http://betterlesson.com/lesson/637340/interpreting-live-data Teachers may elect to have students generate a written assignment (such as comparing and contrasting or analyzing geological changes) or present an alternate media assignment, such as a group presentation using technology describe their understanding

Grade 4 Unit 2: Earth Processes
4-ESS3-2 Earth and Human Activity

4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes and climate change have on humans.

Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.

Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.

Evidence Statements: 4-ESS3-2

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.	**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 (note: This Disciplinary Core Idea can also be found in 3.WC.) **ETS1.B: Designing Solutions to Engineering Problems** Testing a solution involves investigating how well it performs under a range of likely conditions (secondary)	**Cause and Effect** Cause and effect relationships are routinely identified, tested, and used to explain change. **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 develop new ones to increase their benefits, to decrease known risks, and to meet societal demands.

Connections to other DCIs in this grade-band: 4.EST1.C

Articulation of DCIs across grade-bands: K.ETS1.A; 2.ETS1.B; 2.ETS1.C; MS.ESS2.A; MS.ESS3.B; MS.ETS1.B

5E Model

4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.*

Engage **Anticipatory Set**	After viewing the following videos, lead a discussion about the engineering techniques implemented when building bridges and buildings to account for potential Earthquake activity. How do these engineering solutions reduce the potential human impact of Earthquakes? San Francisco Bay Bridge: Seismic Safety Innovations https://www.youtube.com/watch?v=WvAIivBaxso After viewing this video simulation, lead a discussion about the engineering techniques that were implemented to ensure that bridge would twist and flex in the event of any Earthquake. How do these engineering solutions reduce the potential human impact of Earthquakes? How We Design Buildings To Survive Earthquakes https://www.youtube.com/watch?v=c4fKBGsllZI
Exploration **Student Inquiry**	Building an Earthquake Resistant Structure In this lesson, students will explore how they can use the engineering design process to build a structure that can stand up to an earthquake. http://betterlesson.com/lesson/636080/building-an-earthquake-resistant-structure

	Survive the Great Earthquake Shake! In this two day lesson, students work in groups to plan and build an earthquake proof structure using toothpicks and miniature marshmallows. http://betterlesson.com/lesson/635347/survive-the-great-earthquake-shake-part-1 http://betterlesson.com/lesson/640111/survive-the-great-earthquake-shake-part-2 Building a Tarpul In this lesson, students will learn how soil affects a building structure. http://betterlesson.com/lesson/635455/building-a-tarpul
Explanation Concepts and Practices	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): 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 (note: This Disciplinary Core Idea can also be found in 3.WC.) ETS1.B: Designing Solutions to Engineering Problems Testing a solution involves investigating how well it performs under a range of likely conditions (secondary)
Elaboration Extension Activity	I'm a Geotechnical Engineer! In this activity, students act as engineers to determine where a footbridge should be built through the use of core samples and maps of the river. http://betterlesson.com/lesson/635453/i-am-a-geotechnical-engineer
Evaluation Assessment Tasks	Assessment Task A: Building an Earthquake Resistant Structure Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Have students complete the Engineering the Earthquake Resistant Structure Reflection. This could certainly be administered with paper and pencil as well. Earthquake Reflection

Grade 4 Unit 2: Earth Processes		
3-5-ETS1-2 Engineering Design		
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.		
Classification Statement: N/A		
Assessment Boundary: N/A		
Evidence Statements: 3-5-ETS1-2		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.	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 well it performs under a range of likely conditions. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.	**Influence of Science, Engineering, and Technology on Society and the Natural World** Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
Connections to other DCIs in this grade-band: 4th Grade 4-ESS3-2		
Articulation of DCIs across grade-bands: K-2.ETS1.A; K-2.ETS1.B; K-2.ETS1.C; MS.ETS1.B; MS.ETS1.C		

Grade 4 Unit 2: Earth Processes		
3-5-ETS1-3 Engineering Design		
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.		
Classification Statement: N/A		
Assessment Boundary: N/A		
Evidence Statements: 3-5-ETS1-3		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions in 3-5 builds on K-2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	ETS1.B: Develop Possible Solutions Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. 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.	
Connections to other DCIs in this grade-band: 4th Grade 4-ESS3-2; 4-PS4-3		
Articulation of DCIs across grade-bands: K-2.ETS1.A; K-2.ETS1.C; MS.ETS1.B; MS.ETS1.C		

Unit 3 Overview
Unit 3: Structure and Function

Grade: 4

Content Area: Life Science

Pacing: 10 Instructional Days

Essential Question

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

Student Learning Objectives (Performance Expectations)

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

Unit Summary

In this unit of study, students develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. The crosscutting concepts of systems and system models are called out as organizing concepts for this disciplinary core idea. Students are expected to demonstrate grade-appropriate proficiency in engaging in argument from evidence. Students are also expected to use this practice to demonstrate understanding of the core idea.

Technical Terms

macroscopic structures, adaptations, defense mechanisms, nutrients, pollinators, reproduction, thorns, bristles, toxins, biosphere, molecules, organisms, ecosystems, muscular system, skeletal system, respiratory system, niche, nervous system, endocrine system, digestive system, urinary system, circulatory system, immune system, lymphatic system, reproductive system, integumentary system, adaptation, niche, habitat, molecules, organisms, ecosystems, biosphere, cells, excretory system

Formative Assessment Measures

Part A: How do internal and external parts of plants and animals help them to survive, grow, behave, and reproduce?

Students who understand the concepts are able to:
Describe a system in terms of its components and their interactions.
Construct an argument with evidence, data, and/or a model.
Construct an argument to support the claim that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. (Assessment is limited to macroscopic structures within plant and animal systems.) Examples of structures could include: Thorns, Stems, Roots, Petals, Heart, Stomach, Lung, Brain, Skin

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
W.SE.4.6. Gather relevant information from multiple print and digital sources; take notes, prioritize and categorize information; provide a list of sources	4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

Core Instructional Materials	Textbooks Series, Lab Materials, etc.
Career Readiness, Life Literacies and Key Skills	9.4.5.TL.3: Format a document using a word processing application to enhance text, change page formatting, and include appropriate images, graphics, or symbols. 9.4.5.TL.4: Compare and contrast artifacts produced individually to those developed collaboratively (e.g., 1.5.5.CR3a).
Computer Science and Design Thinking	8.1.5.DA.5: Propose cause and effect relationships, predict outcomes, or communicate ideas using data. 8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).

	8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.			
Modifications				
Mutilingual Learners	**Special Education**	**At Risk for School Failure**	**Gifted and Talented**	**504**
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides Think-pair- share Visual aides Modeling Cognates	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication Modified assignments Counseling	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast Parent communication Modified assignments Counseling

Grade 4 Unit 3: Structures and Functions		
4-LS1-1 From Molecules to Organisms: Structures and Processes		
4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.		
Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.		
Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.		
Evidence Statements: 4-LS1-1		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Engaging in Argument from Evidence Engaging in argument from evidence in 3-5 builds on K-2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Construct an argument with evidence, data, and/or a model.	**LS1.A: Structures and Function** Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.	**Systems and System Models** A system can be described in terms of its components and their interactions.

Connections to other DCIs in this grade-band: N/A	
Articulation of DCIs across grade-bands: 1.LS1.A; 1.LS1.D; 3.LS3.B; MS.LS1.A	
5E Model	
4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	
Engage **Anticipatory Set**	You at the Zoo In this video, students learn about plant structures and how certain adaptations help plants survive. http://nj.pbslearningmedia.org/resource/a362ee72-74b3-4b10-9e7c-e7ecbb9aaa8d/a362ee72-74b3-4b10-9e7c-e7ecbb9aaa8d/ BrainPOP: Human Body The following video provides an introduction to the internal systems of the human body. https://www.brainpop.com/health/bodysystems/humanbody/ Life Science with the Wild Kratts The following unit outlines video, interactive, and document resources related to plant and animal structures. Lessons include: - Night Primates and Eye Adaptations - Discovering Animal Senses - Animal Adaptations: Scent Behavior and Communication http://nj.pbslearningmedia.org/resource/1050daca-32b7-4b5b-b4df-9d0825e0ffd6/life-science-for-grade-4-with-wild-kratts/
Exploration **Student Inquiry**	Organs of the Human Body Human organs accomplish necessary functions within the human body. Each organ has a distinct role within a body system. In this lesson, students will identify and describe major organs of the human body. http://betterlesson.com/lesson/618161/organs-of-the-human-body Busy Bees In this lesson, students research bees and how their specialized body parts help them in survival and contribute to the success of plant survival and reproduction. http://betterlesson.com/lesson/640362/busy-bees That's Not a Plant, It's a Weed: Discovering Functions of External Plant Parts Using data and prior knowledge, students explain their observations, measurements and understanding of various plant's external parts and how they help the plant survive in its environment. http://betterlesson.com/lesson/603965/that-s-not-a-plant-it-s-a-weed-discovering-functions-of-external-plant-parts-what-makes-a-plant-a-plant Bird Beak Buffet In this lesson, students learn about bird beaks as an example of adaptations. Students experiment with different beak models and record data on the effectiveness of each model at collecting different foods. http://www.estuarypartnership.org/sites/default/files/Bird%20Beak%20Adaptations%20Lesson%20Plan.pdf

Explanation Concepts and Practices	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): LS1.A: Structures and Function Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
Elaboration Extension Activity	Additional Related Lessons and Resources: NASTA http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=70
Evaluation Assessment Tasks	Assessment Task A Construct an argument with evidence, data, and/or a model. http://betterlesson.com/lesson/618161/organs-of-the-human-body Assessment Task B Options for assessing Busy Bees: Develop a rubric for assessing Jigsaw Research; assess KLEWS chart; have students develop comparisons of data on bees in NJ and a different state of their choice alongside and/or produce research on the importance of bees to New Jersey agriculture. Busy Bees Assessment Resources Assessment Task C: Discovering Plants Plant Classification Chart Demonstrating an understanding of the classification system Assessment Task D: Bird Beak Graph and interpret results Online Quiz

Unit 4 Overview
Unit 4: How Organisms Process Information
Grade: 4
Content Area: Life Science
Pacing: 10 Instructional Days
Essential Question
How do animals use their perceptions and memories to make decisions?
Student Learning Objectives (Performance Expectations)
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 that 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.

Unit Summary
In this unit of study, students are expected to develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. By developing a model, they describe that an object can be seen when light reflected from its surface enters the eye. The crosscutting concepts of cause and effect, systems and system models, and structure and function are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in developing and using models. Students are expected to use these practices to demonstrate understanding of the core ideas.
Technical Terms
cells, sense receptors, molecules, organisms, immunity, temperature, pulse, respiration rate, hypothermia, heat prostration, reflection, refraction, sound waves, light waves, cornea, pupil, iris, light rays, lightning, thunder, focal point, electromagnetic radiation, lens, retina, photoreceptive, cones, rods, photon, electrical impulses
Formative Assessment Measures
Part A: How do animals receive and process different types of information from their environment in order to respond appropriately?
Students who understand the concepts are able to: Describe a system in terms of its components and their interactions. Use a model to test interactions concerning the functioning of a natural system. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. Emphasis is on systems of information transfer. Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.
Part B: What happens when light from an object enters the eye?
Students who understand the concepts are able to: Identify cause-and-effect relationships. Develop a model to describe phenomena. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. (Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works).

Interdisciplinary Connections	
NJSLS- ELA	**NJSLS- Mathematics**
SL.UM.4.5. Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes	MP.4 Model with mathematics. 4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures

Core Instructional Materials	Textbooks Series, Lab Materials, etc.
Career Readiness, Life Literacies and Key Skills	9.4.5.TL.5: Collaborate digitally to produce an artifact (e.g., 1.2.5CR1d). 9.4.5.TL.4: Compare and contrast artifacts produced individually to those developed collaboratively (e.g., 1.5.5.CR3a). 9.4.5.TL.3: Format a document using a word processing application to enhance text, change page formatting, and include appropriate images, graphics, or symbols.
Computer Science and Design Thinking	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.			
Modifications				
Multilingual Learners	**Special Education**	**At Risk for School Failure**	**Gifted and Talented**	**504**
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides Think-pair- share Visual aides Modeling Cognates	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication Modified assignments Counseling	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast Parent communication Modified assignments Counseling

Grade 4 Unit 4: How Organisms Process Information		
4-LS1-2 From Molecules to Organisms: Structures and Processes		
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 that information in different ways.		
Clarification Statement: Emphasis is on systems of information transfer.		
Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.		
Evidence Statements: 4-LS1-2		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Developing and Using Models Modeling in 3-5 builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. Use a model to test interactions concerning the functioning of a natural system.	**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.	**Systems and System Models** A system can be described in terms of its components and their interactions.
Connections to other DCIs in this grade-band: N/A		
Articulation of DCIs across grade-bands: MS.LS1.A; MS.LS1.D		

5E Model	
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 that information in different ways.	
Engage **Anticipatory Set**	Sight, Sound, Smell, Taste, and Touch: How the Human Body Receives Sensory Information This interactive article explains that the nervous system must receive and process information about the world outside in order to react, communicate, and keep the body healthy and safe. http://learn.visiblebody.com/nervous/five-senses BrainPOP: The Nervous System https://www.brainpop.com/health/bodysystems/nervoussystem/ Article: Your Nervous System Students will discover how the five senses all connect to the central nervous system. http://discoverykids.com/articles/your-nervous-system/ 20 Things You Didn't Know About Animal Senses http://discovermagazine.com/2014/may/26-20-things-animal-senses
Exploration **Student Inquiry**	Awesome, Weird, Cool...Not! In this lesson, students learn how they themselves receive, process and respond to information through their sense of touch by touching and describing mystery items in brown paper bags. http://betterlesson.com/lesson/615769/awesome-weird-cool-not Animal Senses In this lesson, students will learn how animals use their senses in special ways and will use their own senses to better understand how animals use theirs. http://www.driftcreek.org/wp-content/uploads/2014/06/Lsn7-Animal-Seneses.pdf Animal Sense-Stations In this lesson, students will be asked to solve some mysteries. At each of four stations, students will complete an activity and unravel clues to determine which animal the activity relates to, just like investigators who use clues to solve crimes or figure out what happened at an accident scene. https://extension.purdue.edu/4h/Documents/Volunteer%20Resources/Livestock%20Volunteers/Animal%20Science.pdf
Explanation **Concepts and Practices**	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): 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.

Elaboration **Extension Activity**	Additional Related Lessons and Resources: NASTA http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=71
Evaluation **Assessment Tasks**	Assessment Task A Use a model to test interactions concerning the functioning of a natural system. Using the models in the above Elaboration tasks, students will be able to describe that animals receive different types of information through their senses, process the information in their brain, and respond to that information in different ways.

Grade 4 Unit 4: How Organisms Process Information		
4-PS4-2 Waves and Their Applications in Technologies for Information Transfer		
4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.		
Clarification Statement: N/A		
Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.		
Evidence Statements: 4-PS4-2		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Developing and Using Models Modeling in 3-5 builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. Develop a model to describe phenomena.	**PS4.B: Electromagnetic Radiation** An object can be seen when light reflected from its surface enters the eyes.	**Cause and Effect** Cause and effect relationships are routinely identified.
Connections to other DCIs in this grade-band: N/A		
Articulation of DCIs across grade-bands: 1.PS4.B; 1.PS4.C; MS.PS4.B; MS.LS1.D		

5E Model	
4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.	
Engage **Anticipatory Set**	How the Eye Works This video gives an overview of the structure and function of the human eye. https://www.youtube.com/watch?v=YcedXDN6a88 BrainPOP: Body Systems- Eyes https://www.brainpop.com/health/bodysystems/eyes/
Exploration **Student Inquiry**	Light Reflection In this lesson, students create models using flashlights and mirrors to define light reflection and identify similarities between refraction and reflection. http://betterlesson.com/lesson/633037/light-reflection Who Turned Out the Lights?

	In this lesson, students will develop a model to describe how light reflecting on an object allows us to see the object. http://betterlesson.com/lesson/617379/who-turned-out-the-lights
Explanation **Concepts and Practices**	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): PS4.B: Electromagnetic Radiation An object can be seen when light reflected from its surface enters the eyes.
Elaboration **Extension Activity**	Kaleidoscopes! Students create kaleidoscopes to explore light energy and how it can be bent and reflected to see shapes. http://betterlesson.com/lesson/637889/kaleidoscopes Discovering The Science Behind the Kaleidoscope Students connect how light energy works within a kaleidoscope. http://betterlesson.com/lesson/639087/discovering-the-science-behind-the-kaleidoscope
Evaluation **Assessment Tasks**	Assessment Task A: Who Turned Out the Lights? Develop a model to describe phenomena. Using the models created in the lesson, students will be able to demonstrate their conceptual understanding by describing that light reflecting from objects and entering the eye allows objects to be seen. Who Turned Out the Lights Assessment Task B Students will return to engagement activity for Kaleidoscope Klews and conduct a reflection and revision of their work with related explanations Kaleidoscope Klews

Unit 5 Overview
Unit 5: Transfer of Energy
Grade: 4
Content Area: Physical & Earth Science
Pacing: 15 Instructional Days
Essential Question
Where do we get the energy we need for modern life?
Student Learning Objectives (Performance Expectations)
4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, or electric currents.
4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Unit Summary
In this unit of study, fourth-grade students develop an understanding that energy can be transferred from place to place by sound, light, heat, and electrical currents. Students also obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment. The crosscutting concepts of cause and effect, energy and matter, and the interdependence of science, engineering, and technology, and influence of science, engineering, and technology on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade appropriate proficiency in planning and carrying out investigations and obtaining, evaluating, and communicating information. Students are also expected to use these practices to demonstrate understanding of the core ideas.
Technical Terms
energy, electric currents, alternating current, direct current, sound waves, heat waves, light waves, ocean waves, electromagnetic waves, fossil fuels, conservation of energy, transfer of energy, amplitude, static electricity, conductor,flow, negative ions, positive ions, voltage, transformers, fuels from natural resources(natural gas, petroleum, coal crude oil, refined oil), turbine
Formative Assessment Measures
Part A: How does energy move?
Students who understand the concepts are able to: Make observations to produce data that can serve as the basis for evidence for an explanation of a phenomenon or for a test of a design solution. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
Part B: From what natural resources are energy and fuels derived? In what ways does the human use of natural resources affect the environment?
Students who understand the concepts are able to: Identify cause-and-effect relationships in order to explain change. Obtain and combine information from books and other reliable media to explain phenomena. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. Examples of renewable energy resources could include: o Wind energy, o Water behind dams, and o Sunlight. Examples of nonrenewable energy resources are: of Fossil fuels, o Fossil materials Examples of environmental effects could include: o Loss of habitat due to dams o Loss of habitat due to surface mining of Air pollution from burning of fossil fuels.

Interdisciplinary Connections	
NJSLS- ELA	**NJSLS- Mathematics**
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. 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	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. 4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

Core Instructional Materials	Textbooks Series, Lab Materials, etc.
Career Readiness, Life Literacies and Key Skills	9.4.5.TL.2: Sort and filter data in a spreadsheet to analyze findings. 9.4.5.TL.3: Format a document using a word processing application to enhance text, change page formatting, and include appropriate images, graphics, or symbols.
Computer Science and Design Thinking	8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim. 8.1.5.DA.3: Organize and present collected data visually to communicate insights gained from different views of the data. 8.1.5.DA.5: Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

Modifications				
Multilingual Learners	**Special Education**	**At Risk for School Failure**	**Gifted and Talented**	**504**
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting	Word walls
Word walls	Visual aides	Peer tutoring	Challenge assignments	Visual aides
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities	Graphic organizers
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities	Multimedia
Think alouds	Leveled readers	Extended time	Independent research/inquiry	Leveled readers
Read alouds	Assistive technology	Parent communication	Collaborative teamwork	Assistive technology
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning	Notes/summaries
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks	Extended time
Think-pair- share	Answer masking		Self-directed activities	Answer masking
Visual aides	Answer eliminator			Answer eliminator
Modeling	Highlighter			Highlighter
Cognates	Color contrast			Color contrast
				Parent communication
				Modified assignments
				Counseling

Grade 4 Unit 5: Transfer of Energy		
4-PS3-2 Energy		
4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, or electric currents.		
Clarification Statement: N/A		
Assessment Boundary: Assessment does not include quantitative measurements of energy.		
Evidence Statements: 4-PS3-2		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3-5 builds on K-2 experiences and progresses to include investigations that control variables and	**PS3.A: Definitions of Energy** Energy can be moved from place to place by moving objects or through sound, light, or electric currents. **PS3.B: Conservation of Energy and Energy Transfer**	**Energy and Matter** Energy can be transferred in various ways and between objects.

provide evidence to support explanations or design solutions. Make observations to produce data to serve as the basis of a phenomenon or test a design solution.	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. Light also transfers energy from place to place. 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.	

Connections to other DCIs in this grade-band: N/A

Articulation of DCIs across grade-bands: MS.PS3.A; MS.PS3.B; MS.PS4.B

5E Model

4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, or electric currents.

Engage **Anticipatory Set**	Energy- Bill Nye the Science Guy The following video describes types of energy and energy transfer. https://vimeo.com/93873773 BrainPOP Videos: Forms of Energy, Heat, Current Electricity, Sound, Light https://www.brainpop.com/science/energy/formsofenergy/ https://www.brainpop.com/science/energy/heat/ https://www.brainpop.com/science/energy/currentelectricity/ https://www.brainpop.com/science/energy/sound/ https://www.brainpop.com/science/energy/light/
Explore **Student Inquiry**	Energy and Waves Unit Lessons in the unit include: Moving Pennies, Colored Paper, Light Bulbs & Golf Ball/Ping Pong Ball http://www.mccracken.kyschools.us/Downloads/4%20NGSS%20UNIT%20Energy%20Waves.pdf Chillin with Colored Paper Students will demonstrate how energy can be transferred from one object to another by melting an ice cube. http://betterlesson.com/lesson/614360/chillin-with-colored-paper Jam, Jam, Jam with a Rubber Band Band Students explore and create a stringed instrument that demonstrates their understanding of sound waves and how energy is transferred. http://betterlesson.com/lesson/637240/jam-jam-jam-with-a-rubber-band-band The Lightbulb Just Went On Students discover how electricity can be converted to light energy through discovery. http://betterlesson.com/lesson/637885/the-lightbulb-just-went-on

Explanation Concepts and Practices	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): PS3.A: Definitions of Energy Energy can be moved from place to place by moving objects or through sound, light, or electric currents. 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. Light also transfers energy from place to place. 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.
Elaboration Extension Activity	Additional Related Lessons & Resources: NASTA http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=77
Evaluation Assessment Tasks	Assessment Task A Make observations to produce data to serve as the basis of a phenomenon or test a design solution. Color and Heat Absorption Worksheet Assessment Task B Students will generate a journal record indicating their predictions and design of closed circuit, conduct the activity for creating the closed circuit, record their steps, observations, and reflections Developing a Closed Circuit

Grade 4 Unit 5: Transfer of Energy		
4-ESS3-1 Earth and Human Activity		
4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.		
Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; nonrenewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.		
Assessment Boundary: N/A		
Evidence Statements: 4-ESS3-1		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 3-5 builds on K-2 experiences and progresses to evaluate the merit and accuracy of ideas and methods.	**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.	**Cause and Effect** Cause and effect relationships are routinely identified and used to explain change. **Connections to Engineering, Technology, and Applications of Science**

Obtain and combine information from books and other reliable media to explain phenomena.		**Interdependence of Science, Engineering and Technology** Knowledge of relevant scientific concepts and research findings is important to engineering. **Influence of Engineering, Technology, and Science on Society and the Natural World** Over time, people's needs and wants change, as do their demands for new and improved technologies.
Connections to other DCIs in this grade-band: N/A		
Articulation of DCIs across grade-bands: 5.ESS3.C; MS.PS3.D; MS.ESS2.A; MS.ESS3.C; MS.ESS3.D		
5E Model		
4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.		
Engage **Anticipatory Set**	Video: Renewable and Nonrenewable Resources https://www.youtube.com/watch?v=MHutG0e58os BrainPOP: Natural Resources & Fossil Fuels https://www.brainpop.com/science/energy/naturalresources/ https://www.brainpop.com/science/energy/fossilfuels/	
Exploration **Student Inquiry**	Classifying Natural Resources In this lesson, students will classify energy sources as renewable or nonrenewable. http://betterlesson.com/lesson/639778/classifying-natural-resources Researching Energy Resources In this lesson, students will locate specific information about an electricity source. http://betterlesson.com/lesson/639919/researching-energy-resources Energy Resource Presentations In this lesson, create and deliver a presentation of energy resources and their environmental effects. http://betterlesson.com/lesson/resource/3230276/presentation-rubric?from=resource_image Coal Mining- An Introduction Students will explain the uses of coal, the basics of how it is mined, and the environmental impacts of coal use and mining. http://betterlesson.com/lesson/642163/coal-mining-an-introduction Mining for Ore In this lesson, students will gain an understanding that the more natural resources you extract, the greater the impact on the land. http://betterlesson.com/lesson/641211/mining-for-ore	
Explanation **Concepts and Practices**	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.	

	Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): 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.
Elaboration **Extension Activity**	Additional Related Lessons & Resources https://www.opened.com/search?standard=4.ESS3.1 http://www.earthsciweek.org/ngss-performance-expectations/4-ess3-1
Evaluation **Assessment Tasks**	Assessment Task A Obtain and combine information from books and other reliable media to explain phenomena. Energy Resources presentation to demonstrate understanding of energy resources and their environmental effects Energy Resource Presentation Rubric Assessment Task B: Coal Mining Exit Ticket http://betterlesson.com/lesson/642163/coal-mining-an-introduction Assessment Task C Students will return to the Mining for Ore Investigation, using different tools, will complete this activity and respond to related questions to evaluate their tools and relate their methods to the way in which actual minerals are mined from the earth http://betterlesson.com/lesson/resource/3244657/mining-for-ore-investigation-sheet?from=resource_title http://betterlesson.com/lesson/641211/mining-for-ore

Unit 6 Overview
Unit 6: Force and Motion
Grade: 4
Content Area: Physical Science
Pacing: 15 Instructional Days
Essential Question
What is the relationship between the speed of an object and the energy of that object?
Student Learning Objectives (Performance Expectations)
4-PS3-1.Use evidence to construct an explanation relating to the speed of an object to the energy of that object.
4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.
Unit Summary
In this unit of study, students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object, and are expected to develop an understanding that energy can be transferred from object to object through collisions. The crosscutting concept of energy and matter is called out as an organizing concept. Students are expected to demonstrate grade-appropriate proficiency in asking questions, defining problems, and constructing explanations, and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.
Technical Terms

kinetic energy, potential energy, solar power, (electricity- as related to energy: mass, volume, friction, speed), finite amount of energy, generator

Formative Assessment Measures

Part A: What is the relationship between the speed of an object and its energy?

Students who understand the concepts are able to:
Describe various ways that energy can be transferred between objects.
Use evidence (e.g., measurements, observations, patterns) to construct an explanation.
Use evidence to construct an explanation relating the speed of an object to the energy of that object. (Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.)

Part B: In what ways does energy change when objects collide?

Students who understand the concepts are able to:
Describe the various ways that energy can be transferred between objects.
Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
Ask questions and predict outcomes about the changes in energy that occur when objects collide. Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact. (Assessment does not include quantitative measurements of energy.)

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
RL.CR.4.1. Refer to details and examples as textual evidence when explaining what a literary text says explicitly and make relevant connections when drawing inferences from the text RI.TS.4.4. Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text. W.SE.4.6. Gather relevant information from multiple print and digital sources; take notes, prioritize and categorize information; provide a list of sources. 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.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.	N/A

W. IW.4.2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly	

Core Instructional Materials	Textbooks Series, Lab Materials, etc.
Career Readiness, Life Literacies and Key Skills	9.4.5.TL.2: Sort and filter data in a spreadsheet to analyze findings. 9.4.5.TL.3: Format a document using a word processing application to enhance text, change page formatting, and include appropriate images, graphics, or symbols.
Computer Science and Design Thinking	8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim. 8.1.5.DA.5: Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

Modifications				
Multilingual Learners	**Special Education**	**At Risk of School Failure**	**Gifted and Talented**	**504**
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides Think-pair- share Visual aides Modeling Cognates	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication Modified assignments Counseling	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast Parent communication Modified assignments Counseling

Grade 4 Unit 6: Force and Motion		
4-PS3-1 Energy		
4-PS3-1.Use evidence to construct an explanation relating to the speed of an object to the energy of that object.		
Clarification Statement: N/A		
Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.		
Evidence Statements: 4-PS3-1		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Use evidence (e.g., measurements, observations, patterns) to construct an explanation.	**PS3.A: Definitions of Energy** The faster a given object is moving, the more energy it possesses.	**Energy and Matter** Energy can be transferred in various ways and between objects.
Connections to other DCIs in this grade-band: N/A		
Articulation of DCIs across grade-bands: MS.PS3.A		
5E Model		
4-PS3-1.Use evidence to construct an explanation relating to the speed of an object to the energy of that object.		
Engage **Anticipatory Set**	BrainPOP: Kinetic Energy https://www.brainpop.com/science/energy/kineticenergy/ Speed Energy: Motion Probe In this demonstration, students will learn to relate the speed of an object to its energy. They will also see that the speed and energy of a moving object is impacted when it collides with another object. https://www.wardsci.com/www.wardsci.com/images/Gr_4_motion_probe.pdf	
Exploration **Student Inquiry**	Balloon Rockets Launch New Learning In this inquiry based lesson, students work with partners to build rockets with balloons, string, and straws. Students work with altering variables in order to observe how energy and speed are related. http://betterlesson.com/lesson/614949/balloon-rockets-launch-new-learning Marvelous Marbles Moving Students will use cardboard tubes to build marble roller coasters and observe that speed is related to the amount of energy in an object. http://betterlesson.com/lesson/617177/marvelous-marbles-moving Deep Impact Students use evidence to construct an explanation relating the speed of an object with the energy of that object. http://betterlesson.com/lesson/628533/deep-impact	
Explanation **Concepts and Practices**	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):	

	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses.
Elaboration **Extension Activity**	Hot Wheels: Speedometry https://hotwheels.mattel.com/en-us/content/images/speedometry/Speedometry_Grade_4_Lessons.pdf Additional Related Lessons & Resources http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=15
Evaluation **Assessment Tasks**	Assessment Task A: Balloon Rocket Launch Use evidence (e.g., measurements, observations, patterns) to construct an explanation. Using the Rocket Science With Balloons Activity worksheet, students will conduct the activity twice using different sized balloons then demonstrate their understanding of the differences in their findings and explain these difference http://betterlesson.com/lesson/614949/balloon-rockets-launch-new-learning Assessment Task B: Marvelous Marbles Moving http://betterlesson.com/lesson/617177/marvelous-marbles-moving Assessment Task C: Deep Impact Supporting Claims with Evidence Rubric http://betterlesson.com/lesson/628533/deep-impact

Grade 4 Unit 6: Force and Motion		
4-PS3-3 Energy		
4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.		
Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.		
Assessment Boundary: Assessment does not include quantitative measurements of energy.		
Evidence Statements: 4-PS3-3		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Asking Questions and Defining Problems Asking questions and defining problems in grade 3-5 builds on grades K-2 experiences and progresses to specifying qualitative relationships. Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.	**PS3.A: Definitions of Energy** Energy can be moved from place to place by moving objects or through sound, light or electric currents. **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.	**Energy and Matter** Energy can be transferred in various ways and between objects.

	PS3.C: Relationships Between Energy and Forces When objects collide, the contact forces transfer energy so as to change the object's motions.	

Connections to other DCIs in this grade-band: N/A

Articulation of DCIs across grade-bands: K.PS2.B; 3.PS2.A; MS.PS2.A; MS.PS3.B; MS.PS3.C

5E Model

4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.

Engage **Anticipatory Set**	Rocket Balls: Energy Lesson https://www.youtube.com/watch?v=ISs_14eQbn4 Stacked Ball Drop https://www.youtube.com/watch?v=2UHS883_P60
Exploration **Student Inquiry**	Colliding Marbles Student will work with various materials to create and answer questions about what happens with energy when objects collide http://betterlesson.com/lesson/628399/colliding-marbles Moving Pennies In this lesson, students work with pennies to develop questions and predict what happens when objects collide. http://betterlesson.com/lesson/614359/moving-pennies Lesson 2: When Cars Collide Students investigate how energy is transferred when objects collide. http://www.harmonydc.org/Curriculum/pdf/4sample.pdf
Explanation **Concepts and Practices**	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): PS3.A: Definitions of Energy Energy can be moved from place to place by moving objects or through sound, light or electric currents. 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. PS3.C: Relationships Between Energy and Forces When objects collide, the contact forces transfer energy so as to change the object's motions.
Elaboration **Extension Activity**	Additional Related Lessons & Resources http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=15

Evaluation Assessment Tasks	Assessment Task A: Colliding Marbles Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. http://betterlesson.com/lesson/628399/colliding-marbles Assessment Task B: Moving Pennies Students journal their experiments. After students are given a chance to refine their experiment, students present their demonstrations to the whole class. In the student demonstrations, students must explain what they learned about energy. http://betterlesson.com/lesson/614359/moving-pennies Assessment Task C: When Cars Collide Using the scientific investigations task worksheet students will demonstrate an understanding of how energy was being transformed. http://www.harmonydc.org/Curriculum/pdf/4sample.pdf

Unit 7 Overview
Unit 7: Using Engineering Design with Force and Motion Systems
Grade: 4
Content Area: Physical Science
Pacing: 15 Instructional Days
Essential Question
How can scientific ideas be applied to design, test, and refine a device that converts energy from one form to another?
Student Learning Objectives (Performance Expectations)
4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*
Unit Summary
In this unit of study, students use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students develop an understanding that energy can be transferred from place to place by sound, light, heat, and electrical currents or from objects through collisions. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. The crosscutting concepts of energy and matter and the influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in asking questions and defining problems, planning and carrying out investigations, constructing explanations, and designing solutions. Students are also expected to use these practices to demonstrate their understanding of the core ideas.
Technical Terms
electrical energy, thermal energy, mechanical energy, nuclear energy, electromagnetic energy, chemical energy, sound energy, potential energy, kinetic energy, wind energy, electrical currents, circuit
Formative Assessment Measures
Part A: How can scientific ideas be applied to design, test, and refine a device that converts energy from one form to another?
Students who understand the concepts are able to: Describe the various ways that energy can be transferred between objects. Apply scientific ideas to solve design problems.

Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. (Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.)
Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound or passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.
Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.
Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.
Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
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.AW.4.1. Write opinion pieces on topics or texts, supporting a point of view with reasons and information RL.CR.4.1. Refer to details and examples as textual evidence when explaining what a literary text says explicitly and make relevant connections when drawing inferences from 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 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1),(3-5-ETS1-3) W.5.7	4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically.

Core Instructional Materials	Textbooks Series, Lab Materials, etc.

Career Readiness, Life Literacies and Key Skills	9.4.5.IML.2: Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3). 9.4.5.TL.5: Collaborate digitally to produce an artifact (e.g., 1.2.5CR1d). 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.
Computer Science and Design Thinking	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.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.

Modifications				
Multilingual Learners	**Special Education**	**At Risk for School Failure**	**Gifted and Talented**	**504**
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides Think-pair- share Visual aides Modeling Cognates	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication Modified assignments Counseling	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast Parent communication Modified assignments Counseling

Grade 4 Unit 7: Using Engineering Design with Force and Motion		
4-PS3-4 Energy		
4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*		
Clarification Statement: Examples of devices could include electric circuits that convert electrical energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.		
Assessment Boundary: Devices should be limited to those that convert motion energy into electrical energy or use stored energy to cause motion or produce light or sound.		
Evidence Statements: 4-PS3-4		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Apply scientific ideas to solve design problems.	**PS3.B: Conservation of Energy and Energy Transfer** 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. **PS3.D: Energy in Chemical Processes and Everyday Life** The expression "produce energy" typically refers to the conservation of stored energy into a desired form for practical use. **ETS1.A: Defining 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. (secondary)	**Energy and Matter** Energy can be transferred in various ways and between objects. **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 develop new ones. **Connections to Nature of Science** **Science is a Human Endeavor** Most scientists and engineers work in teams. Science affects everyday life.
Connections to other DCIs in this grade-band: N/A		
Articulation of DCIs across grade-bands: K.ETS1.A; 2.ETS1.B; 5.PS3.D; 5.LS1.C; MS.PS3.A; MS.PS3.B; MS.ETS1.B; MS.ETS1.C		
5E Model		
4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*		
Engage **Anticipatory Set**	Energy Transformation: Informational Text http://www.softschools.com/examples/science/energy_transformations_examples/161/ Energy Transformation: Videos http://www.science4us.com/elementary-physical-science/energy/energy-transformations/	
Exploration **Student Inquiry**	Bright Time with Circuits In this lesson students use batteries, bulbs, and tinfoil to demonstrate how energy can be transferred from one object to another. http://betterlesson.com/lesson/614362/bright-time-with-circuits Build a Circuit Students understand the transfer of energy by building electrical circuits. http://betterlesson.com/lesson/615544/build-a-circuit Building a Flashlight In this two part lesson, students will use their previously acquired knowledge to build a homemade flashlight. http://betterlesson.com/lesson/639070/building-a-flashlight-preparation-day http://betterlesson.com/lesson/639073/building-a-flashlight-performance-assessment-day	
Explanation **Concepts and Practices**	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.	

	Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): PS3.B: Conservation of Energy and Energy Transfer 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. PS3.D: Energy in Chemical Processes and Everyday Life The expression "produce energy" typically refers to the conservation of stored energy into a desired form for practical use. ETS1.A: Defining 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. (secondary)
Elaboration Extension Activity	Make a Pinwheel http://stem-works.com/subjects/2-wind-energy/activities
Evaluation Assessment Tasks	Assessment Task A Apply scientific ideas to solve design problems. In all three activities in the Exploration section above students will design, test and refine objects, including circuits and a flashlight, to solve the design problem of converting energy from one form to another.

Grade 4 Unit 7: Using Engineering Design with Force and Motion		
3-5-ETS1-1		
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.		
Clarification Statement: N/A		
Assessment Boundary: N/A		
Evidence Statements: 3-5-ETS1-1		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Asking Questions and Defining Problems Asking questions and defining problems in 3-5 builds on grades K-2 experiences and progresses to specifying qualitative relationships. Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.	**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 can be compared on the basis of how well each one meets the specified criteria for success of how well each takes the constraints into account.	**Influence of Science, Engineering, and Technology on Society and the Natural World** People's needs and wants change over time, as do their demands for new and improved technologies.
Connections to other DCIs in this grade-band: 4th Grade P-PS3-4		
Articulation of DCIs across grade-bands: K-2.ETS1.A; MS.ETS1.A; MS.ETS1.B		

Grade 4 Unit 7: Using Engineering Design with Force and Motion		
3-5-ETS1-2 Engineering Design		
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.		
Classification Statement: N/A		
Assessment Boundary: N/A		
Evidence Statements: 3-5-ETS1-2		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.	**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 well it performs under a range of likely conditions. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.	**Influence of Science, Engineering, and Technology on Society and the Natural World** Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
Connections to other DCIs in this grade-band: 4th Grade 4-ESS3-2		
Articulation of DCIs across grade-bands: K-2.ETS1.A; K-2.ETS1.B; K-2.ETS1.C; MS.ETS1.B; MS.ETS1.C		

Grade 4 Unit 7: Using Engineering Design with Force and Motion		
3-5-ETS1-3 Engineering Design		
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.		
Classification Statement: N/A		
Assessment Boundary: N/A		
Evidence Statements: 3-5-ETS1-3		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions in 3-5 builds on K-2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. Plan and conduct an investigation collaboratively to produce data to	**ETS1.B: Develop Possible Solutions** Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. **ETS1.C: Optimizing the Design Solution** Different solutions need to be tested in order to	

serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	determine which of them best solves the problem, given the criteria and the constraints.	
Connections to other DCIs in this grade-band: 4th Grade 4-ESS3-2; 4-PS4-3		
Articulation of DCIs across grade-bands: K-2.ETS1.A; K-2.ETS1.C; MS.ETS1.B; MS.ETS1.C		

Unit 8 Overview
Unit 8: Waves and Information
Grade: 4
Content Area: Physical Science
Pacing: 20 Instructional Days
Essential Question
How can we use waves to gather and transmit information?
Student Learning Objectives (Performance Expectations)
4-PS4-1. Develop a model of waves to describe patterns of amplitude and wavelength and that waves can cause objects to move.
4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.*
Unit Summary
In this unit of study, students use a model of waves to describe patterns of waves in terms of amplitude and wavelength and to show that waves can cause objects to move. The crosscutting concepts of patterns; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, and constructing explanations, and designing solutions. Students are also expected to use these practices to demonstrate their understanding of the core ideas.
Technical Terms
amplitude of waves, wavelength (crest, trough) seismic waves through ground, electromagnetic waves, mechanical waves, radio waves, sound waves,compression waves,transverse waves, Morse Code, binary code
Formative Assessment Measures
Part A: If a beach ball lands in the surf, beyond the breakers, what will happen to it?
Students who understand the concepts can: Sort and classify natural phenomena using similarities and differences in patterns. Develop a model using an analogy, example, or abstract representation to describe a scientific principle. Develop a model (e.g., diagram, analogy, or physical model) of waves to describe patterns in terms of amplitude and wavelength, and that waves can cause objects to move. (Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength).
Part B: Which team can design a way to use patterns to communicate with someone across the room?
Students who understand the concepts can: Sort and classify designed products using similarities and differences in patterns. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Generate and compare multiple solutions that use patterns to transfer information. Examples of solutions could include: Drums sending coded information through sound waves; Using a grid of ones and zeroes representing black and white to send information about a picture
Using Morse code to send text
Plan and conduct an investigation collaboratively to produce data that can serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Interdisciplinary Connections	
NJSLS- ELA	**NJSLS- Mathematics**
RI.AA.4.7. Analyze how an author uses facts, details and explanations to develop ideas or to support their reasoning 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 SL.UM.4.5. Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. 4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. 4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

Core Instructional Materials	Textbooks Series, Lab Materials, etc.
Career Readiness, Life Literacies and Key Skills	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 (e.g., W.4.7, 8.2.5.ED.6).
Computer Science and Design Thinking	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.

Modifications				
English Language Learners	**Special Education**	**At Risk for School Failure**	**Gifted and Talented**	**504**
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting	Word walls
Word walls	Visual aides	Peer tutoring	Challenge assignments	Visual aides
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities	Graphic organizers
Bilingual	Multimedia	Graphic organizers	Tiered activities	Multimedia
dictionaries/translation	Leveled readers	Extended time	Independent research/inquiry	Leveled readers
Think alouds	Assistive technology	Parent communication	Collaborative teamwork	Assistive technology
Read alouds	Notes/summaries	Modified assignments	Higher level questioning	Notes/summaries
Highlight key vocabulary	Extended time	Counseling	Critical/Analytical thinking tasks	Extended time
Annotation guides	Answer masking		Self-directed activities	Answer masking

Think-pair- share Visual aides Modeling Cognates	Answer eliminator Highlighter Color contrast			Answer eliminator Highlighter Color contrast Parent communication Modified assignments Counseling

Grade 4 Unit 8: Waves and Information		
4-PS4-1 Waves and Their Applications in Technologies for Information Transfer		
4-PS4-1. Develop a model of waves to describe patterns of amplitude and wavelength and that waves can cause objects to move.		
Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.		
Assessment Boundary: Assessment does not include interference effects, electromagnet waves, non-periodic waves, or quantitative models of amplitude and wavelength.		
Evidence Statements: 4-PS4-1		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Developing and Using Models Modeling in 3-5 builds on K-2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. Develop a model using an analogy, example, or abstract representation to describe a scientific principle. Scientific Knowledge is Based on Empirical Evidence Science findings are based on recognizing patterns.	**PS4.A: Wave Properties** Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. (Note: This grade band endpoint was moved from K-2). Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).	**Patterns** Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena.
Connections to other DCIs in this grade-band: 4.PS3.A; 4.PS3.B		
Articulation of DCIs across grade-bands: MS.PS4.A		
5E Model		
4-PS4-1. Develop a model of waves to describe patterns of amplitude and wavelength and that waves can cause objects to move.		
Engage **Anticipatory Set**	Types of Waves https://www.youtube.com/embed/w2s2fZr8sqQ BrainPOP: Waves https://www.brainpop.com/science/energy/waves/	

	Frequency and Amplitude Interactive http://www.classzone.com/books/ml_science_share/vis_sim/wslm05_pg18_graph/wslm05_pg18_graph.html
Exploration **Student Inquiry**	Pop Bottle Waves & Hair Dryer Ripples In this lessons, students will explore what waves are all about as we observe, draw, and think about how waves are shaped and how they move and what creates them. http://betterlesson.com/lesson/636706/pop-bottle-waves-hair-dryer-ripples Seismic Slinky In this lesson, students will use a Slinky to make a model of earthquake waves. http://www.exploratorium.edu/faultline/activezone/slinky.html Catch the Wave See and hear how sound waves travel through different materials. http://www.teacherstryscience.org/kidsexperiments/catch-wave How Do Waves Move Objects? Students use what they have learned to develop questions about waves and begin to understand how waves transfer energy. http://betterlesson.com/lesson/637060/how-do-waves-move-objects Simon Says Big Amplitude, Small Wavelength! Students will manipulate rope to create and identify wavelength and amplitude: https://www.teachengineering.org/activities/view/cub_soundandlight_lesson2_activity1
Explanation **Concepts and Practices**	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): PS4.A: Wave Properties Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. (Note: This grade band endpoint was moved from K-2). Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).
Elaboration **Extension Activity**	Additional Related Lessons and Resources http://ngss.nsta.org/DisplayStandard.aspx?view=pe&id=80
Evaluation **Assessment Tasks**	Assessment Task A Develop a model using an analogy, example, or abstract representation to describe a scientific principle. In the various activities in the Exploration section above, students will develop a model of waves to describe patterns of amplitude and wavelength and that waves can cause objects to move. If rubrics are not provided, the following 3D model rubric can be used to assess. 3D Model Rubric

Grade 4 Unit 8: Waves and Information		
4-PS4-3 Waves and Their Applications in Technologies for Information Transfer		
4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.*		
Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.		
Assessment Boundary: N/A		
Evidence Statements: 4-PS4-3		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.	**PS4.C: Information Technologies and Instrumentation** Digitized information can be transmitted over long distances without a 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. **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)	**Patterns** Similarities and differences in patterns can be used to sort and classify designed products. **Connections to Engineering, Technology, and Applications of Science** **Interdependence of Science, Engineering, and Technology** Knowledge of relevant scientific concepts and research findings is important in engineering.
Connections to other DCIs in this grade-band: 4.ETS1.A		
Articulation of DCIs across grade-bands: K.ETS1.A; 2.ETS1.B; 2.ETS1.C; 3.PS2.A; MS.PS4.C; MS.ETS1.B		

5E Model	
4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.*	
Engage **Anticipatory Set**	See and Hear Morse Code Introduce the idea that people can communicate and transfer information using patterns, such as Morse Code. https://www.youtube.com/watch?v=_J8YcQETyTw
Exploration **Student Inquiry**	Top Secret In this lesson, students will create a circuit to send an encoded message answering the question, "How can you use what you know about electricity to send a message to someone else?" http://betterlesson.com/lesson/640420/top-secret Binary Code In this lesson students will read and write numbers and words written in binary form. http://betterlesson.com/lesson/640683/binary-code

	Chose Your Code In this lesson, students will chose the most appropriate communication system using patterns for a given situation. http://betterlesson.com/lesson/645206/chose-your-code
Explanation Concepts and Practices	In these lessons: Teachers should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): PS4.C: Information Technologies and Instrumentation Digitized information can be transmitted over long distances without a 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. 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)
Elaboration Extension Activity	Additional Related Lessons and Resources http://ngss.nsta.org/DisplayStandard.aspx?view=dci&id=35 https://www.opened.com/search?offset=0&standard=4.PS4.3
Evaluation Assessment Tasks	Assessment Task A Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. Choose the Code Worksheet

Grade 4 Unit 8: Waves and Information		
3-5-ETS1-2 Engineering Design		
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.		
Classification Statement: N/A		
Assessment Boundary: N/A		
Evidence Statements: 3-5-ETS1-2		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.	**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 well it performs under a range of likely conditions. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.	**Influence of Science, Engineering, and Technology on Society and the Natural World** Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
Connections to other DCIs in this grade-band: 4th Grade 4-ESS3-2		

Articulation of DCIs across grade-bands: K-2.ETS1.A; K-2.ETS1.B; K-2.ETS1.C; MS.ETS1.B; MS.ETS1.C

Grade 4 Unit 8: Waves and Information		
3-5-ETS1-3 Engineering Design		
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.		
Classification Statement: N/A		
Assessment Boundary: N/A		
Evidence Statements: 3-5-ETS1-3		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions in 3-5 builds on K-2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	**ETS1.B: Develop Possible Solutions** Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. **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.	
Connections to other DCIs in this grade-band: 4th Grade 4-ESS3-2; 4-PS4-3		
Articulation of DCIs across grade-bands: K-2.ETS1.A; K-2.ETS1.C; MS.ETS1.B; MS.ETS1.C		