Audubon Public Schools

Grade 4: Science

Curriculum Guide

Developed by:

Mr. Zach Bentley

Mrs. Kathleen Hueber

August 15, 2019

Table of Contents

Course Description

Grade 4: Science

The fourth grade science curriculum is based on the Next Generation Science Standards. Each unit has three dimensions: disciplinary core ideas, scientific and engineering practices, and crosscutting concepts. The disciplinary core ideas focus on scientific knowledge. The science and engineering practices require involvement in scientific inquiry. The crosscutting concepts connect scientific knowledge to other areas of learning. This curriculum will incorporate the three strands of Science: Physical Sciences, Life Science, and Earth Science. In fourth grade, the focus will be on Earth's

Overview / Progressions

Grade 4: Science

Overview		Physical Sciences	Life Sciences	Earth Sciences
Unit 1- Earth's Place in the Universe	**Focus standards (Objectives)**			**ESS1-1** **ESS2-1**
Unit 2- Earth's Systems and Earth and Human Activity	**Focus standards (Objectives)**			**ESS3-1** **ESS3-2**
Unit 3- Energy and Waves and their Applications in Technologies for Information Transfer	**Focus standards (Objectives)**	**PS3-1** **PS3-2** **PS3-3** **PS3-4** **PS4-1** **PS4-2** **PS4-3**		

Unit 4- From Molecules to Organisms: Structures and Processes	**Focus standards (Objectives)**		**LS1-2** **LS1-2**	

Earth Science	Grade 4	Unit 1 Earth's Place in the Universe	15 Instructional Days

Earth Science Unit 1-Earth's Place in the Universe:

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.

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

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

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

In addition to using models to understand the effects of water and ice on land, students should build and use models to simulate the effects of wind on earth materials. There are a variety of models that can be easily built. Students should have opportunities to change

variables, such as the speed or volume of airflow. From these experiences, students should begin to understand that wind, water, and ice cause changes to the earth's surface, and that the stronger or faster the flow of wind or water, the greater the change it causes.

In this unit, students also need opportunities to observe ways in which plants affect the weathering and erosion of earth materials. Plants can have a variety of effects on rocks, soils, and landforms. Plants often slow or stop the effects of moving wind and water on land. Students can observe this phenomenon using models. As they make observations, students can change variables, such as the amount or type of plant used to slow or stop erosion, and they can collect and analyze data to determine cause-and-effect relationships between the amount of change and the plants used to prevent it. Then students can walk around the schoolyard and nearby neighborhoods to look for examples of plants that are used to prevent erosion. In addition to slowing or preventing erosion, plants can cause weathering of rocks. Students can easily find examples in their own environment of growing plant and tree roots causing rocks, sidewalks, and driveways to crack and break down into smaller and smaller components. This phenomenon can also be simulated with models in the classroom. Students can soak lima beans in water overnight, then "plant" them in small cups containing a 2–3 cm. layer of wet Plaster of Paris on top of potting soil. (One or two seeds should be placed in the wet layer of plaster.) After a few days, the seeds will germinate and grow, eventually causing the dried plaster to crack. Again, students need opportunities to change variables, such as the number of seeds planted (one seed vs. multiple seeds, for example) and the type of seeds, then make observations and collect data to determine the amount of weathering each change causes to the dried plaster.

In this unit, students learn that patterns can be used as evidence to explain changes to the earth's landforms and rock formations, and that local, regional, and global patterns of rock formations reveal changes over time due to earth forces. If possible, students should make observations of local landforms; however, pictures from books and online sources can give students the opportunity to identify evidence of change from patterns in rock formations and fossils in rock layers.

Overarching Essential Questions	Overarching Enduring Understandings
● How can evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation be observed or measured? ● What can rock formations tell us about the past?	● Cause-and-effect relationships are routinely identified, tested, and used to explain change. ● Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

	● Rainfall helps to shape the land and affects the types of living things found in a region. ● Living things affect the physical characteristics of their regionsScience assumes consistent patterns in natural systems. ● Patterns can be used as evidence to support an explanation. ● Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. ● The presence and location of certain fossil types indicate the order in which rock layers were formed.
Student Learning Objectives	
● Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. [Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.] [Assessment Boundary: Assessment is limited to a single form of weathering or erosion.]	**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	**ESS2-1**

Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.] [Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.]	

The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting 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. (4-ESS2-1)	**ESS2.A: Earth Materials and Systems** Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-1) **ESS2.B: Plate Tectonics and Large Scale System Interactions** The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur	**Patterns** ● Patterns can be used as evidence to support an explanation. (4-ESS2- 2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS2- 1) ● Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) ● Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS3- 2)

	Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing 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. (4-ESS2-2) **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	in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4-ESS2-2) **ESS2.E: Biogeology** Living things affect the physical characteristics of their regions. (4-ESS2-1) **ESS3.A: Natural Resources** Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3- 1) **ESS3.B: Natural Hazards** A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. (4-ESS3-2) (Note: This Disciplinary	

on how well they meet the criteria and constraints of the design solution. (4-ESS3-2) **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. Obtain and combine information from books and other reliable media to explain phenomena. (4-ESS3-1)	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 to 4-ESS3-2)	

Embedded English Language Arts/Literacy and Mathematics

To support integration of the language arts standards in this unit, students can read content-specific texts to deepen their understanding of the cause-and-effect relationships within earth systems. As they read, students should take notes, which can be used to help them understand and explain how earth processes affect the world around them. They should ask questions, such as, What types of soil erode faster? Why do some rocks weather more easily or more quickly than others? What patterns of change can be observed using models? As they attempt to answer these questions, students can cite evidence from observations and from texts to support their thinking. In addition, students can conduct short research projects that will help them gather additional evidence to support explanations. Throughout this unit, students should collect and record data in science journals and analyze the data to identify patterns of change. Mathematics To support integration of the Mathematics standards into this unit, students are expected to use mathematics when analyzing quantitative data to identify patterns, explain cause-and-effect relationships, and make predictions. Students need opportunities to measure earth materials using tools, such as balances and graduated cylinders, and to measure distances and heights using rulers or tape measures. Students should also be required to solve problems involving measurement and data.

ELA/Literacy

- W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-ESS1-1)
- W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-ESS2-1),(4-ESS1-1)
- W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS1-1)

Mathematics

- MP.2 Reason abstractly and quantitatively. (4-ESS2-1)
- MP.4 Model with mathematics. (4-ESS2-1)
- MP.5 Use appropriate tools strategically. (4-ESS2-1)
- 4.MD.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-ESS2-1)
- 4.MD.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. (4-ESS2-1), (4-ESS2-2)

- 4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-1), (4-ESS3-2)

Articulation across grade levels:
• 2.ESS1.C (4-ESS1-1) • 3.LS4.A (4-ESS1-1) • MS.LS4.A (4-ESS1-1) • MS.ESS1.C (4-ESS1-1) • MS.ESS2.A (4-ESS1-1) • MS.ESS2.B (4-ESS1-1)

Modifications: ***Teachers identify the modifications that they will use in the unit. The unneeded modifications can then be deleted from the list.(See NGSS Appendix D)***
• *Restructure lesson using UDL principles (*http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA*)* • *Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.* • *Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques- auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).* • *Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).* • *Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).*

- *Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.*
- *Use project-based science learning to connect science with observable phenomena.*
- *Structure the learning around explaining or solving a social or community-based issue.*
- *Provide ELL students with multiple literacy strategies.*
- *Collaborate with after-school programs or clubs to extend learning opportunities*

Leveraging English Language Arts/Literacy and Mathematics
English Language Arts/Literacy- • Create and present written descriptions to accompany the models developed • Recall information from written and digital sources • Ask and answer questions to demonstrate understanding ***Mathematics-*** • Use graphs to represent data • Analyze and interpret data • Use appropriate measuring tools effectively

Differentiation		
504	● preferential seating ● extended time on tests and assignments ● reduced homework or classwork ● verbal, visual, or technology aids	● modified textbooks or audio-video materials ● behavior management support ● adjusted class schedules or grading ● verbal testing

Enrichment	• Utilize collaborative media tools • Provide differentiated feedback • Opportunities for reflection •	• Encourage student voice and input • Model close reading • Distinguish long term and short term goals
IEP	• Utilize “skeleton notes” where some required information is already filled in for the student • Provide access to a variety of tools for responses • Provide opportunities to build familiarity and to practice with multiple media tools • Graphic organizers	• Leveled text and activities that adapt as students build skills • Provide multiple means of action and expression • Consider learning styles and interests • Provide differentiated mentors
ELLs	• Pre-teach new vocabulary and meaning of symbols • Embed glossaries or definitions • Provide translations • Connect new vocabulary to background knowledge	• Provide flash cards • Incorporate as many learning senses as possible • Portray structure, relationships, and associations through concept webs • Graphic organizers
At-risk	• Purposeful seating • Counselor involvement • Parent involvement	• Contracts • Alternate assessments • Hands-on learning
21st Century Skills		
• Creativity • Innovation		• Problem Solving • Communication

● Critical Thinking	● Collaboration
Integrating Technology	
● Chromebooks ● Internet research ● Online programs	● Virtual collaboration and projects ● Presentations using presentation hardware and software

Earth Science	Grade 4	Unit 2 Earth's Systems and Earth and Human Activity	20 Instructional Days

Earth Science Unit 2 Earth's Systems and Earth and Human Activity:

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.

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

During this unit, students also learn that engineers develop or improve technologies to solve societal problems. A variety of hazards result from natural processes (e.g. earthquakes, floods, tsunamis, volcanic eruptions). Although we cannot eliminate the hazards, we can take steps to reduce their impacts. Students must have the opportunity to engage in the engineering design process in order to generate and compare multiple solutions that reduce the impacts of natural Earth processes on humans.

Overarching Essential Questions	Overarching Enduring Understandings
• What can maps tell us about the features of the world?	• Patterns can be used as evidence to support an explanation.

• In what ways can the impacts of natural Earth processes on humans be reduced?	• Maps can help locate the different land and water features of Earth. • • The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. • Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. • Major mountain chains form inside continents or near their edges • Cause-and-effect relationships are routinely identified, tested, and used to explain change. • Engineers improve existing technologies or develop new ones to increase benefits, decrease known risks, and meet societal demands. • A variety of hazards result from natural processes (e.g., earthquakes, floods, tsunamis, volcanic eruptions). • Humans cannot eliminate the hazards, but they can take steps to reduce their impacts. • Research on a problem should be carried out before beginning to design a solution. • Testing a solution involves investigating how well it performs under a range of likely conditions. • At whatever stage, communicating with peers about proposed solutions to

	a problem is an important part of the design process, and shared ideas can lead to improved designs. ● Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. ● Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.
Student Learning Objectives	
● Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]	4-ESS3-1
● 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.]	4-ESS3-2

The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting 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. (4-ESS3-2) **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and	**ESS3.A: Natural Resources** Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3- 1) **ESS3.B: Natural Hazards** A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. (4-ESS3-2) (Note: This Disciplinary Core Idea can also be found in 3.WC.) **ETS1.B: Designing Solutions to Engineering Problems**	**Cause and Effect** ● Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) ● Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS3- 2) **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. (4-ESS3- 1) **Influence of Science, Engineering and Technology on Society and the Natural World**

communicating information in 3–5 builds on K–2 experiences and progresses to evaluate the merit and accuracy of ideas and methods. Obtain and combine information from books and other reliable media to explain phenomena. (4-ESS3-1)	Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4-ESS3-2)	• Over time, people's needs and wants change, as do their demands for new and improved technologies. (4-ESS3-1) • Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2)

Embedded English Language Arts/Literacy and Mathematics

ELA/Literacy

- RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-ESS3-2)
- RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-ESS3-2)
- W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-ESS3-1)
- W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-ESS3-1)
- W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4- ESS3-1)

Mathematics

- MP.2 Reason abstractly and quantitatively. (4-ESS3-1), (4-ESS3-2)
- MP.4 Model with mathematics. (4-ESS3-1), (4-ESS3-2)

- 4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-1), (4-ESS3-2)

Articulation across grade levels:

- K.ETS1.A (4-ESS3-2)
- 2.ETS1.B (4-ESS3-2)
- 2.ETS1.C (4-ESS3-2)
- 5.ESS3.C (4-ESS3-1)
- MS.PS3.D (4-ESS3-1)
- MS.ESS2.A (4-ESS3-1), (4-ESS3-2)
- MS.ESS3.A (4-ESS3-1)
- MS.ESS3.B (4-ESS3-2)
- MS.ESS3.C (4-ESS3-1)
- MS.ESS3.D (4-ESS3-1)
- MS.ETS1.B (4-ESS3-2)

Modifications: ***Teachers identify the modifications that they will use in the unit. The unneeded modifications can then be deleted from the list.(See NGSS Appendix D)***
• *Restructure lesson using UDL principles (*http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA*)* • *Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.* • *Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques- auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).* • *Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).* • *Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).* • *Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.* • *Use project-based science learning to connect science with observable phenomena.* • *Structure the learning around explaining or solving a social or community-based issue.* • *Provide ELL students with multiple literacy strategies.* • *Collaborate with after-school programs or clubs to extend learning opportunities*

Leveraging English Language Arts/Literacy and Mathematics
English Language Arts/Literacy- • Create and present written descriptions to accompany the models developed

- Recall information from written and digital sources
- Ask and answer questions to demonstrate understanding

Mathematics-

- Use graphs to represent data
- Analyze and interpret data
- Use appropriate measuring tools effectively

Differentiation		
504	● preferential seating ● extended time on tests and assignments ● reduced homework or classwork ● verbal, visual, or technology aids	● modified textbooks or audio-video materials ● behavior management support ● adjusted class schedules or grading ● verbal testing
Enrichment	• Utilize collaborative media tools • Provide differentiated feedback • Opportunities for reflection •	• Encourage student voice and input • Model close reading • Distinguish long term and short term goals
IEP	• Utilize “skeleton notes” where some required information is already filled in for the student • Provide access to a variety of tools for responses • Provide opportunities to build familiarity and to practice with multiple media tools • Graphic organizers	• Leveled text and activities that adapt as students build skills • Provide multiple means of action and expression • Consider learning styles and interests • Provide differentiated mentors

ELLs	• Pre-teach new vocabulary and meaning of symbols • Embed glossaries or definitions • Provide translations • Connect new vocabulary to background knowledge	• Provide flash cards • Incorporate as many learning senses as possible • Portray structure, relationships, and associations through concept webs • Graphic organizers
At-risk	• Purposeful seating • Counselor involvement • Parent involvement	• Contracts • Alternate assessments • Hands-on learning
21st Century Skills		
• Creativity • Innovation • Critical Thinking		• Problem Solving • Communication • Collaboration
Integrating Technology		
• Chromebooks • Internet research • Online programs		• Virtual collaboration and projects • Presentations using presentation hardware and software

Physical Science	Grade 4	Unit 3 Energy	15 Instructional Days

Earth Science Unit 3 Energy:

In this unit of study, students develop an understanding of electrical energy and how that energy can be transferred in various ways through objects to create a circuit. Using a wide variety of different objects, students demonstrate what makes a good conductor and insulator for these electrical circuits.Students will explain how different materials interact with the circuits and why some materials make good insulators and others make good conductors.

In this unit of study, students will model how to construct an open and closed circuit and provide everyday real life examples of both circuits. Through these models, students will explain how energy is transferred from one place to another through these circuits. Using the different named parts of a circuit, students can understand how electricity from a circuit can produce light, sound, motion, and heat. Students are expected to know and understand the safety measures that go into working with circuits and how to produce them safely.

In this unit of study, students learn the different types of circuits and how energy can be transferred differently depending on the circuit type. These different types of circuits are used for different applications. Students will be able to explain which real world applications will benefit from each circuit type.

In this unit of study, students will examine two different current types, DC and AC, and the New Jersey related inventors who engineered these types of currents. After learning about these inventors and the currents they promoted, students will learn the benefits and problems with both currents and which one is used more often today.

Overarching Essential Questions	Overarching Enduring Understandings
● How can energy be transferred from one object to another? ● How have circuits helped form our modern world? ● What technology do we use in our everyday lives that rely on circuits?	● Electricity can be transferred in a number of ways, including from person to person. ● Different materials will attract electrical energy. ● Some materials can outright block or insulate electrical currents. ● Circuits are constantly being opened and closed in order to use certain technologies. ● Different types of circuits are needed in order to be more efficient. ● Circuits are used in many everyday objects that we use. ● Inventors based in New Jersey helped develop two different current types. ● Circuits can be used to produce more than just lights, also heat, sound, and motion.
Student Learning Objectives	
● Use evidence to construct an explanation relating the speed of an object to the energy of that object. [*Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.*	**PS3-1**

• Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. [*Assessment Boundary: Assessment does not include quantitative measurements of energy.*]	**PS3-2**
• 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.*]	**PS3-3**
• Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.* [Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [*Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.*]	**PS3-4**
• Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [*Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.*]	**PS4-1**

• Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. [*Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.*]	**PS4-2**
• 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.]	**PS4-3**

The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting 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 to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design	**PS3.B: Conservation of Energy and EnergyTransfer** • 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	**Energy and Matter** • Energy can be transferred in various ways and between objects. (4-PS3-1),(4-PS3-2),(4-PS3-3),(4-PS3-4) **Science is a Human Endeavor** • Most scientists and engineers work in teams. (4-PS3-4) • Science affects everyday life. (4-PS3-4)

solution. (4-PS3-2) **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. (4-PS3-1) • Apply scientific ideas to solve design problems. (4-PS3-4)	sound is produced. (4-PS3-2),(4-PS3-3) ● Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2),(4-PS3-4)	

Embedded English Language Arts/Literacy and Mathematics

ELA/Literacy

- RI.4.1. Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- RI.4.3. Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.
- RI.4.9. Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.
- W.4.2.Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- W.4.7. Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- W.4.8. Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
- W.4.9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

Mathematics

- 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.

Articulation across grade levels:

- K.PS2.B (4-PS3-3)
- K.ETS1.A (4-PS3-4)
- 2.ETS1.B (4-PS3-4)
- 3.PS2.A (4-PS3-3)
- 5.PS3.D (4-PS3-4)
- 5.LS1.C (4-PS3-4)
- MS.PS2.A (4-PS3-3)
- MS.PS3.A (4-PS3-1),(4-PS3-2),(4-PS3-3),(4-PS3-4)
- MS.PS3.B (4-PS3-2),(4-PS3-3),(4-PS3-4)
- MS.PS3.C (4-PS3-3)
- MS.PS4.B (4-PS3-2)
- MS.ETS1.B (4-PS3-4)
- MS.ETS1.C (4-PS3-4)

Modifications: ***Teachers identify the modifications that they will use in the unit. The unneeded modifications can then be deleted from the list.(See NGSS Appendix D)***

- *Restructure lesson using UDL principles (*http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA*)*
- *Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.*

- *Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques- auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).*
- *Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).*
- *Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).*
- *Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.*
- *Use project-based science learning to connect science with observable phenomena.*
- *Structure the learning around explaining or solving a social or community-based issue.*
- *Provide ELL students with multiple literacy strategies.*
- *Collaborate with after-school programs or clubs to extend learning opportunities*

Leveraging English Language Arts/Literacy and Mathematics

English Language Arts/Literacy-

- Create and present written descriptions to accompany the models developed
- Recall information from written and digital sources
- Ask and answer questions to demonstrate understanding

Mathematics-

- Use graphs to represent data
- Analyze and interpret data
- Use appropriate measuring tools effectively

Differentiation		
504	● preferential seating ● extended time on tests and assignments ● reduced homework or classwork ● verbal, visual, or technology aids	● modified textbooks or audio-video materials ● behavior management support ● adjusted class schedules or grading ● verbal testing
Enrichment	● Utilize collaborative media tools ● Provide differentiated feedback ● Opportunities for reflection ●	● Encourage student voice and input ● Model close reading ● Distinguish long term and short term goals
IEP	● Utilize “skeleton notes” where some required information is already filled in for the student ● Provide access to a variety of tools for responses ● Provide opportunities to build familiarity and to practice with multiple media tools ● Graphic organizers	● Leveled text and activities that adapt as students build skills ● Provide multiple means of action and expression ● Consider learning styles and interests ● Provide differentiated mentors
ELLs	● Pre-teach new vocabulary and meaning of symbols ● Embed glossaries or definitions ● Provide translations ● Connect new vocabulary to background knowledge	● Provide flash cards ● Incorporate as many learning senses as possible ● Portray structure, relationships, and associations through concept webs ● Graphic organizers

At-risk	• Purposeful seating • Counselor involvement • Parent involvement	• Contracts • Alternate assessments • Hands-on learning
21st Century Skills		
• Creativity • Innovation • Critical Thinking		• Problem Solving • Communication • Collaboration
Integrating Technology		
• Chromebooks • Internet research • Online programs		• Virtual collaboration and projects • Presentations using presentation hardware and software

Life Science	**Grade 4**	**Unit 4** **From Molecules to Organisms: Structures and Processes**	**25 Instructional Days**

Earth Science Unit 4 From Molecules to Organisms: Structures and Processes:

In this unit of study, students will classify different types of plants based on how they reproduce. Students will identify different types of seeds and how they sprout new plants and any special conditions those seeds may need to sprout. Seeds from different biomes will have different needs or conditions.

In this unit, students will identify and describe the parts of a plant including seeds, roots, stems, leaves, and their importance for survival. Some plants may have special parts in order to aid in survival, including camouflage, poison, or other survival characteristics. Students will analyze photosynthesis and the elements needed in order for plants to make their own energy. Students will compare the process of photosynthesis to solar powered panels collecting sunlight to be used as energy.

In this unit, students will learn and be able to categorize the parts of a flower including male and female parts, to support reproduction. Students will be able to describe how different parts of plants have adapted parts of the flower in order to survive. Investigations into how pollination occurs for different plant species and their importance. Students will also distinguish how plants and animals have adaptations in order to support the reproduction process for plants.

Overarching Essential Questions	Overarching Enduring Understandings
● How do plants grow from a seed into a mature plant? ● How have plants adapted in order to survive?	● Plants come in a variety of different seeds. ● Seeds may have different requirements in order to sprout. ● Different environments will produce different plants. ● Plants have adaptations in order to survive. ● Plants produce energy through sunlight. ● Types of plants can have different reproduction parts. ● Plants will try to spread their seeds differently, with different styles of pollination.

Student Learning Objectives	
Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. [Clarification Statement: Emphasis is on systems of information transfer.] [*Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.*]	LS1-2

The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting 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.

Embedded English Language Arts/Literacy and Mathematics

ELA/Literacy

- SL.4.5.Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.

Articulation across grade levels:

- MS.LS1.A
- MS.LS1.D

Modifications: ***Teachers identify the modifications that they will use in the unit. The unneeded modifications can then be deleted from the list.(See NGSS Appendix D)***

- *Restructure lesson using UDL principles (*http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA*)*
- *Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.*

- *Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques- auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).*
- *Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).*
- *Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).*
- *Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.*
- *Use project-based science learning to connect science with observable phenomena.*
- *Structure the learning around explaining or solving a social or community-based issue.*
- *Provide ELL students with multiple literacy strategies.*
- *Collaborate with after-school programs or clubs to extend learning opportunities*

Leveraging English Language Arts/Literacy and Mathematics

English Language Arts/Literacy-

- Create and present written descriptions to accompany the models developed
- Recall information from written and digital sources
- Ask and answer questions to demonstrate understanding

Mathematics-

- Use graphs to represent data
- Analyze and interpret data
- Use appropriate measuring tools effectively

Differentiation		
504	● preferential seating ● extended time on tests and assignments ● reduced homework or classwork ● verbal, visual, or technology aids	● modified textbooks or audio-video materials ● behavior management support ● adjusted class schedules or grading ● verbal testing
Enrichment	● Utilize collaborative media tools ● Provide differentiated feedback ● Opportunities for reflection ●	● Encourage student voice and input ● Model close reading ● Distinguish long term and short term goals
IEP	● Utilize “skeleton notes” where some required information is already filled in for the student ● Provide access to a variety of tools for responses ● Provide opportunities to build familiarity and to practice with multiple media tools ● Graphic organizers	● Leveled text and activities that adapt as students build skills ● Provide multiple means of action and expression ● Consider learning styles and interests ● Provide differentiated mentors
ELLs	● Pre-teach new vocabulary and meaning of symbols ● Embed glossaries or definitions ● Provide translations ● Connect new vocabulary to background knowledge	● Provide flash cards ● Incorporate as many learning senses as possible ● Portray structure, relationships, and associations through concept webs ● Graphic organizers

At-risk	• Purposeful seating • Counselor involvement • Parent involvement	• Contracts • Alternate assessments • Hands-on learning
21st Century Skills		
• Creativity • Innovation • Critical Thinking		• Problem Solving • Communication • Collaboration
Integrating Technology		
• Chromebooks • Internet research • Online programs		• Virtual collaboration and projects • Presentations using presentation hardware and software

APPENDIX

	4th Grade **Unit 3: Earth's Systems: Processes that Shape the Earth** (25 Instructional Days)

	Rationale: Students will understand the processes that shape their world. Content Statement: This unit will provide students with the knowledge to describe Earth's many features, how these features are affected by erosion, and how humans can reduce the impact these changes have on their lives.

Overarching Essential Questions	Overarching Enduring Understandings
• How are patterns in Earth's features created? • Can we prove that land changes over time? • How can humans reduce the impact of these changes on their lives?	• There are patterns within Earth's features. • Erosion by water, ice, wind, and vegetation affects the land over time. • evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. • Humans can minimize the effect of natural processes (earthquakes, floods, tsunamis, and volcanic eruptions.) have on their lives.

Student Learning Experiences and Formative Assessments	NGSS *Standards*
This resource is accessed through the Dynamic Earth multimedia site. Plate Tectonics and Volcanoes is selected, then Volcanoes and Hot Spots. Students visit 5 sites which discuss size, shape, and influence of plate tectonics on volcanic formations. The "Volcano Profiles" and "Inside an Active Volcano" sites allow students to scroll over volcano types and interiors, then click on specific terms to locate definitions. The "Build a Volcano" site interactive activity focuses on volcano size, strength, and shape depends on magma output, amount of gas, and viscosity. Students create their own volcano as they choose amounts of viscosity, volume, and volatility. Their created volcano is then displayed in a video. "Volcano Profiles" and "Build a Volcano" should be considered supplemental in nature, for use by students during volcanic enrichment activities.The "Tracking Volcano" site displays a map which aligns plate tectonic locations with volcanic eruption sites. The final site called, "Above Hot Spots" focuses on the development of the Kilauea volcano on the Hawaiian islands, and the past eruptions under Yellowstone Park. This section includes maps of the areas, as well as cross-sections of the earth's mantle for each location. (2 days) https://www.learner.org/interactives/dynamicearth/ This sixty-four page teacher guide / student informative text provides additional reference materials for educators who are using the Stratovolcanoes of the World poster (see Instructional Materials) Each poster featured on the map has a smaller map showing its location. Fictional stories giving details about each volcano and questions for students are also included. Teachers can also access additional references and	**4-ESS2-2.**

activities. Words in bold print in the text are defined in the accompanying glossary (3-4 days).https://www.ngdc.noaa.gov/hazard/stratoguide/stratoguide.pdf	
This hands-on activity allows students to explore five earth forces that may cause erosion as they model, observe, and record the effects of erosion on earth surfaces. Stations include demonstrations of chemical, wind, water, ice and heat forces as they affect weathering. (3-4 days) https://www.teachengineering.org/activities/view/cub_earth_lesson5_activity1	**4-ESS2-1.**
This set of 31 Weathering and Erosion slides depict landform changes that occur due to the natural processes of weathering and erosion. Captions explain/define the different causes of weathering and erosion (ice, wind, water, and vegetation). Before and after photographs of United States locations (such as Mt. St. Helens) provide contrast between processes that may occur slowly or very quickly. These slides also illustrate the beauty and uniqueness of landforms that weathering and erosion may produce. The concept of deposition is introduced using labeled diagrams that illustrate movement of weathered materials. (4 days) http://www.slideshare.net/MMoiraWhitehouse/weathering-erosion-and-depositioneasier	**4-ESS1-1.**
This activity helps to demonstrate the importance of rocks, soils, and minerals in engineering and how using the right material for the right job is important. The students build 3 different sand castles composed of varying amounts of sand, water, and glue. The 'buildings' in this lesson are made of sand and glue, sand being a soil and glue being composed of different minerals.They then test them for strength (load bearing), and resistance to weathering. The students will then compare possible solutions and discuss how well each is likely to work while meeting the criteria and constraints of the problem. The students will be the engineers who figure out which materials are best for the buildings they are making, taking into consideration all the properties of materials that are discussed in the lesson. (4 days) https://www.teachengineering.org/activities/view/cub_earth_lesson1_activity1	**4-ESS3-2.**
Students investigate which building types are structured to withstand earthquake damage. They take on the role of engineers as they design their own earthquake resistant buildings, then test them in a simulated earthquake activity. Students also develop an appreciation for the job of engineers who need to know about earthquakes and their causes in order to design resistant buildings. This lesson is one of several in the "Earthquakes Rock" unit provided by the Teach Engineering site. The unit "url" listed here is not being reviewed for the Performance Expectation listed. It is offered as a supplemental concept and lesson background aid for teachers. (4 days) ***https://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_natdis/cub_natdis_lesson03.xml*** https://www.teachengineering.org/activities/view/cub_natdis_lesson03_activity1	**4-ESS3-2.**

Summative (Benchmark) Assessment
Students become archeologists and present their most recent findings **Changing_Earth.final.pdf- copy this into your search window and download document, scroll for some great ideas-pg 97 or 151:** Observable features of the student performance by the end of the grade: 1. Articulating the explanation of phenomena a. Students identify the given explanation for a phenomenon, which includes a statement about the idea that landscapes change over time. b From the given explanation, students identify the specific aspects of the explanation they are supporting with evidence. 2 Evidence a Students identify the evidence relevant to supporting the explanation, including local and regional patterns in the following: i. Different rock layers found in an area (e.g., rock layers taken from the same location show marine fossils in some layers and land fossils in other layers). ii. Ordering of rock layers (e.g., layer with marine fossils is found below layer with land fossils). iii. Presence of particular fossils (e.g., shells, land plants) in specific rock layers. **Teacher made assessment reviewing vocabulary: (including but not limited to: convergent boundaries, divergent boundaries, transform boundaries, erosion, Ring of Fire, seismograph, delta):** Observable features of the student performance by the end of the grade: The change in the shape of Earth materials as the result of weathering or the rate of erosion by one of the following: 1. Motion of water. 2. Ice (including melting and freezing processes). 3. Wind (speed and direction). 4. Vegetation Students identify patterns in the location of Earth features, including the locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes. These relationships include: i. Volcanoes and earthquakes occur in bands that are often along the boundaries between continents and oceans. ii. Major mountain chains form inside continents or near their edges

Embedded English Language Arts/Literacy and Mathematics

Common Core State Standards Connections:

ELA/Literacy -

RI.4.1	Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-ESS3-2)
RI.4.7	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. (4-ESS2-2)
RI.4.9	Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-ESS3-2)
W.4.7	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. (4-ESS1-1),(4-ESS2-2)
W.4.8	Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-ESS1-1),(4-ESS2-1)
W.4.9	Draw evidence from literary or informational texts to support analysis, reflection, and research. *(4-ESS1-1)*

Mathematics -

MP.2	Reason abstractly and quantitatively. *(4-ESS1-1),*(4-ESS2-1),*(4- ESS3-2)*
MP.4	Model with mathematics. *(4-ESS1-1),*(4-ESS2-1)*(4-ESS3-2)*
MP.5	Use appropriate tools strategically. (4-ESS2-1)
4.MD.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-ESS1-1),(4-ESS2-1)*
4.MD.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. *(4-ESS2-1),(4-ESS2-2)*
4.OA.A.1	Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. *(4-ESS3-2)*

Three-Dimensional Teaching and Learning

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on	**ESS1.C: The History of Planet Earth** • Local, regional, and global patterns of rock formations reveal changes over time	**Patterns** • Patterns can be used as evidence to support an explanation. (4-ESS1-1),(4-

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. (4-ESS2-1) **Analyzing and Interpreting Data** Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing 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. (4-ESS2-2) **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. ● Identify the evidence that supports particular points in an explanation. (4-ESS1-1) ● Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-ESS3-2)	due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4-ESS1-1) **ESS2.A: Earth Materials and Systems** ● Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-1) **ESS2.B: Plate Tectonics and Large-Scale System Interactions** ● The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4-ESS2-2) **ESS2.E: Biogeology** ● Living things affect the physical characteristics of their regions. (4-ESS2-1) **ESS3.B: Natural Hazards** ● A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. (4-ESS3-2) *(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 to 4-ESS3-2)*	ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (4- ESS2-1),(4-ESS3-2) - ***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. (4-ESS3-2) - ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ● Science assumes consistent patterns in natural systems. (4-ESS1-1)

Prior Learning
Science: ● familiarity with data collection ● Observable patterns can help predict future changes to a system. Math: ● Awareness of comparable values within measurement: mile, km, years ● Ability to read and interpret charts and diagrams Social Studies: ● Awareness of basic map features

Modifications: *Teachers identify the modifications that they will use in the unit. The unneeded modifications can then be deleted from the list.(See NGSS Appendix D)*
● *Restructure lesson using UDL principals (*http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA*)* ● *Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.* ● *Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).* ● *Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).* ● *Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).* ● *Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.*

- *Use project-based science learning to connect science with observable phenomena.*
- *Structure the learning around explaining or solving a social or community-based issue.*
- *Provide ELL students with multiple literacy strategies.*
- *Collaborate with after-school programs or clubs to extend learning opportunities.*

Samples of Open Education Resources for this unit:
Smithsonian- this website has lesson plans and web-based projects to support learning.
Bill Nye the Science Guy -this website contains a wide variety of videos to support instruction
Better Lesson is a site to find sample lesson plans on a given NGSS topic
EdPuzzle is a site where you can choose and assign premade videos/comprehension questions or create your own videos with embedded questioning
Teaching Channel is a website where you can learn about the principles of Steam lessons
Stem4fun is a website where you can find printables for recording observation
Khan Academy is a resource for teachers and students alike to gain a deeper, intuitive understanding of science and math concepts.
NSTA Classroom Resources is a website of sample lessons aligned directly with each 7th grade space and Life Science unit.
Brainpop is a website of short mini-lesson videos.
CK-12 is a resource where you can create supplemental content in online “flexbooks” for students aligned with NGSS.
PhET Simulator is a resource of simulations of hundreds of concepts.

Appendix

Differentiation	
Enrichment	● Utilize collaborative media tools ● Provide differentiated feedback ● Opportunities for reflection ● Encourage student voice and input ● Model close reading ● Distinguish long term and short term goals
Intervention & Modification	● Utilize “skeleton notes” where some required information is already filled in for the student ● Provide access to a variety of tools for responses ● Provide opportunities to build familiarity and to practice with multiple media tools ● Leveled text and activities that adapt as students build skills ● Provide multiple means of action and expression ● Consider learning styles and interests ● Provide differentiated mentors ● Graphic organizers

ELLs	• Pre-teach new vocabulary and meaning of symbols • Embed glossaries or definitions • Provide translations • Connect new vocabulary to background knowledge • Provide flash cards • Incorporate as many learning senses as possible • Portray structure, relationships, and associations through concept webs • Graphic organizers
21st Century Skills	
• Creativity • Innovation • Critical Thinking • Problem Solving • Communication • Collaboration	
Integrating Technology	
• Chromebooks • Internet research • Online programs • Virtual collaboration and projects • Presentations using presentation hardware and software	

4th Grade

Unit 2: Structure, Function, and Information Processing (20 Instructional Days)

Rationale: Students will begin to understand how plants and animals interact with their environment.

Content Statement: This unit will provide students with the knowledge to describe how living things gather information from their environment and how this information affects behavior, helps them grow, survive, and reproduce.

Overarching Essential Questions	Overarching Enduring Understandings
• How do animals use their senses to get information from their surroundings? • How do our eyes work? • What other systems are within plants and animals that help them grow, survive, reproduce, and can affect their behavior?	• Animals receive different types of information through their senses. They process the information in their brains. They respond to the information in different ways. • Light reflecting from objects and entering the eye allows objects to be seen. • Plants and animals have internal and external structures that support growth, survival, reproduction, and behavior.

Student Learning Experiences and Formative Assessments	NGSS *Standards*
This lesson sequence involves student investigation of human reaction time and variables that may affect it. An initial phase has students practice catching a dropped ruler and converting the distance it drops to the length of time it took to react. This provides an opportunity for data collection, graphing, and writing a conclusion. After this guided inquiry phase, students may conduct research on human senses and reaction time, or move on to designing their own investigations of the effects of variables of their choosing on their reaction times. (7 days) **http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/science/Gr5_Task_Student.pdf**	**4-LS1-2.**
In this activity, students make a pinhole camera and see images formed on an internal screen. They then use a lens to see how this affects the images. Students investigate variables in its construction, and explore how it models the human eye's ability to receive and process information. http://sciencelearn.org.nz/Contexts/Light-and-Sight/Teaching-and-Learning-Approaches/Pinhole-cameras-and-eyes (4 days)	**4-PS4-2**

This resource provides some background information and discussion questions about camouflage and countershading as an example of penguin adaptation. Then students engage in an experiment to simulate the effectiveness of blubber as an insulator against the cold temperatures penguins typically experience. A worksheet is provided that explains other penguin adaptations and asks comprehension questions based on the text. http://www.educationinnature.com/~/media/Corporate/EIN/Files/LessonPlans/CamouflageCountershadingAdaptationsLessonPlan.ashx?force=1 (3-4 days)	**4-LS1-1.**
In this activity students examine how the structure of various animal mouthparts affects their function. They will have an opportunity to predict what foods are likely to be eaten by birds with different beak types, watch a video comparing and analyzing snake and human mouth structures, and construct explanations about how other animals' mouths are related to their feeding (4 days) (strategies.http://nj.pbslearningmedia.org/resource/tdc02.sci.life.colt.lp_mouths/animal-mouth-structures/	**4-LS1-1.**

Summative (Benchmark) Assessment
Create your own insect project: http://www.siemensscienceday.com/activities/createyourowninsect.cfm (search insect, and you will locate the lesson plan): Observable features of the student performance by the end of the grade: 1 Supported claims a Students make a claim to be supported about a phenomenon. In the claim, students include the idea that plants and animals have internal and external structures that function together as part of a system to support survival, growth, behavior, and reproduction. 2 Identifying scientific evidence a Students describe* the given evidence, including: i. The internal and external structures of selected plants and animals. ii. The primary functions of those structures 3 Evaluating and critiquing evidence a Students determine the strengths and weaknesses of the evidence, including whether the evidence is relevant and sufficient to support a claim about the role of internal and external structures of plants and animals in supporting survival, growth, behavior, and/or reproduction. 4 Reasoning and synthesis a Students use reasoning to connect the relevant and appropriate evidence and construct an argument that includes the idea that plants and animals have structures that, together, support survival, growth, behavior, and/or reproduction. Students describe* a chain of reasoning that includes: i. Internal and external structures serve specific functions within plants and animals (e.g., the heart pumps blood to the body, thorns discourage predators). ii. The functions of internal and external structures can support survival, growth, behavior, and/or reproduction in plants and animals (e.g., the heart pumps blood throughout the body, which allows the entire body access to oxygen and nutrients; thorns prevent predation, which allows the plant to grow and reproduce). iii. Different structures work together as part of a system to support survival, growth, behavior, and/or reproduction (e.g., the heart works with the lungs to carry oxygenated blood throughout the system; thorns protect the plant, allowing reproduction via stamens and pollen to occur). **Teacher created test covering key terminology discussed through lessons: (including but not limited to: adaptation, lens, cornea, camouflage, countershading, insulation, reaction time):** Observable features of the student performance by the end of the grade: Connections a. Students use the model to describe* that: i. Information in the environment interacts with animal behavioral output via interactions mediated by the brain. ii. Different types of sensory information are relayed to the brain via different sensory receptors, allowing experiences to be perceived, stored as memories, and influence behavior (e.g., an animal sees a brown, rotten fruit and smells a bad odor — this sensory information allows the animal to use information about other fruits that appear to be rotting to make decisions about what to eat; an animal sees a red fruit and a green fruit — after eating them both, the animal learns that the red fruit is sweet and the green fruit is bitter and then uses this sensory information, perceived

and stored as memories, to guide fruit selection next time). iii. Sensory input, the brain, and behavioral output are all parts of a system that allow animals to engage in appropriate behaviors. b Students use the model to test interactions involving sensory perception and its influence on animal behavior within a natural system, including interactions between: i. Information in the environment. June 2015 Page 12 of 20 ii. Different types of sense receptors. iii. Perception and memory of sensory information. iv. Animal behavior.

Embedded English Language Arts/Literacy and Mathematics

Common Core State Standards Connections:

ELA/Literacy -

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

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

Mathematics -

MP.4 Model with mathematics. *(4-PS4-2)*

4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. *(4-PS4-2)*

4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. *(4-LS1-1)*

Three-Dimensional Teaching and Learning

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting 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. (4-PS4-2) **LS1.A: Structure and Function**	**Cause and Effect** • Cause and effect relationships are routinely identified. (4-PS4-2) **Systems and System Models** • A system can be described in terms of its

(4-PS4-2) • Use a model to test interactions concerning the functioning of a natural system. (4-LS1-2) **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. (4-LS1-1)	• Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1) **LS1.D: Information Processing** • Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4-LS1-2)	components and their interactions. (4-LS1-1),(4-LS1-2)

Prior Learning
Science: • how to record results using charts and graphs Mathematics: • Basic Measurement skills (length, height, volume) • Basic computation skills • graphing • data collection

Modifications: *Teachers identify the modifications that they will use in the unit. The unneeded modifications can then be deleted from the list.(See NGSS Appendix D)*
• *Restructure lesson using UDL principles (*http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA*)* • *Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.*

- *Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).*
- *Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).*
- *Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).*
- *Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.*
- *Use project-based science learning to connect science with observable phenomena.*
- *Structure the learning around explaining or solving a social or community-based issue.*
- *Provide ELL students with multiple literacy strategies.*
- *Collaborate with after-school programs or clubs to extend learning opportunities.*

Samples of Open Education Resources for this unit:
Better Lesson is a site to find sample lesson plans on a given NGSS topic
EdPuzzle is a site where you can choose and assign premade videos/comprehension questions or create your own videos with embedded questioning
Teaching Channel is a website where you can learn about the principles of Steam lessons
Stem4fun is a website where you can find printables for recording observation
Khan Academy is a resource for teachers and students alike to gain a deeper, intuitive understanding of science and math concepts.
NSTA Classroom Resources is a website of sample lessons aligned directly with each 7th grade space and Life Science unit.
Brainpop is a website of short mini-lesson videos.
CK-12 is a resource where you can create supplemental content in online “flexbooks” for students aligned with NGSS.
PhET Simulator is a resource of simulations of hundreds of concepts.

Appendix

Differentiation	
Enrichment	● Utilize collaborative media tools ● Provide differentiated feedback ● Opportunities for reflection ● Encourage student voice and input ● Model close reading ● Distinguish long term and short term goals
Intervention & Modification	● Utilize “skeleton notes” where some required information is already filled in for the student ● Provide access to a variety of tools for responses ● Provide opportunities to build familiarity and to practice with multiple media tools ● Leveled text and activities that adapt as students build skills ● Provide multiple means of action and expression ● Consider learning styles and interests ● Provide differentiated mentors ● Graphic organizers

ELLs	• Pre-teach new vocabulary and meaning of symbols • Embed glossaries or definitions • Provide translations • Connect new vocabulary to background knowledge • Provide flash cards • Incorporate as many learning senses as possible • Portray structure, relationships, and associations through concept webs • Graphic organizers
21st Century Skills	
• Creativity • Innovation • Critical Thinking • Problem Solving • Communication • Collaboration	
Integrating Technology	
• Chromebooks • Internet research • Online programs • Virtual collaboration and projects • Presentations using presentation hardware and software	

4th Grade

Unit 1: Energy and Waves (20 Instructional Days)

Rationale: Students will learn how energy relates to their lives.
Content Statement: This unit will provide students with the knowledge to describe what energy is, how it is related to motion, how energy is transferred, and how energy can be used to solve a problem.

Overarching Essential Questions	Overarching Enduring Understandings
• What effects the energy of an object? • How can energy be transferred from one object to another? • How is energy transferred from one object to another? • How do people obtain energy from their surroundings?	• Speed of an object affects the energy of that object • Energy can be transferred from one object to another • People obtain energy from their environment through renewable and nonrenewable sources • Using non-renewable resources to create energy affects our environment • There are patterns within waves in terms of amplitude and wavelength. • Patterns within waves transfer information

Student Learning Experiences and Formative Assessments	NGSS *Standards*
Students create Spool Racers: The students build their own spool racers and then conduct tests with the racer by varying the number of twists in the rubber band or changing other design features. http://ngss.nsta.org/Resource.aspx?ResourceID=22 (3-4 days)	**4-PS3-1.**
Electric Messages: Then and Now: This lesson integrates social studies and energy transfer concepts as students explore the history of electronic messaging systems (Morse Code and text messaging) before applying concepts of energy transfer through the construction of a simple signaling device by which they can send messages to each other via Morse Code.https://www.ieee.org/documents/electricmessages.pdf (4 days)	**4-PS3-2** **4-PS4-3.**

Sled Wars/ Gizmos: Students explore acceleration, speed, momentum, and energy by sending a sled down a hill into a group of snowmen.https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=1055 (3 days)	**4-PS3-3.**
Cooking with the Sun- In this lesson students build and then compare four different solar cookers. They measure the temperature of water in the cooker and graph changes over time: https://www.teachengineering.org/activities/view/cub_energy2_lesson09_activity3 (3 days)	**4-PS3-4.**
Pop Bottle Waves and Hairdryer Ripples: In this lesson, the students 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. (3 days) http://betterlesson.com/lesson/636706/pop-bottle-waves-hair-dryer-ripples	**4-ESS3-1.**

Summative (Benchmark) Assessment (2 days)
Rube Goldberg Project: Mousetrap Observable features of the student performance by the end of the grade: Identifying the phenomenon under investigation a. From the given investigation plan, students describe* the phenomenon under investigation, which includes the following ideas: i. The transfer of energy, including: 1. Collisions between objects. 2. Light traveling from one place to another. 3. Electric currents producing motion, sound, heat, or light. 4. Sound traveling from one place to another. 5. Heat passing from one object to another. 6. Motion, sound, heat, and light causing a different type of energy to be observed after an interaction (e.g., in a collision between two objects, one object may slow down or stop, the other object may speed up, and the objects and surrounding air may be heated; a specific sound may cause the movement of an object; the energy associated with the motion of an object, via an electrical current, may be used to turn on a light). b Students describe* the purpose of the investigation, which includes providing evidence for an explanation of the phenomenon, including the idea that energy can be transferred from place to place by: i. Moving objects. June 2015 Page 2 of 20 ii. Sound. iii. Light. iv. Heat. v. Electric currents. 2 Identifying the evidence to address the purpose of the investigation a From the given investigation plan, students describe* the data to be collected that will serve as the basis for evidence, including: i. The motion and collision of objects before and after an interaction (e.g., when a given object is moving fast, it can move another object farther than when the same object is moving more slowly). ii. The relative presence of sound, light, or heat (including in the surrounding air) before and after an interaction (e.g. shining a light on an object can increase the temperature of the object; a sound can move an object). iii. The presence of electric currents flowing through wires causally linking one form of energy output (e.g., a moving object) to another form of energy output (e.g., another moving object; turning on a light bulb). b Students describe* how their observations will address the purpose of the investigation, including how the observations will provide evidence that energy, in the form of light, sound, heat, and motion, can be transferred from place to place by sound, light, heat, or electric currents (e.g., in a system in which the motion of an object generates an observable electrical current to turn on a light, energy (from the motion of an object) must be transferred to

another place (energy in the form of the light bulb) via the electrical current, because the motion doesn't cause the light bulb to light up if the wire is not completing a circuit between them; when a light is directed at an object, energy (in the form of light) must be transferred from the source of the light to its destination and can be observed in the form of heat, because if the light is blocked, the object isn't warmed. 3 Planning the investigation a From the given investigation plan, students identify and describe* how the data will be observed and recorded, including the tools and methods for collecting data on: i. The motion and collision of objects, including any sound or heat producing the motion/collision, or produced by the motion/collision. ii. The presence of energy in the form of sound, light, or heat in one place as a result of sound, light, or heat in a different place. iii. The presence of electric currents in wires and the presence of energy (in the form of sound, light, heat, or motion resulting from the flow of electric currents through a device). b Students describe* the number of trials, controlled variables, and experimental set up. 4 Collecting the data a Students make and record observations according to the given investigation plan to provide evidence that: i. Energy is present whenever there are moving objects, sound, light, or heat. ii. That energy has been transferred from place to place (e.g., a bulb in a circuit is not lit until a switch is closed and it lights, indicating that energy is transferred through electric current in a wire to light the bulb; a stationary ball is struck by a moving ball, causing the stationary ball to move and the moving ball to slow down, indicating that energy has been transferred from the moving ball to the stationary one).

Teacher created test covering key terminology discussed through lessons: (including but not limited to: conduction, convection, insolation, renewable, non-renewable, momentum, energy, friction, kinetic, potential energy, speed):

Students describe the phenomenon which include the following ideas: i. The transfer of energy, including: 1. Collisions between objects. 2. Light traveling from one place to another. 3. Electric currents producing motion, sound, heat, or light. 4. Sound traveling from one place to another. 5. Heat passing from one object to another. 6. Motion, sound, heat, and light causing a different type of energy to be observed after an interaction (e.g., in a collision between two objects, one object may slow down or stop, the other object may speed up, and the objects and surrounding air may be heated; a specific sound may cause the movement of an object; the energy associated with the motion of an object, via an electrical current, may be used to turn on a light).

Embedded English Language Arts/Literacy and Mathematics	
Common Core State Standards Connections: Energy	
	ELA/Literacy -
RI.4.1	Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS3-1)
RI.4.3	Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. (4-PS3-1)
RI.4.9	Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. *(4-PS3-1)*
W.4.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (4-PS3-1)
W.4.7	Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4- PS3-2),(4-PS3-3),(4-PS3-4),*(4-ESS3-1)*
W.4.8	Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-PS3-1),(4-PS3-2),(4-PS3-3),(4-PS3-4),(4-ESS3-1)
W.4.9	Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-PS3-1),*(4-ESS3-1)*
	Mathematics -
MP.2	Reason abstractly and quantitatively. *(4-ESS3-1)*
MP.4	Model with mathematics. *(4-ESS3-1)*

4.OA.A.1	Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-1)
4.OA.A.3	Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. *(4-PS3-4)*
	Common Core State Standards Connections: Waves
	ELA/Literacy -
RI.4.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and inf *PS4-3)*
RI.4.9	Integrate information from two texts on the same topic in order to write or speak about knowledgeably. (4-PS4-3)
SL.4.5	Add audio recordings and visual displays to presentations when appropriate to enhanc development of main ideas or themes. *(4-PS4-1)*
	Mathematics -
MP.4	Model with mathematics. *(4-PS4-1)*
4.G.A.1	Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicula lines. Identify these in two-dimensional figures. *(4-PS4-1)*

Three-Dimensional Teaching and Learning

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in grades 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. (4-PS3-3)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds

Disciplinary Core Ideas

PS3.A: Definitions of Energy

- The faster a given object is moving, the more energy it possesses. (4-PS3-1)
- Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2),(4-PS3-3)

PS3.B: Conservation of Energy and EnergyTransfer

- Energy is present whenever there are moving objects, sound, light, or heat.

Crosscutting Concepts

Energy and Matter

- Energy can be transferred in various ways and between objects. (4-PS3-1),(4-PS3-2),(4-PS3-3),(4-PS3-4)

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1)

- -

Connections to Engineering, Technology, and Applications of Science

on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. ● Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2) **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. (4-PS3-1) ● Apply scientific ideas to solve design problems. (4-PS3-4) **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. ● Obtain and combine information from books and other reliable media to explain phenomena. (4-ESS3-1)	When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4-PS3-2), (4-PS3-3) ● Light also transfers energy from place to place. (4-PS3-2) ● Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2),(4-PS3-4) **PS3.C: Relationship Between Energy and Forces** ● When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3- 3) **PS3.D: Energy in Chemical Processes and Everyday Life** ● The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4) **ESS3.A: Natural Resources** ● Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1) **ETS1.A: Defining 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	**Interdependence of Science, Engineering, and Technology** ● Knowledge of relevant scientific concepts and research findings is important in engineering. (4-ESS3-1) **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. (4-ESS3-1) ● Engineers improve existing technologies or develop new ones. (4-PS3-4) - ***Connections to Nature of Science*** **Science is a Human Endeavor** ● Most scientists and engineers work in teams. (4-PS3-4) ● Science affects everyday life. (4-PS3-

	specified criteria for success or how well each takes the constraints into account. *(secondary to 4-PS3-4)*	

Prior Learning
Science: ● Basic understanding of cause and effect. ● Understanding that patterns of motion can be observed and measured ● Understanding that patterns of change can be used to make predictions Mathematics: ● Basic Measurement skills (length, height, volume) ● Basic computation skills

Modifications: *Teachers identify the modifications that they will use in the unit. The unneeded modifications can then be deleted from the list.(See NGSS Appendix D)*
Restructure lesson using UDL principles (http://www.cast.org/our-work/about- udl.html#.VXmoXcfD_UA) ● Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. ● Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). ● Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies). ● Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).

● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

● Use project-based science learning to connect science with observable phenomena.

● Structure the learning around explaining or solving a social or community-based issue.

● Provide ELL students with multiple literacy strategies.

● Collaborate with after-school programs or clubs to extend learning opportunities.

Samples of Open Education Resources for this unit:
Better Lesson is a site to find sample lesson plans on a given NGSS topic EdPuzzle is a site where you can choose and assign premade videos/comprehension questions or create your own videos with embedded questioning Teaching Channel is a website where you can learn about the principles of Steam lessons Stem4fun is a website where you can find printables for recording observation Khan Academy is a resource for teachers and students alike to gain a deeper, intuitive understanding of science and math concepts. NSTA Classroom Resources is a website of sample lessons aligned directly with each 7th grade space and Life Science unit. Brainpop is a website of short mini-lesson videos. CK-12 is a resource where you can create supplemental content in online “flexbooks” for students aligned with NGSS. PhET Simulator is a resource of simulations of hundreds of concepts.

Appendix

Differentiation	
Enrichment	● Utilize collaborative media tools ● Provide differentiated feedback ● Opportunities for reflection ● Encourage student voice and input ● Model close reading ● Distinguish long term and short term goals
Intervention & Modification	● Utilize “skeleton notes” where some required information is already filled in for the student ● Provide access to a variety of tools for responses ● Provide opportunities to build familiarity and to practice with multiple media tools ● Leveled text and activities that adapt as students build skills ● Provide multiple means of action and expression ● Consider learning styles and interests ● Provide differentiated mentors ● Graphic organizers

ELLs	● Pre-teach new vocabulary and meaning of symbols ● Embed glossaries or definitions ● Provide translations ● Connect new vocabulary to background knowledge ● Provide flash cards ● Incorporate as many learning senses as possible ● Portray structure, relationships, and associations through concept webs ● Graphic organizers
21st Century Skills	
● Creativity ● Innovation ● Critical Thinking ● Problem Solving ● Communication ● Collaboration	
Integrating Technology	
● Chromebooks ● Internet research ● Online programs ● Virtual collaboration and projects ● Presentations using presentation hardware and software	