Audubon Public Schools

Grade 2: Science

Curriculum Guide

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Course Description

Grade 2: Science

Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s). The performance expectations in elementary school grade bands develop ideas and skills that will allow students to explain more complex phenomena in the four disciplines as they progress to middle school and high school. While the performance expectations shown in kindergarten through fifth grade couple particular practices with specific disciplinary core ideas, instructional decisions should include use of many practices that lead to the performance expectations.

Overview / Progressions

Grade 2: Science

Overview		Earth and Space Sciences	Life Sciences	Physical Sciences
Unit 1	**Focus standards (Objectives)**		2-LS4-1 2-LS2-1 2-LS2-2 K-2-ETS1-1	
Unit 2	**Focus standards (Objectives)**			2-PS1-1 2-PS1-2 K-2 ETS1-3
Unit 3	**Focus standards (Objectives)**			2-PS1-3 2-PS1-4
Unit 4	**Focus standards**	2-ESS2-3 2-ESS2-2		
Unit 5		2-ESS1-1 2-ESS2-1 K-2-ETS1-1 K-2-ETS1-2		

Physical Science	Grade 2	Unit 1	Trimester 1

Physical Science Unit 1- Properties of Matter: (20 Instructional Days)

How do the properties of materials determine their use?

In this unit of study, students demonstrate an understanding of observable properties of materials through analysis and classification of different materials. 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 demonstrate grade-appropriate proficiency in planning and carrying out investigations and analyzing and interpreting data. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Overarching Essential Questions	Overarching Enduring Understandings
What is matter? How is matter classified? s physical properties. ********** Essential Questions: What is matter? What are the properties of a solid, liquid, and gas? How can properties of matter be changed? How can states of matter be changed? How do properties of an object affect its use? How do scientists gather information?	Everything is matter-solids, liquids, and gases. Matter is observed and classified by its physical properties. ********** Enduring Understandings: The structures of materials determine their properties. Everything is matter-solids, liquids, and gases. Water can exist in any of three states. The state of matter is primarily determined by its temperature. Changing the temperature of matter may change its state.

	Some properties of matter change as a result of processes such as heating and cooling. Not all materials respond the same way to these processes. Scientists use inquiry skills and science tools to find out information.
Student Learning Objectives	
Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. *[Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]*	2-PS1-1
Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. *[Clarification Statement: Examples of properties could include strength, flexibility, hardness, texture, and absorbency.] [Assessment Boundary: Assessment of quantitative measurements is limited to length.]*	2-PS1-2
Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	K-2-ETS1-3

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 K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.	**PS1.A: Structure and Properties of Matter** Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1)	**Patterns** Patterns in the natural and human designed world can be observed. (2-PS1-1) **Cause and Effect** Events have causes that generate observable patterns. (2-PS1-4)

• Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.(2-PS1-1) **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. • Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2-PS1-3) **Engaging in Argument from Evidence**	• Different properties are suited to different purposes. (2- PS1-2),(2-PS1-3) • A great variety of objects can be built up from a small set of pieces. (2-PS1-3) **PS1.B: Chemical Reactions** • Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)	Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2) **Energy and Matter** • Objects may break into smaller pieces and be put together into larger pieces, or change shapes. (2-PS1-3) - **Connections to Engineering, Technology, and Applications of Science** **Influence of Engineering, Technology, and Science, on Society and the Natural World** Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. (2-PS1-2)

Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s). ● Construct an argument with evidence to support a claim. (2-PS1-4) --- ***Connections to Nature of Science*** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ● Scientists search for cause and effect relationships to explain natural events. (2-PS1-4)		

Embedded English Language Arts/Literacy and Mathematics

English Language Arts

The NJSLS for English Language Arts can be incorporated in this unit in a number of ways. Students can participate in shared research, using trade books and online resources, to learn about the properties of matter. As students explore different types of materials, they can record their observations in science journals, and then use their notes to generate questions that can be used for formative or summative assessment. Students can add drawings or other visual displays to their work, when appropriate, to help clarify their thinking. To teach students how to describe how reasons support specific points an author makes in a text, teachers can model the comprehension skill of main idea and details using informational text about matter. Technology can be integrated into this unit of study using free software programs (e.g., Animoto) that students can use to produce and publish their writing in science.

Mathematics

Throughout this unit of study, students have opportunities to model with mathematics and reason abstractly and quantitatively. During investigations, students can collect and organize data using picture graphs and/or bar graphs (with a single-unit scale). This can lead to opportunities to analyze data and solve simple put together, take-apart, and compare problems using information presented in these types of graphs. Some examples of ways to sort and classify materials in order to create graphs include:

- Classifying materials as solids, liquids, or gases.
- Classifying materials by color, shape, texture, or hardness.
- Classifying materials based on what they are made of (e.g., wood, metal, paper, plastic).
- Classifying materials based on potential uses.

With any graph that students create, they should be expected to analyze the data and answer questions that require them to solve problems.

New Jersey Student Learning Standards:

ELA/Literacy –

RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (2-PS1-4)

RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-PS1-4)

RI.2.8 Describe how reasons support specific points the author makes in a text. (2-PS1-2),(2-PS1-4)

W.2.1 Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., because, and, also) to connect opinion and reasons, and provide a concluding statement or section. (2-PS1-4)

W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-PS1-1),(2-PS1- 2),(2-PS1-3)

W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-PS1-1),(2-PS1-2),(2-PS1-3)

Mathematics

MP.2 Reason abstractly and quantitatively. (2-PS1-2)

MP.4 Model with mathematics. (2-PS1-1),(2-PS1-2)

MP.5 Use appropriate tools strategically. (2-PS1-2)

2.MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (2-PS1-1),(2-PS1-2)

Three-Dimensional Teaching and Learning
In this unit of study, students look for patterns and cause-and-effect relationships as they describe and classify materials using physical properties. In addition, students collaboratively plan and carry out investigations and analyze and interpret data in order to determine which materials are best suited for an intended purpose. In the natural world, different types of matter exist, and all matter can be described and classified according to physical properties. To begin this unit's progression of learning, students plan and conduct investigations to describe different kinds of material using observable properties. They will collect data during these investigations; analyze the data to find patterns, such as similar properties that different materials share; and use the data to classify materials. Materials can be classified by color, texture, hardness, flexibility, or state of matter. For example, students can explore hardness of rocks by shaking them in containers to see how easily they break apart. They can explore viscosity by pouring a set amount of various liquids, such as glue, oil, and water from one container to another to observe the relative speed that each flows. Students can also heat or cool a variety of materials, such as butter, chocolate, or pieces of crayon, in order to determine whether or not these materials can be either solid or liquid depending on temperature. Because every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world, it is important that students understand that different properties are suited to different purposes. After investigating and classifying a variety of materials based on their physical properties, students will engage in the engineering design process. Students can work collaboratively, with adult guidance, to test different materials to determine which have properties that are best suited for an intended purpose. For example, this project could be launched using the children's story, *The Three Little Pigs*. After reading the story, students would: ● Investigate the physical properties of straw, sticks, and bricks in order to determine what properties make bricks the material best suited for building a house. ● Work together to brainstorm a list of possible structures that could be built with different materials. For example, students could build bridges or simple roller coasters for marbles. ● Select one structure from the list and determine the intended purpose of that structure. ● Select two or three different materials that could be used to build the structure. ● Investigate the physical properties of the materials, including shape, strength, flexibility, hardness, texture, or absorbency. ● Collect and analyze data to determine whether or not the given materials have properties that are suited for the intended purpose of the selected structure. ● In groups, use one of the materials to build the structure. (Teachers should have different groups use different materials.)

- Test and compare how each structure performs. Because there is always more than one possible solution to a problem, it is useful to compare the strengths and weaknesses of each structure and each material used.

Integration of engineering

In this unit, students investigate the physical properties of a variety of materials, and then build a structure with materials that are best suited for the structure's intended purpose. This process is outlined in greater detail in the previous section.

Prior Learning
• A situation that people want to change or create can be approached as a problem to be solved through engineering. • Asking questions, making observations, and gathering information are helpful in thinking about problems. • Before beginning to design a solution, it is important to clearly understand the problem. • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people

Part A: How can we sort objects into groups that have similar patterns?

Can some materials be a solid or a liquid?

Concepts	**Formative Assessment**
• Patterns in the natural and human-designed world can be observed. • Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. • Matter can be described and classified by its observable properties.	*Students who understand the concepts can:* ● Observe patterns in the natural and human-designed world. ● Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. ● Plan and conduct an investigation to describe and classify different kinds of material by their observable properties. Observations could include color, texture, hardness, and

	flexibility. Patterns could include the similar properties that different materials share.

Part B: What should the three little pigs have used to build their houses?	
Concepts	**Formative Assessment**
• Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. • Simple tests can be designed to gather evidence to support or refute student ideas about causes. • Different properties are suited to different purposes. • Because there is always more than one possible solution to a problem, it is useful to compare and test designs.	*Students who understand the concepts can:* ● Design simple tests to gather evidence to support or refute student ideas about causes. ● Analyze data from tests of an object or tool to determine if it works as intended. ● Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. (Assessment of quantitative measurements is limited to length.) Examples of properties could include: ● Strength ● Flexibility ● Hardness ● Texture ● Absorbency Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of each.

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)***

(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.)

- 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.
- Restructure lesson using UDL principles (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).

Leveraging English Language Arts/Literacy and Mathematics

English Language Arts/Literacy-

- Read and discuss the different building materials of each house The Three Little Pigs
- Develop a written response of why bricks were suited best for a structure

Mathematics-

- Analyze data from tests conducted and graph results of material strength

Samples of Open Education Resources for this unit:

Exploring Reversible Changes of State and Exploring Irreversible Changes of State: These two lessons work together to explore reversible and irreversible changes of state through guided investigations. The PDF is a set of activities focusing on materials followed by some optional post-activity lessons.

Discovering Science: classifying and categorizing (matter, grades 2-3): This resource is a day, or longer, lab activity aimed for second and third grade students. The lesson starts with a guided discussion and an activity identifying and classifying materials, then it guides students through a series of observations of mixing and changing different materials of different states and observing the resulting effects. Overall, the lesson targets the states of matter, and forces and motion. Some of the ideas (i.e., gas and energy) are aimed at the third grader and beyond. Please note that the link above goes to a larger set of activities and you need to click on the link Discovering science: Classifying and categorizing matter grades 2-3.

Materials and Their Properties, lessons Comparing the Properties of Different Materials (pp. 22); and Exploring Thermal Insulators and Conductors (pp. 23): Students participate in an open-ended sort using various materials. Based on their self-selected categories, students explain their reasoning. Next, through a fair test trial, students use new information to decide, using evidence, which material is best suited for maintaining cold the longest.

The Properties of Materials and their Everyday Uses: This wonderful set of lessons engage students in testing materials to understand their properties and discuss appropriate uses for the materials based on those properties. For example, one activity has the students examining the materials that a number of balls are made out of (plastic, rubber, aluminum, etc.) and describing the properties of the materials (light, stretchy, rigid). Next, the students test balls made of those materials for bouncing height and record their data. The students discuss which materials are best for bouncing and why. The teacher could choose to do all of

the activities and have a robust alignment with the three dimensions of the NGSS PS1-2, an engineering physical science Performance Expectation.

Matter song a music video by untamed Science: This is an engaging music video that defines and gives examples of matter. The video is fun, colorful and explores many different kinds of matter as part of the music video sequence. Young students will love the song and the interactive dance sequences.

Science Games For Kids: Properties of Materials: This resource is an interactive simulation designed to have students test various materials for different properties including flexibility, strength, waterproof, and transparency. The simulation includes a workshop where students can select different materials to see if the selected property matches the intended use.

Mystery Science: Mystery Science provides ready-made science mysteries for elementary school students. Each lesson contains a central mystery, discussion questions, supplemental reading, and a hands-on activity.

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

Earth and Space Science	Grade 2	Unit 2	Trimester 1

Earth and Space Science Unit 2- The Earth's Land and Water: (15 Instructional Days)	
Where do we find water? In this unit of study, students use information and models to identify and represent the shapes and kinds of land and bodies of water in an area and where water is found on Earth. The crosscutting concept of *patterns* is called out as an organizing concept for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in *developing and using models* and *obtaining, evaluating, and communicating information*. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 2-ESS2-3 and 2-ESS2-2.	
Overarching Essential Questions	**Overarching Enduring Understandings**
How does land change and what are some things that cause it to change? What are the different types of land and water?	Understand that wind and water can change the shape of the land. Identify and represent the shapes and kinds of lands and bodies of water in an area and where water is found on earth.
Student Learning Objectives	
Obtain information to identify where water is found on Earth and that it can be solid or liquid.	2-ESS2-3
Develop a model to represent the shapes and kinds of land and bodies of water in an area.	2-ESS2-2

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**
Obtaining, Evaluating, and Communicating Information ● Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question. (2-ESS2-3) **Developing and Using Models** ● Develop a model to represent patterns in the natural world. (2-ESS2-2)	**ESS2.C: The Roles of Water in Earth's Surface Processes** ● Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. (2-ESS2-3) **ESS2.B: Plate Tectonics and Large-Scale System Interactions** Maps show where things are located. One can map the shapes and kinds of land and water in any area. (2-ESS2-2)	**Patterns** ● Patterns in the natural world can be observed. (2-ESS2-2),(2-ESS2-3)

Embedded English Language Arts/Literacy and Mathematics

English Language Arts

Students gather information about the types of landforms and bodies of water from experiences or from text and digital resources. They can use this information to answer questions such as, "Where can water be found as solid ice or snow year round?" Students should also have the opportunity to use their research to publish a writing piece, with guidance and support from adults or collaboratively with peers, based on their findings about various landforms and bodies of water. Diagrams, drawings, photographs, audio or video recordings, poems, dioramas, models, or other visual displays can accompany students' writing to help recount experiences or clarify thoughts and ideas.

Mathematics

As students collect data about the size of landforms and bodies of water, these numbers can be used to answer questions, make comparisons, or solve problems. For example,

- If students know that a mountain is 996 feet in height, a lake is 550 feet deep, a river is 687 miles long, and a forest began growing about 200 years ago, have students show each number in three ways using base-ten blocks, number words, and expanded form.
- A stream was 17 inches deep before a rainstorm and 33 inches deep after a rainstorm. How much deeper did it get during the rainstorm?

As students engage in these types of mathematical connections, they are also modeling with mathematics and reasoning abstractly and quantitatively. When modeling with mathematics, students diagram situations mathematically (using equations, for example) and/or solve addition or subtraction word problems. When students reason abstractly and quantitatively, they manipulate symbols (numbers and other math symbols) abstractly and attend to the meaning of those symbols while doing so.

Three-Dimensional Teaching and Learning

Students look for patterns as they identify where water is found on Earth and explore the shapes and kinds of land and bodies of water found in an area. Students also develop models to identify and represent the shapes and kinds of land and bodies of water in an area.

To begin this unit's progression of learning, students identify where water is found on Earth and whether it is solid or liquid. Using texts, maps, globes, and other resources (including appropriate online resources), students will observe that water is found in liquid form in oceans, rivers, lakes, and ponds. They also discover that water exists as a solid in the Earth's snowcaps and glaciers.

After students identify where water is found on the Earth, they take a closer look at bodies of water and landforms that can be found in the natural world. Using firsthand observations and media resources, students should look for patterns among the types of landforms and bodies of water. For example, students should notice that mountains are much taller and more rugged than hills, lakes are an enclosed body of water surrounded by land, and streams flow across land and generally end at a larger body of water, such as a lake or the ocean.

Students should also have opportunities to use maps to determine where landforms and bodies of water are located. As students become more familiar with the types and shapes of landforms and bodies of water, they develop models to represent the landforms and bodies of water found in an area. For example, students can draw/create a map of the area of the state in which they live, showing various landforms (e.g., hills, coastlines, and islands) and bodies of water (e.g., rivers, lakes, ponds, and the ocean). Teachers should keep in mind that assessment does not include quantitative scaling of models (an accurate proportional relationship with the real world).

Prior Learning
Kindergarten Unit 1: Pushes and Pulls A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. *(secondary)*

Part A: How can we identify where water is found on Earth and if it is solid or liquid?	
Concepts ● Patterns in the natural world can be observed.	**Formative Assessment** Students who understand the concepts are able to: ● Observe patterns in the natural world.

• Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.	• Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) and other media that will be useful in answering a scientific question. • Obtain information to identify where water is found on Earth and to communicate that it can be a solid or liquid.

Part B: In what ways can you represent the shapes and kinds of land and bodies of water in an area?	
Concepts	**Formative Assessment**
• Patterns in the natural world can be observed. • Maps show where things are located. One can map the shapes and kinds of land and water in any area.	Students who understand the concepts are able to: • Observe patterns in the natural world. • Develop a model to represent patterns in the natural world. • Develop a model to represent the shapes and kinds of land and bodies of water in an area. (*Assessment does not include quantitative scaling in models.)*

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)***

(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.)

- 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.
- Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).

Leveraging English Language Arts/Literacy and Mathematics

English Language Arts/Literacy-

- Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). W.2.7
- Recall information from experiences or gather information from provided sources to answer a question. W.2.8

Mathematics-

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Samples of Open Education Resources for this unit:

Mystery Science: Mystery Science provides ready-made science mysteries for elementary school students. Each lesson contains a central mystery, discussion questions, supplemental reading, and a hands-on activity.

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

Earth and Space Science	Grade 2	Unit 3	Trimester 2

Earth and Space Science Unit 3- Changes to Earth's Land: (20 Instructional Days)

In what ways do humans slow or prevent wind or water from changing the shape of the land?

In this unit of study, students apply their understanding of the idea that wind and water can change the shape of land to compare design solutions to slow or prevent such change. The crosscutting concepts of *stability and change*; *structure and function*; 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 demonstrate grade-appropriate proficiency in *asking questions and defining problems, developing and using models*, and *constructing explanations and designing solutions*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 2-ESS1-1, 2-ESS2-1, K-2-ETS1-1, and K-2-ETS1-2.

Overarching Essential Questions	Overarching Enduring Understandings
What forces act on the Earth and cause its crust to move? How do weathering and erosion change the Earth's surface? In what ways can people control the effects of forces that shape Earth's surface? Why do some Earth changes happen very slowly or quickly?	The Earth's crust is the outermost layer of the planet and is composed of may plates. These plates lay on top of the Earth's mantle which is solid, but can still flow like a hard liquid. Movement in the mantle causes the plates to move. The plates can go through compression, tension, and shear movements. These movements can cause volcanoes and earthquakes. Different forces shape the landforms that make up the Earth's surface. People try to control, or understand the effect

	of forces that shape the Earth's surface, by building levees, dams, and flood control channels to try to control the damage. The surface of the earth changes. Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides
Student Learning Objectives	
Use information from several sources to provide evidence that Earth events can occur quickly or slowly. [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [Assessment Boundary: Assessment does not include quantitative measurements of timescales.]	2-ESS1-1
Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*[Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]	2-ESS2-1
Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.	K-2-ETS1-1

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 ● Make observations from several sources to construct an	**ESS1.C: The History of Planet Earth** ● Some events happen very quickly; others occur very slowly, over a time period	**Stability and Change** ● Things may change slowly or rapidly. (2-ESS1-1) ● Things may change slowly or rapidly. (2-ESS2-1)

evidence-based account for natural phenomena. (2-ESS1-1) ● Compare multiple solutions to a problem. (2-ESS2-1) **Asking Questions and Defining Problems** ● Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1) ● Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1) **Developing and Using Models** ● Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)	much longer than one can observe. (2-ESS1-1) **ESS2.A: Earth Materials and Systems** ● Wind and water can change the shape of the land. (2-ESS2-1) **ETS1.A: Defining and Delimiting Engineering Problems** ● A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1) ● Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1) ● Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1) **ETS1.B: Developing Possible Solutions** ● Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-2)	**Structure and Function** ● The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-2) - ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Engineering, Technology, and Science on Society and the Natural World** ● Developing and using technology has impacts on the natural world. (2-ESS2-1) - ***Connections to Nature of Science*** **Science Addresses Questions About the Natural and Material World** ● Scientists study the natural and material world. (2-ESS2-1)

Embedded English Language Arts/Literacy and Mathematics

English Language Arts

Students participate in shared research to gather information about Earth events from texts and other media and digital resources. They will use this information to answer questions and describe key ideas and details about ways in which the land can change and what causes these changes. Students should also have opportunities to compose a writing piece, either independently or collaboratively with peers, using digital tools to produce and publish their writing. Students should describe connections between Earth events and the changes they cause, and they should include photographs, videos, poems, dioramas, models, drawings, or other visual displays of their work, when appropriate, to clarify ideas, thoughts, and feelings.

Mathematics

Students have multiple opportunities to reason abstractly and quantitatively as they gather information from media sources. Students can organize data into picture graphs or bar graphs in order to make comparisons. For example, students can graph rainfall amounts. Students can use the data to solve simple addition and subtraction problems using information from the graphs to determine the amount of change that has occurred to local landforms. For example, a gulley was 17 inches deep before a rainstorm and 32 inches deep after a rainstorm. How much deeper is it after the rainstorm? Students must also have an understanding of place value as they encounter the varying timescales on which Earth events can occur. For example, students understand that a period of thousands of years is much longer than a period of hundreds of years, which in turn is much longer than a period of tens of years. In addition, teachers should give students opportunities to work with large numbers as they describe length, height, size, and distance when learning about Earth events and the changes they cause. For example, students might write about a canyon that is 550 feet deep, a river that is 687 miles long, or a forest that began growing about 200 years ago.

Three-Dimensional Teaching and Learning

In this unit of study, students learn that a situation that people want to change or create can be approached as a problem to be solved through engineering. Before beginning to design a solution, it is important to clearly understand the problem, and asking questions, making observations and gathering information are helpful in thinking about and clarifying problems. Students learn that designs can be conveyed through sketches, drawings, or physical models, and that these representations are useful in communicating ideas for a problem's solutions to other people. As outlined in the narrative above, students will develop simple sketches or drawings showing how humans have helped minimize the effects of a chosen Earth event.

Students use evidence from several sources to develop an understanding that Earth events can occur quickly or slowly. Because some events happen too quickly too observe, and others too slowly, we often rely on models and simulations to help us understand how changes to the surface of the Earth are caused by a number of different Earth events. For example,

> Volcanic eruptions are Earth events that happen very quickly. As volcanic eruptions occur, ash and lava are quickly emitted from the volcano. The flow of lava from the volcano causes immediate changes to the landscape as it flows and cools.
>
> Flooding can happen quickly during events such as hurricanes and tsunamis. Flooding can cause rapid changes to the surface of the Earth.
>
> Rainfall is an event that recurs often over long periods of time and will gradually lead to the weathering and erosion of rocks and soil.

In order to gather information to use as evidence, students need to make observations. They can easily look for evidence of changes caused by rain, flooding, or drought. However, actually observing Earth events as they happen is often not possible; therefore, students will need opportunities to observe different types of Earth events using models, simulations, video, and other media and online sources. At this grade level, quantitative measurements of timescales are not important. Students do need to see the kinds of changes that Earth events cause, and whether the changes are rapid or slow.

Engaging in engineering design helps students understand that a situation that people want to change or create can be approached as a problem to be solved through engineering. Asking questions, making observations, and gathering information are helpful in clearly understanding the problem. Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. In this unit of study, students need the opportunity to engage in the engineering design process in order to generate and compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. Students are not expected to come up with original solutions, although original solutions are always welcome. The emphasis is on asking questions, making observations, and gathering information in order to compare

multiple solutions designed to slow or prevent wind or water from changing the land. This process should include the following steps:

- As a class, with teacher guidance, students brainstorm a list of natural Earth events, such as a volcanoes, earthquakes, tsunamis, or floods. The class selects one Earth event to research in order to gather more information.
- As a class or in small groups, with guidance, students conduct research on the selected Earth event using books and other reliable sources. They gather information about the problems that are caused by the selected event, and gather information on the ways in which humans have minimized the effects of the chosen earth event. For example,

  Different designs of dikes or dams to hold back water,

  Different designs of windbreaks to hold back wind, or

  Different designs for using plants (shrubs, grass, and/or trees) to hold back the land.

- Next, students look for examples in their community of ways that humans have minimized the effect of natural Earth events. This can be accomplished through a nature walk or short hike around the schoolyard, during a field trip, or students can make observations around their own neighborhoods. If available, students can carry digital cameras (or other technology that allows them to take pictures) in order to document any examples they find.
- Groups select one solution they have found through research and develop a simple sketch, drawing, or physical model to illustrate how it minimizes the effects of the selected Earth event.
- Groups should prepare a presentation using their sketches, drawings, or models, and present them to the class.

Prior Learning

Kindergarten Unit 1: Pushes and Pulls

- A situation that people want to change or create can be approached as a problem to be solved through engineering.
- Asking questions, making observations, and gathering information are helpful in thinking about problems.
- Before beginning to design a solution, it is important to clearly understand the problem.
- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Part A: What evidence can we find to prove that Earth events can occur quickly or slowly?	
Concepts	**Formative Assessment**
● Some events happen very quickly; others occur very slowly over a time period much longer than one can observe. ● Things may change slowly or rapidly	Students who understand the concepts are able to: ● Make observations from several sources to construct an evidence-based account for natural phenomena. ● Use information from several sources to provide evidence that Earth events can occur quickly or slowly. (Assessment does not include quantitative measurements of timescales.) Some examples of these events include: Volcanic explosions Earthquakes Erosion of rocks.

Part B: In what ways do humans slow or prevent wind or water from changing the shape of the land?	
Concepts	**Formative Assessment**
● Things may change slowly or rapidly. ● Developing and using technology has impacts on the natural world. ● Scientists study the natural and material world. ● The shape and stability of structures of natural and designed objects are related to their function(s). ● Wind and water can change the shape of the land. ● Because there is always more than one possible solution to a problem, it is useful to compare and test designs.	Students who understand the concepts are able to: ● Compare multiple solutions to a problem. ● Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. Examples of solutions could include: Different designs of dikes and windbreaks to hold back wind and water

• A situation that people want to change or create can be approached as a problem to be solved through engineering. • Asking questions, making observations, and gathering information are helpful in thinking about problems. • Before beginning to design a solution, it is important to clearly understand the problem. • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.	Different designs for using shrubs, grass, and trees to hold back the land. • Ask questions based on observations to find more information about the natural and/or designed world. • Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. • Define a simple problem that can be solved through the development of a new or improved object or tool. • Develop a simple model based on evidence to represent a proposed object or tool. • Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

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)***
• *(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.)* • 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.
- Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).

Leveraging English Language Arts/Literacy and Mathematics

English Language Arts/Literacy-

- Students participate in shared research to gather information about Earth events from texts and other media and digital resources. Students use this information to answer questions and describe key ideas and details about ways in which the land can change and what causes these changes. Students can use this information to write about the effects of wind and water on the land.

Mathematics-

- Analyze data from research on the height of various landforms and create and analyze graphs

Samples of Open Education Resources for this unit:

How Can Water Change the Shape of the Land?

In this lesson plan children investigate water erosion. Students make a sand tower and observe the erosion as they drop water on it. Students observe, illustrate, and record notes about the process. Short videos and a read aloud also further support understanding of the Performance Expectation.

How Can Wind Change the Shape of the Land?

This lesson builds on another lesson created by Jeri Faber in which students discovered how water changes the earth. For this lesson, students take part in a teacher-led investigation to show how wind changes the land. The children use straws to blow on a small mound or hill of sand. As each child takes a turn, the other students record their detailed observations that will later be used to draw conclusions. Students also watch a short video on wind erosion and discuss the new learning with partners.

Finding Erosion at Our School

In this lesson, students walk around the school grounds, neighborhood, or another area of their community to locate evidence of erosion. Various problems caused by erosion are discussed and a solution is developed for one of the problems. This lesson is one in a series on erosion by Jeri Faber. A follow-up lesson is available where students compare their erosion design solutions.

Mystery Science: Mystery Science provides ready-made science mysteries for elementary school students. Each lesson contains a central mystery, discussion questions, supplemental reading, and a hands-on activity.

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

Ecosystems	Grade 2	Unit 4	Trimester 3

Unit 4-Relationships in Habitats: (15 Instructional Days)

Why do we see different living things in different habitats?

In this unit of study, students develop an understanding of what plants need to grow and how plants depend on animals for seed dispersal and pollination. Students also compare the diversity of life in different habitats. The crosscutting concepts of cause and effect and structure and function are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in planning and carrying out investigations and developing and using models. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 2-LS4-1, 2-LS2-1, 2-LS2-2, and K-2-ETS1-1. S

Overarching Essential Questions	Overarching Enduring Understandings
How do animals interact within their ecosystem? What body features or behaviors allow an animal to survive in its habitat? How do animals interact within their ecosystem?	People look for patterns and order when making observations about the world.

What products do we acquire from animals? What needs do people have that are met through animals? What system components are needed to construct a food web?	There are many different kinds of living things in any area, and they exist in different places on land and in water. Events have causes that generate observable patterns. Plants depend on water and light to grow
Student Learning Objectives	
Make observations of plants and animals to compare the diversity of life in different habitats. [Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.] [Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.]	2-LS4-1
Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.	2-LS2-2
Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.	K-2-ETS1-1

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 **• Plan and conduct investigations collaboratively to produce evidence to answer a question. (1- PS4-1),(2-LS2-1)** **Planning and Carrying Out Investigations • Make observations**	**LS4.D: Biodiversity and Humans • There are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1) LS2.A: Interdependent Relationships in Ecosystems • Plants depend on water and light to grow. (2- LS2-1) • Plants**	**Cause and Effect • Events have causes that generate observable patterns. (2-LS2-1) Structure and Function • The shape and stability of structures of natural and designed objects are related to their function(s). (2-LS2-2), (K-2-ETS1-2) - Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence •**

(firsthand or from media) to collect data that can be used to make comparisons. (2-LS4-1) **Developing and Using Models** **• Develop a simple model based on evidence to represent a proposed object or tool. (2-LS2-2)** **Asking Questions and Defining Problems** **• Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1)** **• Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)----------** ***Connections to Nature of Science*** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ● Scientists search for cause and effect relationships to explain natural events. (2-PS1-4)	**depend on animals for pollination or to move their seeds around. (2-LS2-2) ETS1.B: Developing Possible Solutions • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.(secondary to 2-LS2-2) ETS1.A: Defining and Delimiting Engineering Problems • A situation that people want to change or create can be approached as a problem to be solved**	**Scientists look for patterns and order when making observations about the world. (2-LS4-1)**

Embedded English Language Arts/Literacy and Mathematics

English Language Arts/Literacy:

English Language Arts can be leveraged in this unit in a number of ways. Students can participate in shared research using trade books and online resources to learn about the diversity of life in different habitats or to discover ways in which animals help pollinate plants or distribute seeds. Students can record their findings in science journals or use the research to write and illustrate their own books. Students can also learn to take notes in their journals order to help them recall information from experiences or gather information from provided sources. They can add drawings or other visual displays to their work, when appropriate, to clarify ideas, thoughts, and feelings.

Mathematics:

Throughout this unit of study, students need opportunities to represent and interpret categorical data by drawing picture graphs and/or bar graphs (with a single-unit scale) to represent a data set with up to four categories. This will lead to opportunities to solve simple put-together, take-apart, and compare problems using information presented in these types of graphs. For example, students could create bar graphs that show the number of seedlings that sprout with and without watering or that document plant growth. They could also create a picture graph showing the number of plant species, vertebrate animal species, and invertebrate animal species observed during a field trip or in a nature photograph. As students analyze the data in these types of graphs, they can use the data to answer simple put-together, take apart, and compare problems. This unit also presents opportunities for students to model with mathematics. They can diagram situations mathematically or solve a one-step addition or subtraction word problems. Data collected in bar graphs and picture graphs can easily be used for this purpose.

New Jersey Student Learning Standards:

ELA/Literacy –

Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-LS2-1) W.2.7

Recall information from experiences or gather information from provided sources to answer a question. (2-LS2-1),(K-2-ETS1-1) W.2.8

Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (2-LS2-2) SL.2.5

With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (K-2-ETS1-1) W.2.6

Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (K-2-ETS1-1) RI.2.1

Mathematics

Reason abstractly and quantitatively. (2-LS2-1),(K-2-ETS1-1) MP.2

Model with mathematics. (2-LS2-1),(2-LS2-2),(K-2-ETS1-1) MP.4

Use appropriate tools strategically. (2-LS2-1),(K-2-ETS1-1) MP.5

Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (2-LS2-2) 2.MD.D.10

Three-Dimensional Teaching and Learning

In this unit of study, students explore and compare the diversity of life in different habitats. They develop an understanding of what plants need to grow and how plants depend on animals for seed dispersal and pollination. Students learn about cause-and-effect relationships and how an organism's structures are related to the function that each structure performs. Developing and using models plays an important role in students' understanding of structure/function relationships. To begin this unit's progression of learning, students observe a variety of plants and animals from a variety of habitats in order to compare the diversity of life. Using firsthand observations and media resources, students explore and collect data about different habitats that exist in the world and how plants and animals have structures that help them survive in their habitats. Students need many opportunities to observe many different kinds of living things, whether they live on land, in water, or both. As students learn about the diversity of life, they begin to look for patterns and order in the natural world. As scientists, students will begin to notice patterns in the structures that enable organisms to support their existence in specific habitats. For example, webbed feet enable survival in wetlands; gills enable survival in rivers, lakes, and oceans; and blubber enables survival in polar regions. The learning progresses as students' focus changes from diversity to commonalities among plants—what plants need in order to grow. Students need opportunities to observe that plants depend on water and light to grow. As they begin to understand that changes in the amount of water and light can affect the growth of plants, they begin to understand that all cause-and-effect relationships generate observable patterns. For example, some plants require very little water to survive, most plants will not grow without sunlight, and most plants need an adequate amount of water to thrive. Students might also observe patterns such as the effects of too much or too little water on a plant and too much or too little light on a plant. In order for students to develop these understandings, they should plan and conduct investigations and collect data, which should be used as evidence to support the idea that all events have causes that generate observable patterns. Finally, students investigate the roles that animals play in plant reproduction. Students learn that many types of plants depend on animals for pollination and/or for the dispersal of seeds. As students begin to explore the interdependent relationships among plants and animals, they learn that the shape and stability of the structures of organisms are related to their function. For example,

- As bees collect nectar, portions of their body are designed to collect and then carry pollen from plant to plant.
- Some seeds are designed to stick to animal fur so that animals can carry them from place to place.
- Animals eat fruits containing seeds, which are then dispersed through animals' body waste.

Second graders will need multiple opportunities to develop an understanding of the important relationship between structure and function, because they are expected to use engineering design to plan and develop simple models that mimic the function of an animal in dispersing seeds or pollinating plants. Students can use sketches, drawings or physical models to illustrate how the shape of the model helps it function as needed, and they should use evidence to support their design choices. Some common examples of models could include the following:

- Using Velcro "seeds" and furry material to model how seeds with hooks adhere to animal fur.
- Using pipe cleaners to gather and distribute "pollen" in a way similar to bees pollinate flowers.

In this unit of study, students learn that designs can be conveyed through sketches, drawings, or physical models, and that these representations are useful in communicating ideas for a problem's solutions to other people. As described in the narrative above, students develop simple sketches, drawings, or models that mimic the function of an animal in dispersing seeds or pollinating plants in order to illustrate how the shape of an object helps it function as needed to solve a given problem.

Prior Learning
Kindergarten Unit 1: Pushes and Pulls • A situation that people want to change or create can be approached as a problem to be solved through engineering. • Asking questions, making observations, and gathering information are helpful in thinking about problems. • Before beginning to design a solution, it is important to clearly understand the problem. **Kindergarten Unit 4: Basic Needs of Living Things** • Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. • All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.

Part A: How does the diversity of plants and animals compare among different habitats?	
Concepts	**Formative Assessment**
	Students who understand the concepts can:

• People look for patterns and order when making observations about the world. • There are many different kinds of living things in any area, and they exist in different places on land and in water.	• Look for patterns and order when making observations about the world. • Make observations (firsthand or from media) to collect data that can be used to make comparisons. • Make observations of plants and animals to compare the diversity of life in different habitats. (Note: The emphasis is on the diversity of living things in each of a variety of different habitats; assessment does not include specific animal and plant names in specific habitats.)

Part B: What do plants need to live and grow?	
Concepts	**Formative Assessment**
• Events have causes that generate observable patterns. • Plants depend on water and light to grow.	*Students who understand the concepts can:* ● Observe patterns in events generated by cause-and-effect relationships. ● Plan and conduct an investigation collaboratively to produce data to serve as a basis for evidence to answer a question. ● Plan and conduct an investigation to determine whether plants need sunlight and water to grow. (Note: Assessment is limited to one variable at a time.)

Part C: : Why do some plants rely on animals for reproduction?	
Concepts	**Formative Assessment**
• The shape and stability of structures of natural and designed objects are related to their function.	*Students who understand the concepts can:*

• Plants depend on animals for pollination or to move their seeds around. • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.	• Describe how the shape and stability of structures are related to their function. • Develop a simple model based on evidence to represent a proposed object or tool. • Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. • Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

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)***

(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.)

- 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.
- Restructure lesson using UDL principles (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).

Leveraging English Language Arts/Literacy and Mathematics

English Language Arts/Literacy-

- Students participate in shared research to gather information about habitats from texts and other media and digital resources. Students use this information to answer questions and describe key details about how habitats interacts. Students can use this information to write about the effects of pollination.

Mathematics-

- Analyze data from graph results.

Samples of Open Education Resources for this unit:

Do Plants Need Sunlight? Students will explore the importance sunlight for a plant's survival by conducting an investigation. Each group of students will cover parts of plants' leaves with black construction paper and make observations of the plant's leaves over several days. This lesson serves to model the process of investigation. The investigation will take 7 days to

complete. Then students can remove the black paper, place the plants back in the sunlight, and view the leaves in a second investigation. (Note: Chlorophyll is not a necessary concept/vocabulary term to address in this lesson.)

Who Needs What? Students identify the physical needs of animals. Through classroom discussion, students speculate on the needs of plants. With teacher guidance, students then design an experiment that can take place in the classroom to test whether or not plants need light and water in order to grow. Students conduct the associated activity in which sunflower seeds are planted in plastic cups, and once germinated, are exposed to different conditions. In the classroom setting, students test for the effects of light versus darkness, and watered versus non-watered conditions. During exposure of the plants to these different conditions, students measure growth of the seedlings every few days using non-standard measurement. After a few weeks, students compare the growth of plants exposed to the different conditions, and make pictorial bar graphs that demonstrate these comparisons.

I Scream, You Scream, We All Scream for Vanilla Ice Cream! In this lesson students design a vanilla plant pollinator. This is an end-of-the-unit task, taking about 3 days to complete. The students will view an amazing video that tells about the problems with pollinating vanilla by hand. The students pretend to be employees of Ben and Jerry's ice cream company and help to plan and design a pollinator for the vanilla plant so that the great vanilla flavored ice cream can continue to be produced. (This is the first of several lessons created by Jeri Faber on plant pollination at: betterlessons.com/)

Building and Testing Our Vanilla Plant Pollinator: In previous lessons designed by Jeri Faber, students have learned about how animals help pollinate flowers. The students have also planned and designed their own vanilla plant pollinator. In this lesson, students use the engineering design process to build and test the plant pollinator they planned the day before in class.

Two Scoops Are Better Than One: This lesson is the second day of an end of the unit task to address the Performance Expectation: Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. This end of unit task is expected to take 3-4 days to complete. In the previous lesson (http://betterlesson.com/lesson/628130/i-scream-you-scream-we-all-scream-for-vanilla-ice-cream), the students were challenged to brainstorm their version of a vanilla flower pollinator. For this lesson, students work with a partner to choose and develop their engineering plans by drawing a diagram for a vanilla plant pollinator. They also create a list of materials needed for the task.

Improving Our Vanilla Bean Pollinators: This lesson is part of a series of lessons created by Jeri Faber on using the engineering design process to solve a problem. In the Ice Scream, You Scream We All Scream for Vanilla Ice Cream, the students were

challenged to design a vanilla flower plant pollinator. For day 2, Two Scoops Are Better Than One, students worked with a partner to determine which design to build for their vanilla plant pollinator. For day 3, Building and Testing Our Vanilla Pollinators, the students constructed and tested the effectiveness of their pollinators based on the design plans. In this lesson, students improve their plant pollinator models and retest the pollinator's effectiveness.

The Bug Chicks-Mission: Pollination (Episode 5): The Bug Chicks' five minute video provides a fun, animated way of learning about the fascinating world of pollination and insects. In this video, the students observe interesting museums and habitats to look at lesser known insect pollinators. The student challenge at the end leads students into their environment to look for other pollinators and encourages them to bring their observations back to the classroom to discuss.

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 2**	**Unit 5**	**Trimester 3**

Physical Science Unit 5- Changes to Matter: (15 Instructional Days)

In this unit of study, students continue to develop an understanding of observable properties of materials through analysis and classification of different materials. The crosscutting concepts of cause and effect and energy and matter are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in constructing explanations, designing solutions, and engaging in argument from evidence. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 2-PS1-3 and 2-PS1-4.

Overarching Essential Questions	Overarching Enduring Understandings
How can objects change? Are all changes reversible? ********** Essential Questions: What is matter? What are the properties of a solid, liquid, and gas? How can properties of matter be changed? How can states of matter be changed? How do properties of an object affect its use? How do scientists gather information?	Everything is matter-solids, liquids, and gases. Matter is observed and classified by its physical properties. ********** Enduring Understandings: The structures of materials determine their properties. Everything is matter-solids, liquids, and gases. Water can exist in any of three states. The state of matter is primarily determined by its temperature. Changing the temperature of matter may change its state. Some properties of matter change as a result of processes such as heating and cooling. Not all materials respond the same way to these processes. Scientists use inquiry skills and science tools to find out information.
Student Learning Objectives	
Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. [Clarification	2-PS1-3

Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]	
Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. [Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.]	2-PS1-4

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 Analyzing and Interpreting Data • Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1) Constructing Explanations and Designing Solutions • Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2-PS1-3) Engaging in Argument from Evidence • Construct an argument with evidence to support a claim. (2-PS1-4)	PS1.A: Structure and Properties of Matter • Different properties are suited to different purposes. (2-PS1-3) • A great variety of objects can be built up from a small set of pieces. (2-PS1-3) PS1.B: Chemical Reactions • Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)	Cause and Effect • Events have causes that generate observable patterns. (2-PS1-4) Energy and Matter • Objects may break into smaller pieces and be put together into larger pieces, or change shapes. (2- PS1-3) - Connections to Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena • Science searches for cause and effect relationships to explain natural events. (2-PS1-4)

Embedded English Language Arts/Literacy and Mathematics

English Language Arts

Students need opportunities to read texts that give information about matter and the changes that can happen to matter. With adult support, students can identify the main idea and details in informational text in order to answer questions about matter. With teacher support and modeling, students can ask and answer who, what, where, when, why, and how questions to demonstrate their understanding of key details in informational text.

As students investigate reversible and irreversible changes to matter, they should record observations in science journals, using drawings or other visual displays, when appropriate, to help clarify their thinking. To further support their learning, students can conduct shared research using trade books and online resources in order to learn more about physical changes to matter.

After reading informational texts and conducting investigations, students should be able to write opinion pieces in which they state an opinion, supply evidence to support their opinion, use linking words to connect opinion to evidence (reasons), and provide a concluding statement. For example, students can be presented with an example of matter that has been changed in some way, then asked to write an opinion piece in which they state whether or not they think the change is reversible or irreversible, and supply evidence to support their thinking. Evidence can include information recalled from experiences or information gathered from informational texts or other resources. Some possible changes that can be used are:

- Tearing paper
- Bending a spoon
- Baking a cake
- Hammering a nail into a piece of wood
- Getting grass stains on a pair of jeans
- Cutting your hair

Mathematics N/A

Three-Dimensional Teaching and Learning
In this unit of study, students investigate cause-and-effect relationships between matter and energy as they analyze and classify materials that undergo change. Throughout the unit, students will construct explanations and engage in argument from evidence as they investigate the ways in which matter can change and determine whether or not a change is reversible. In Unit 2, Properties of Matter, students engaged in the engineering design process in order to understand that different properties are suited to different purposes. Students use this understanding as they construct evidence-based accounts of how an object made of small pieces can be disassembled and made into new objects. In order to do this, they need multiple opportunities to take apart and reassemble objects that are made of small pieces. For example, using blocks, building bricks, and other small objects such as Legos, small groups of students can build an object, and then a second group of students can take the object apart and build another object using those same small blocks or bricks. As students construct and deconstruct objects, then reconstruct the pieces into new objects, they should document the process in their science journals, explaining how they went about reconstructing the pieces into a new object. After students have worked through and documented this process, ask them, “Are the changes you made to each of the original objects reversible? Can we disassemble the new objects and use the pieces to reconstruct the original object? After class discussion, ask students, “Are all changes reversible?” This should lead to opportunities for students to observe changes caused by heating or cooling. With close supervision and guidance by teachers, students can investigate such changes as heating or cooling butter,

chocolate chips, or pieces of crayon, freezing water, and melting ice. They can observe an egg before and after cooking or a small piece of paper or cardboard before and after burning. As they attempt to reverse changes, they will also notice that all events have causes that generate patterns of change that can be observed and predicted. Through these types of experiences, students will recognize that some changes caused by heating or cooling can be reversed and some cannot, and they can use evidence from their investigations to support their thinking.

Prior Learning
• A situation that people want to change or create can be approached as a problem to be solved through engineering. • Asking questions, making observations, and gathering information are helpful in thinking about problems. • Before beginning to design a solution, it is important to clearly understand the problem. • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

Part A: In what ways can an object made of a small set of pieces be disassembled and made into a new object?	
Concepts	**Formative Assessment**
• Objects may break into smaller pieces and be put together into larger pieces or change shapes. • Different properties are suited to different purposes. • A great variety of objects can be built up from a small set of pieces.	*Students who understand the concepts can:* ● Break objects into smaller pieces and put them together into larger pieces or change shapes. ● Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.

	• Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

Part B: Can all changes caused by heating or cooling be reversed?	
Concepts	**Formative Assessment**
• People search for cause-and-effect relationships to explain natural events. • Events have causes that generate observable patterns. • Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.	*Students who understand the concepts can:* Observe patterns in events generated due to cause-and-effect relationships. • Construct an argument with evidence to support a claim. • Construct an argument with evidence that some changes caused by heating or cooling can be reversed, and some cannot. Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include: • Cooking an egg • Freezing a plant leaf • Heating paper

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)***
(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.)

- 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.
- Restructure lesson using UDL principles (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).

Leveraging English Language Arts/Literacy and Mathematics
English Language Arts/Literacy- ● Write "how to" informational piece that describes how state of matter changed (ex. baking a cake, boiling an egg) ***Mathematics-*** ● Analyze data from tests conducted and graph results

Samples of Open Education Resources for this unit:

STEM in a BOX - Shakin' Up the Classroom: K-3EarthScienceSTEMintheboxprint.docx: In this engaging lesson, the students examine and describe materials and their properties in order to assemble these materials into a strong building that could withstand the earth shaking. The physical science core ideas in the Performance Expectation are met through a larger earth science/earthquake unit that is part of the unit level resource. Go to the resource listed under K-3: k-3EarthScienceSTEMintheboxprint.docx

Thousands of tiny pieces can create something big: In this resource which is based on enactment in a second grade classroom and includes videos and examples of student work, the teacher introduces students to Watt's tower, a tower made of many pieces of junk in the neighborhood. Students make their own objects out of many pieces or materials that the teacher provides and the students think about and discuss whether they could use the same set of materials to make something different.

Take it apart, put it together: This is a wonderfully supported and creative lesson that involves students taking apart an old appliance and making a new object using the appliance parts. The teacher guides students using a variety of teacher prompts and individual journaling to track their idea development, questions, changing plans, and evidence-based explanations.

Exploring Reversible Changes of State and Exploring Irreversible Changes of State These two lessons work together to explore reversible and irreversible changes of state through guided investigations. The PDF is a set of activities focusing on materials followed by some optional post-activity lessons. Two of these post activity lessons deal with reversible and irreversible changes to materials. The first lesson involves teachers showing students phenomena and then asking the students to generate questions about their observations of the phenomena. The second lesson involves students engaging in investigating, explaining and asking questions about two irreversible changes and using observations to identify what about the changes make them irreversible.

The Magic School Bus Bakes in a Cake lesson and video, "Ready Set Dough" !: This is a lesson plan that accompanies the reading or watching of The Magic School Bus Bakes a Cake, or Ready Set Dough. The lesson is a short activity with guided questions that accompany making pretzel dough. In the book and video, which are not included in the resource, The Magic School Bus shrinks down to molecule size to observe and discuss chemical and physical changes while baking. The resource

contains a link to purchase the book. The video can be found at https://www.youtube.com/watch?v=dTw-ok3KkuU. The Science of Macaroni Salad (and 2. Dig Deeper): This three minute video is great for teachers who need a short and deeper understanding of what is entailed in the Performance Expectations for Properties of Matter and what is involved when a physical and chemical change occurs. It would be over the heads of younger children, but perfect for elementary teachers who can either view the video themselves and translate the most pertinent ideas in it, or watch the video with the students and narrate in kid language. If the teacher watched the video first, they would be ensured that they had the understanding necessary for tough questions.

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 A

Second Grade

Unit 1: Structure and Properties of Matter (20 Instructional Days)

Rationale: All objects and substances in the natural world are composed of matter. Matter exists in different states: solids, liquids, and gases. Liquids take the shape of the container they occupy. Solids retain their shape regardless of the container they occupy.

Content Statement: Students will explore the structure and properties of matter. They will discover words to describe the properties of matter. They will also discover that temperature is the catalyst that changes one state of matter to the next. To observe the changing states of matter, students will conduct experiments with water.

Overarching Essential Questions	Overarching Enduring Understandings
What is matter? How is matter classified?	Everything is matter-solids, liquids, and gases. Matter is observed and classified by its physical properties.
Essential Questions	Enduring Understandings
What is matter? What are the properties of a solid, liquid, and gas? How can properties of matter be changed? How can states of matter be changed? How do properties of an object affect its use? How do scientists gather information?	The structures of materials determine their properties. Everything is matter-solids, liquids, gases. Water can exist in any of three states. The state of matter is primarily determined by its temperature. Changing the temperature of matter may change its state. Some properties of matter change as a result of processes such as heating and cooling. Not all materials respond the same way to these processes. Scientists use inquiry skills and science tools to find out information.

Student Learning Experiences and Formative Assessments	
	NGSS *Standards*
Students identify and describe* the phenomenon under investigation, which includes the following idea: different kinds of matter have different properties, and sometimes the same kind of matter has different properties depending on temperature. Students identify and describe* the purpose of the investigation, which includes answering a question about the phenomenon under investigation by describing* and classifying different kinds of materials by their observable properties. Students define matter and create science journals: http://betterlesson.com/lesson/634511/what-does-it-matter	2-PS1-1 1 (a,b)
The observations of the materials provide evidence about the properties of different kinds of materials. ii. Observable patterns in the properties of materials provide evidence to classify the different kinds of materials. Students explore the 3 matters of state: Solids, liquids, gases: http://betterlesson.com/lesson/638666/defining-properties-of-solids-liquids-and-gases	2-PS1-1 2(b i, ii)
Students describe* relationships between materials and their properties (e.g., metal is strong, paper is absorbent, rocks are hard, sandpaper is rough). Students make a claim to be supported about a phenomenon. In their claim, students include the idea that some changes caused by heating or cooling can be reversed and some cannot. How can states of matter change? Gummy Bear Lesson-This Candy is Not What it Seems http://betterlesson.com/lesson/634049/this-candy-is-not-what-it-seems	2-PS1-2 2(a) 2-PS1-4 1(a)
Students individually describe* how the properties of materials, and the method for classifying them, are relevant to answering the question. Students describe* which properties allow a material to be well suited for a given intended use (e.g., ability to absorb for cleaning up spills, strength for building material, hardness for breaking a nut) Students explore why the property of certain matter is important for certain jobs: http://betterlesson.com/lesson/635162/testing-tower-materials-part-1	2-PS1-1 3(b) 2-PS1-2 3(a)

Students articulate a statement that relates the given phenomenon to a scientific idea, including that an object made of a small set of pieces can be disassembled and made into a new object. Students investigate how to disassemble and rebuild cubes, then analyze results http://betterlesson.com/lesson/635840/building-things-in-different-ways	2-PS1-3 1(a)
According to the developed investigation plan, students collaboratively collect and record data on the properties of the materials. Using graphical displays (e.g., pictures, charts, grade-appropriate graphs), students use the given data from tests of different materials to organize those materials by their properties (e.g., strength, flexibility, hardness, texture, ability to absorb). Students articulate a statement that relates the given phenomenon to a scientific idea, including that an object made of a small set of pieces can be disassembled and made into a new object Students use reasoning to connect the evidence to the claim. Students describe* the following chain of reasoning: i. Some changes caused by heating or cooling can be reversed by cooling or heating (e.g., ice that is heated can melt into water, but the water can be cooled and can freeze back into ice [and vice versa]). ii. Some changes caused by heating or cooling cannot be reversed by cooling or heating (e.g., a raw egg that is cooked by heating cannot be turned back into a raw egg by cooling the cooked egg, cookie dough that is baked does not return to its uncooked form when cooled, charcoal that is formed by heating wood does not return to its original form when cooled). Provide students with materials to create a poster about changes in matter that reflects what they have learned.	2-PS1-1 4(a) 2-PS1-2 1(a) 2-PS1-3 1(a) 2-PS1-4 4(a)

Summative (Benchmark) Assessment
Journal entry Lab report/graphs Written Assessment Observations Assessment of key vocabulary (solid, liquid, gas, matter, properties, strength, flexibility, hardness, texture, absorbency)

Embedded English Language Arts/Literacy and Mathematics

ELA: Literacy:

RI.2.1, RI.2.3, RI.2.8

W.2.1, W.2.7, W.2.8

Mathematics:

MP.2, MP.4, MP.5, 2.MD.D.10

Three-Dimensional Teaching and Learning

Science and Engineering Practices

Planning and Carrying Out Investigations-Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

*Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-PS1-1)

Analyzing and Interpreting Data-Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

*Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2)

Constructing Explanations and Designing Solutions-Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

*Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2-PS1-3)

Engaging in Argument from Evidence-Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).

*Construct an argument with evidence to support a claim. (2- PS1-4)

Connections to Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

*Scientists search for cause and effect relationships to explain natural events. (2-PS1-4)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

*Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1)

*Different properties are suited to different purposes. (2- PS1-2),(2-PS1-3)

*A great variety of objects can be built up from a small set of pieces. (2-PS1-3)

PS1.B: Chemical Reactions Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)

Crosscutting Concepts

Patterns

*Patterns in the natural and human designed world can be observed. (2-PS1-1)

Cause and Effect

*Events have causes that generate observable patterns. (2-PS1-4)

*Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2)

Energy and Matter

*Objects may break into smaller pieces and be put together into larger pieces, or change shapes. (2-PS1-3)

Connections to Engineering, Technology, and Applications of Science

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

*Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. (2-PS1-2)

Prior Learning
Core Vocabulary:

solid, liquid, gas, matter, properties, strength, flexibility, hardness, texture, absorbency

Modifications
Special Needs: Small group, peer coaches, activities based on learning styles **ELL:** Hands-on, picture cues, visual learning activities **Gifted Learners:** Additional higher level questioning and “stretched” activities with journal response

Samples of Open Education Resources for this unit:
Books: The World of Matter, Newbridge, Ron Cole States of Matter, Delta Science Readers Water Can Change by Briana Birchall Matter is Everything by Becky Gold The Cloud Book by Tommie de Paola

Chag It! Solids, Liquids, Gases and You by Adrienne Mason

Amazing Materials by Sally Hewitt

Mixing and Separating by Chris Oxlade

What is the WOrld Made of? All about Solids, Liquids, and Gases by Kathleen Weidner Zoehfeld

Videos:

BrainPOPJr. Solids, Liquids, and Gases

The Magic School Bus: The Magic School Bus Meets Molly Cule by Joanna Cole video

Websites:

http://harcourtschool.com/activity/states_of_matter/

Http://www.brainpopjr.com/science/matter/solidsliquidsandgases/preview.weml

http://www.strangematterexhibit.com

Course Title

Unit 2: Interdependent Relationships in Ecosystems (20 Instructional Days)

Rationale: This unit builds upon prior knowledge of life cycles of plants and animals. Students will explore ecosystems in greater depth to determine the health and future of all living things. This will provide more opportunities to use critical thinking. Students will also have the opportunity to evaluate the effects of human behavior on the general health of each ecosystem explored during the unit study.

Overarching Essential Questions	Overarching Enduring Understandings

What do living things need to survive? How do the adaptations of living things help them to survive?	Organisms have basic needs (animals need air and food; plants need air, water, nutrients, and light) though the amount of these needs may vary. Each plant and animal adapts in their own way to their environment.
Essential Questions	Enduring Understandings
What are ecosystems? What happens when the environment changes? Can organisms only survive in one ecosystem? What is a habitat? How do some plants rely on animals for reproduction?	Ecosystems are made up of climate, plants, soil, and animals. When the environment changes, plants and animals adapt, move, or die. Some organisms can survive in multiple ecosystems due to their adapting ability. Animals live where their basic needs are met and they are adapted to survive. Pollination occurs when pollen is transferred.

Student Learning Experiences and Formative Assessments	
	NGSS *Standards*
Students plan and conduct an investigation to determine if plants need water and sunlight to grow. Students plant lima beans in a bag so they can observe the different parts. Set-up 4 different parts: 1. Sunlight and water 2. Sunlight and no water 3. Water and no sunlight 4. No water no sunlight. They keep a science journal, recording their observations every few days for 2 weeks.	2-LS2-1 1a, 2a, 2b, 3a, 3b, 4a
Students develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. Introduce The Food Chain to students and read the book, What if There Were No Bees? by Suzanne Slade. Have students explain what would happen if bees were taken out of the food chain. Students create a "What if...:" writing piece based on this.	2-LS2-2 1a, 2a,

	3a
Students observe and collect data on plants and animals to compare the diversity of life in different habitats. To emphasize the diversity of life in different habitats, students discuss the rainforest and the many different animals that live there. Watch National Geographic kids-watch and discuss animals and plants from around the world/different habitats.	2-LS4-1 1a,2a
Introduce the definition of a habitat. Assign students to small groups to learn about the habitat and present the information to the rest of the class.	2-LS4-1 3a

Summative (Benchmark) Assessment
Journal Entry **Lab Report** **Written Assessment** **Observations** **Assessment of Key Vocabulary**

Embedded English Language Arts/Literacy and Mathematics

ELA: Literacy:

RI.2.1, RI.2.3, RI.2.8

W.2.7, W.2.8

Mathematics:

MP.s, MP.4, MP.5, 2.MD.D.10

Three-Dimensional Teaching and Learning

Science and Engineering Practices

Developing and Using Models-Modeling in K-2 builds on prior experiences...

Planning and Carrying Out Investigations- Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

*Plan and conduct an investigation to determine if plants need sunlight and water to grow. (2-LS2-1-1)

Constructing Explanations and Designing Solutions-Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

*Make observations of plants and animals to compare the diversity of life in different habitats. (2-LS4-1)

Engaging in Argument from Evidence-Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).

*Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. (2-LS2-2).

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

*Scientists look for patterns and order when making observations about the world (2-LS4-1)

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

*Plants depend on water and light to grow. (2-LS2-1)

* Plants depend on animals for pollination or to move their seeds around. (2-LS2-2)

LS4.D: Biodiversity and Humans

*There are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1)

ETS1.B: Developing Possible Solutions

*Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (secondary to 2-LS2-2)

Crosscutting Concepts

Cause and Effect

*Events have causes that generate observable patterns. (2-LS2-1)

Structure and Function

*The shape and stability of structures of natural and designed objects are related to their function(s). (2-LS2-2)

Prior Learning
Core Vocabulary: plants, animals, sunlight, water, seeds, pollinate, habitat, living/nonliving

Modifications
Special Needs: Follow IEP plans and 504 plans Small group, peer coaches, activities based on learning styles **ELL:**

Hands-on, picture cues, visual learning activities

Gifted Learners:

Additional higher level questioning and “stretched” activities with journal response

Samples of Open Education Resources for this unit:

Books:

What it There Were No Bees? by Suzanne Slade

Who Eats What? by Holly Keller

Cactus Hotel by Brenda Guiberson

Life in the Polar Region by Melvin Berger

How Do Fish Live? by Heather Jenkins

A Tree Can Be by Judy Nayer

Websites:

- http://pbs.panda-prod.cdn.s3.amazonaws.com/media/assets/wgbh/ess05/ess05_int_seasonsgame/index.html (seasons)
- http://www.sciencecourseware.org/eec/GlobalWarming/Tutorials/Seasons/ (seasons)
- http://spaceplace.nasa.gov/science-fair/en/ (science method fair ideas)
- http://thehappyscientist.com/next-generation-science-standards-second-grade
- http://www.hookedonscience.org/nextgenerationsciencestandards.html
- https://www.teachingchannel.org/videos/next-generation-science-standards-achieve
- http://www.earthsciweek.org/classroom-activities/ngss

●http://betterlesson.com/next_gen_science/browse/2091/ngss-2-ls2-1-plan-and-conduct-an-investigation-to-determine-if-plantsneed-sunlight-and-water-to-grow/browse/2091/ngss-2-ls2-1-plan-and-conduct-an-investigation-to-determine-if-plants-needsunlight-and-water-to-grow?from=domain_core

● http://www.exploringnature.org/db/detail.php?dbID=93&detID=3684

●http://betterlesson.com/next_gen_science/browse/2092/ngss-2-ls2-2-develop-a-simple-model-that-mimics-the-function-of-ananimal-in-dispersing-seeds-or-pollinating-plants

● http://clearintotheclassroom.com/wp-content/uploads/2013/12/CITC_LessonsWhoLivesWhereWhatGrowsWhere.pdf

● http://www.exploringnature.org/db/detail.php?dbID=93&detID=3685 15

● https://www.opened.com/search?category=biological-evolution-unity-and-diversity-k- 5&grade_group=elementary&standard=2.LS4.1&standard_group=next-generation-science-standards

Course Title

Unit 3: Earth Systems: Processes that Shape the Earth (20 instructional days)

Rationale: Understanding that different forces shape the landforms on Earth's surface will assist students with recognizing why and how people try to control the forces that shape the Earth's surface. This unit provides students with knowledge of the Earth's surface and the many changes it undergoes. The results of these movements are landforms such as volcanoes, faults, and mountains. A variety of hands-on activities with substances such as wind, sand and water demonstrate the processes of erosion and weathering. By the end of the unit the students can correctly identify which forces are constructive and which are destructive.

Overarching Essential Questions	Overarching Enduring Understandings
What shapes the Earth? What are landforms?	Weathering and erosion shape the earth's surface. A landform is any natural formation of rock and dirt, found on earth. A landform can be as large as a mountain range,, or as small as a hill. Earth's surface changes in different ways through weathering and erosion. Weathering breaks down materials of the Earth's crust into smaller pieces. It can "eat away" at rock and create landforms such as caverns. Erosion is the process of picking up and carrying away of pieces of rock. Erosion can create landforms such as deltas and can destroy parts of the land such as a large boulder.
Essential Questions	Enduring Understandings
What forces act on the Earth and cause its crust to move? How do weathering and erosion change the Earth's surface? In what ways can people control the effects of forces that shape Earth's surface? Why do some Earth changes happen very slowly or quickly?	The Earth's crust is the outermost layer of the planet and is composed of may plates. These plates lay on top of the Earth's mantle which is solid, but can still flow like a hard liquid. Movement in the mantle causes the plates to move. The plates can go through compression, tension, and shear movements. These movements can cause volcanoes and earthquakes. Different forces shape the landforms that make up the Earth's surface. People try to control, or understand the effect of forces that shape the Earth's surface, by building levees, dams, and flood control

	channels to try to control the damage. The surface of the earth changes. Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides

Student Learning Experiences and Formative Assessments	
List and describe the learning experiences that will lead to answers to the essential questions, (the answers to the EQs are the enduring understandings). Some of the experiences will also be formative assessment (how you assess students during active instruction and learning experiences).	NGSS *Standards*
Make observations from media to construct an evidence based account that Earth events can occur quickly or slowly. Discuss weather reports, watch videos based on weather, show images of waterfalls, discuss erosion and watch/discuss Ice Age. Cupcake Core Sampling Activity: Make cupcakes with three different layers of batter (different colors). Use a straw to take out a core sample. Relate this to what geologists do.	2-ESS1-1 1a,b
Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. Look at and discuss images of sand dunes, dams, levees, etc. Make a sand tower and have students gently blow through straws to see what happens and make observations. Make a sand tower and have students gently pour water on it and make observations.	2-ESS2-1 1a,b 2a
Develop a model to represent the shapes and kinds of land and bodies of water in an area. Use a foil pie tin, fill it with cold water and add dry spice that floats, such as oregano. Gently blow through a straw so students can see where oregano goes and discuss this buildup as creating a land mass over time.	2-ESS2-2 1a 2a,b 3a
Obtain information to identify where water is found on Earth and that it can be solid or liquid. View and discuss Google Earth, look at pictures of glaciers, oceans, lakes, etc. Discuss Water Cycle and have students create water cycle posters and present to rest of class.	2-ESS2-3 1a,2a

Create Science journal and keep key vocabulary in there and observations of all activities.	2-ESS1-1 2-ESS2-1 2-ESS2-2 2-ESS2-3

Summative (Benchmark) Assessment
Journal Entry **Lab Report** **Written Assessment** **Observations** **Assessment of Key Vocabulary**

Embedded English Language Arts/Literacy and Mathematics
ELA: Literacy: RI.2.1, RI.2.3, RI.2.8 W.2.7, W.2.8 Mathematics: MP.s, MP.4, MP.5, 2.MD.D.10

Three-Dimensional Teaching and Learning

Science and Engineering Practices

Developing and Using Models-Modeling in K-2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

*Develop a model to represent patterns in the natural world (2-ESS2-2).

Constructing Explanations and Designing Solutions-Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

*Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2-ESS1-1)

*Compare multiple solutions to a problem. (2-ESS2-1)

Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in K-2 builds on prior experiences and uses observations and texts to communicate new information.

*Obtain information using various texts, text features (e.g. headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question. (2-ESS2-3)

Disciplinary Core Ideas

ESS1.C: The History of Planet Earth Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. (2-ESS1-1)

ESS2.A: Earth Materials and Systems Wind and water can change the shape of the land. (2- ESS2-1)

ESS2.B: Plate Tectonics and Large-Scale System Interactions Maps show where things are located. One can map the shapes and kinds of land and water in any area. (2-ESS2- 2)

ESS2.C: The Roles of Water in Earth's Surface Processes Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. (2-ESS2-3)

ETS1.C: Optimizing the Design Solution Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (secondary to 2-ESS2-1)

Crosscutting Concepts

Patterns

*Patterns in the natural world can be observed. (2-ESS2-2),(2-ESS2-3)

Stability and Change

*Things may change slowly or rapidly. (2- ESS1-1),(2-ESS2-1)

Connections to Engineering, Technology, and Applications of Science

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

*Developing and using technology has impacts on the natural world. (2-ESS2-1)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

*Scientists study the natural and material world. (2-ESS2-1)

Prior Learning
Key Vocabulary-soil, Earth, wind, flood, sand, rock, water, land, lake, pond, stream, river, ocean, landform, mountain, eruption, hurricane, volcano, earthquake, erosion

Modifications
Special Needs: Follow IEP plans and 504 plans Small group, peer coaches, activities based on learning styles **ELL:** Hands-on, picture cues, visual learning activities **Gifted Learners:** Additional higher level questioning and “stretched” activities with journal response

Samples of Open Education Resources for this unit:
Books: Earthquakes and Volcanoes, by Nash Kramer Wind, by Nash Kramer Water, by Nash Kramer Looking at Earth, How Does it Change? by Jackie Gaff Websites: Brainpop Jr.-Landforms www.pebblego.com Earth and Space/Earth Science http://discoveryeducation.com http://learner.org/interactives/dynamicearth/ http://geography.mrdonn.org

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	● 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