TOWNSHIP OF UNION PUBLIC SCHOOLS

Grade 2 Science Model Curriculum

Curriculum Guide

Updated December 18, 2018

Mission Statement

The mission of the Township of Union Public Schools is to build on the foundations of honesty, excellence, integrity, strong family, and community partnerships. We promote a supportive learning environment where every student is challenged, inspired, empowered, and respected as diverse learners. Through cultivation of students' intellectual curiosity, skills and knowledge, our students can achieve academically and socially, and contribute as responsible and productive citizens of our global community.

Philosophy Statement

The Township of Union Public School District, as a societal agency, reflects democratic ideals and concepts through its educational practices. It is the belief of the Board of Education that a primary function of the Township of Union Public School System is to formulate a learning climate conducive to the needs of all students in general, providing therein for individual differences. The school operates as a partner with the home and community.

Statement of District Goals

- **Develop reading, writing, speaking, listening, and mathematical skills.**
- **Develop a pride in work and a feeling of self-worth, self-reliance, and self-discipline.**
- **Acquire and use the skills and habits involved in critical and constructive thinking.**
- **Develop a code of behavior based on moral and ethical principles.**
- **Work with others cooperatively.**
- **Acquire a knowledge and appreciation of the historical record of human achievement and failures and current societal issues.**
- **Acquire a knowledge and understanding of the physical and biological sciences.**
- **Participate effectively and efficiently in economic life and the development of skills to enter a specific field of work.**
- **Appreciate and understand literature, art, music, and other cultural activities.**
- **Develop an understanding of the historical and cultural heritage.**
- **Develop a concern for the proper use and/or preservation of natural resources.**
- **Develop basic skills in sports and other forms of recreation.**

Curriculum Units – Second Grade Science

Unit 1: Relationships in Habitats

Unit 2: Properties of Matter

Unit 3: Changes to Matter

Unit 4: The Earth's Land and Water

Unit 5: Changes to Earth's Land

Pacing Guide- Second Grade Science

Unit 1: Relationships in Habitats **Instructional Days: 15**

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.

Unit 2: Properties of Matter **Instructional Days: 20**

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.

This unit is based on 2-PS1-1, 2-PS1-2, and K-2-ETS1-3.

Unit 3: Changes to Matter **Instructional Days: 15**

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.

Unit 4: The Earth's Land and Water **Instructional Days: 20**

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.

Unit 5: Changes to Earth's Land **Instructional Days: 20**

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.

Note:
The number of instructional days is an estimate based on the information available at this time. 1 day equals approximately 42 minutes of seat time. Teachers are strongly encouraged to review the entire unit of study carefully and collaboratively to determine whether adjustments to this estimate need to be made.

Unit 1: Relationships in Habitats **Instructional Days: 15**

Unit Summary
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.
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)**
Plan and conduct an investigation to determine if plants need sunlight and water to grow. [*Assessment Boundary: Assessment is limited to testing one variable at a time.*] **(2-LS2-1)**
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)

Part A: *How does the diversity of plants and animals compare among different habitats?*

Concepts	Formative Assessment
• 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.	*Students who understand the concepts can:* • 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. • 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.	*Students who understand the concepts can:* • 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.

Unit Resources and Suggested Activities

- **Suggested Mentor Texts:**
  1. From Seed to Plant by Gail Gibbons
  2. A Fruit is a Suitcase for Seeds by Jean Richards
  3. A Tiny Seed by Eric Carle
  4. Science Fusion Leveled Readers-Unit 1

- **Suggested Websites/Videos:**
  1. http://www.readworks.org/
  2. http://pbskids.org/plumlanding/
  3. http://www.e-learningforkids.org/science/grade/2/
  4. http://www.turtlediary.com/videos/second-grade/science.html
  5. Roots and Shoots video: **https://nj.pbslearningmedia.org/search/?q=roots+and+shoots&selected_facets=&selected_facets=**
  6. **www.brainpopjr.com (animal habitats)**
  7. **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.**

- **Suggested Investigations:**
  1. Use of school garden to plant, reinforce plant needs, and measure plant growth over a given time period
  2. Fusion Unit 4, Inquiry Lesson 2-pg. 147
  3. Pollinating Plants with Kool-Aid: http://www.classroomfreebiestoo.com/2016/02/pollinating-plants-with-kool-aid.html

- **Suggested Activities:**
  1. Nature Walk: Students will go on a nature walk and use the five senses to describe the habitat they visited. (Use five senses and take note of plants and animals that live there).
  2. S.T.E.M. Zoo Move—Students will read various articles/books about different habitats and record information in a graphic organizer. Students will

follow up their research with the building of a means of transferring an animal from zoo to another and ensuring the animal has the basics of its habitat to survive its trip.

3. S.T.E.M Jigsaw Plant Parts Model—Students are placed into small groups and each group is given a designated plant part to create using provided materials. After creating parts, students come together to create the full plant, explaining the job of each plant part and how it helps the plant grow and survive.
4. Fusion Unit 5, Inquiry Lesson 3-pg. 205
5. Grow a Grass Head activity: http://www.kidspot.com.au/things-to-do/activities/grow-a-grass-head (Adaptation: change use of the stocking to a clear plastic cup and students can create a graph that demonstrates the height of the grass each week)
6. S.T.E.M. Challenge activity:
   - ✓ 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.
   - ✓ Building and Testing Our Vanilla Plant Pollinator: In previous lessons, 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: 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.

Connecting with 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.

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

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.

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**

Modifications

(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).

NGSS and Foundations for the Unit
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)**
Plan and conduct an investigation to determine if plants need sunlight and water to grow. [*Assessment Boundary: Assessment is limited to testing one variable at a time.*] **(2-LS2-1)**
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 performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions • Make observations (firsthand or from media) to collect data that can be used to make comparisons. (2-LS4-1) **Planning and Carrying Out Investigations** • Plan and conduct investigations	**NGSS Standards and bullet points** **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)	**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

collaboratively to produce evidence to answer a question. (1-PS4-1),(2-LS2-1) **Using Mathematics and Computational Thinking** • Model Science with Mathematics using appropriate tools. **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)	**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) **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 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)	to their function(s). (2-LS2-2), (K-2-ETS1-2) --- ***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)

Unit 2: Properties of Matter **Instructional Days: 20**

Unit Summary
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.

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)

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.

Unit Resources and Suggested Activities

- **Suggested Mentor Texts:**
  1. What is the World Made of by Kathleen Weidner Zoehfeld
  2. Air is All Around You by Franklin M. Branley
  3. Science Fusion Leveled Readers-Unit 2
- **Suggested Websites/Videos:**
  1. http://www.readworks.org/
  2. http://pbskids.org/plumlanding/
  3. http://www.e-learningforkids.org/science/grade/2/

4. http://www.turtlediary.com/videos/second-grade/science.html
5. Matter Chatter song on youTube

- **Suggested Investigations:**

1. Properties of Matter Scavenger Hunt
2. After reading the story, Bartholomew and the Oobleck, students complete an Oobleck experiment to determine if Oobleck is a solid or a liquid based on learned properties.

- **Suggested Activites:**

1. Matter Three Corner: Teacher will say an item and students will decide if it is a solid, liquid, or gas (can also use whiteboards).
2. After reading the story The 3 Little Pigs, students conduct a S.T.E.M. activity:
   - ✓ 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.
   - ✓ 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.

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

The CCSS 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.

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

With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (K-2-ETS1-3) **W.2.6**

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) **W.2.7**

Recall information from experiences or gather information from provided sources to answer a question. (2-PS1-1),(2-PS1-2),(K-2-ETS1-3) **W.2.8**

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.

Reason abstractly and quantitatively. (2-PS1-2), (K-2-ETS1-3) **MP.2**

Model with mathematics. (2-PS1-1),(2-PS1-2, (K-2-ETS1-3)) **MP.4**

Use appropriate tools strategically. (2-PS1-2), (K-2-ETS1-3) **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-PS1-1),(2-PS1-2), (K-2-ETS1-3) **2.MD.D.10**

Modifications
(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).

NGSS and Foundations for the Unit
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 performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Planning and Carrying Out Investigations • Plan and conduct an investigation	**NGSS Standards and bullet points** **PS1.A: Structure and Properties of Matter**	**Patterns** • Patterns in the natural and human designed

collaboratively to produce data to serve as the basis for evidence to answer a question.(2-PS1-1) **Analyzing and Interpreting Data** • Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2) (K-2-ETS1-3) **Using Mathematics and Computational Thinking** • Create picture graphs or bar graphs to reflect object classifications.	• 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) **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. (K-2-ETS1-3)	world can be observed. (2-PS1-1) **Cause and Effect** • Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2) --- ***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)

Unit 3: Changes To Matter **Instructional Days: 15**

Unit Summary
How can objects change? ***Are all changes reversible?***

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.

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 Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]* **(2-PS1-3)**

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)**

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 are able to:* • 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.	*Students who understand the concepts are able to:* • Observe patterns in events generated due to cause-and-effect relationships. • Construct an argument with evidence to support a claim.

Sometimes these changes are reversible, and sometimes they are not.	• 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

Unit Resources and Suggested Activities

- **Suggested Mentor Texts:**
  4. Water! Water! Water! By Nancy Elizabeth Wallace
  5. Rosie Revere, Engineer by Andrea Beaty
  6. Science Fusion Leveled Readers-Unit 3
- **Suggested Websites/Videos:**
  6. http://www.readworks.org/
  7. http://pbskids.org/plumlanding/
  8. http://www.e-learningforkids.org/science/grade/2/
  9. http://www.turtlediary.com/videos/second-grade/science.html
  10. www.brainpopjr.com (changes in matter)
  11. Magic School Bus: Ready, Set, Dough (youTube)
- **Suggested Investigations:**
  3. Making Macaroni Salad
  4. Dancing Raisins: http://scifun.chem.wisc.edu/HomeExpts/dancingraisins.htm
  5. Snowman Melt Time Lapse: https://www.youtube.com/watch?v=3db3wc3LIoU
- **Suggested Activites:**
  1. Take it apart, put it together: This is a wonderfully supported and creative lesson that involves students building, taking apart, and reassembling Legos.

2. 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.
3. 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.

Connecting with 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.

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.2.1**

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.2.3**

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

Mathematics

Students need opportunities to recognize that temperature can change the state of matter.

Modifications

(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).

NGSS and Foundations for the Unit

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 Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.] **(2-PS1-3)**
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 performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
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)	**NGSS Standards and bullet points** **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)

Unit 4: The Earth's Land and Water **Instructional Days: 20**

Unit Summary

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.

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. *[*Assessment Boundary: Assessment does not include quantitative scaling in models.*]* **(2-ESS2-2)**

Part A: *How can we identify where water is found on Earth and if it is solid or liquid?*

Concepts	Formative Assessment
• Patterns in the natural world can be observed. • Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.	*Students who understand the concepts are able to:* • Observe patterns in the natural world. • 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.)*

Unit Resources and Suggested Activities

- **Suggested Mentor Texts:**

1. A Drop Around the World by Barbara Shaw McKinney
2. Water Dance by Thomas Locker
3. The Magic School Bus Presents Planet Earth by Scholastic
4. Earth's Landforms and Bodies of Water by Natalie Hyde
5. Arctic Ocean by John F. Prevost
6. Science Fusion Leveled Readers-Unit 4

- **Suggested Websites/Videos:**

1. http://www.readworks.org/
2. http://pbs.org/plumlanding/
3. http://www.e-learningforkids.org/science/grade/2/
4. http://turtlediary.com/videos/second-grade/science.html
5. The Water Cycle Song: https://www.youtube.com/watch?v=TWb4KlM2vts
6. The Water Cycle for Kids: https://www.youtube.com/watch?v=gY9HG8zUgOE

- **Suggested Investigations:**

1. Why doesn't the ocean freeze? There's too much salt in it. Bodies of water located farther inland like islands and rivers have less salt in them, allowing them to freeze when the temperature drops to 0 degrees Celsius. Complete experiment. https://www.education.com/science-fair/article/why-doesnt-the-ocean-freeze/

- **Suggested Activities:**

1. Intro to Water- How many of you have been swimming? List and discuss different places people can swim.
2. Use smartboard to show students the Earth and discuss amount of water/oceans. Then slowly zoom in closer and closer to show North America, then US, then NJ, then Union, and ending with picture of school. Note the bodies of water and landforms as you go.
3. S.T.E.M. activity: Play-doh Landform Model
4. Model/Drawing of the Water Cycle with follow-up writing in which students pretend they are a raindrop or a snowflake going through the water cycle.

Connecting with English Language Arts/Literacy and Mathematics
English Language Arts/Literacy

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.

With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (2-ESS2-3) **W.2.6**

Recall information from experiences or gather information from provided sources to answer a question. (2-ESS2-3) **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-ESS2-2) **SL.2.5**

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.

Reason abstractly and quantitatively. (2-ESS2-2) **MP.2**

Model with mathematics. (2-ESS2-2) **MP.4**

Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. (2-ESS2-2) **2.NBT.A.3**

Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem. (2-ESS2-1) **2.MD.B.5**

Modifications

(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).

NGSS and Foundations for the Unit
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. *[*Assessment Boundary: Assessment does not include quantitative scaling in models.*]* **(2-ESS2-2)**

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

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
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	**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	**Patterns** • Patterns in the natural world can be observed. (2-ESS2-2),(2-ESS2-3)

natural world. (2-ESS2-2)	any area. (2-ESS2-2)	

Unit 5: Changes to Earth's Land **Instructional Days: 20**

Unit Summary
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.

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)
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. (K-2-ETS1-2)

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.	*Students who understand the concepts are able to:* • Compare multiple solutions to a problem.

• 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. • 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.	• 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 ✓ 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.

Unit Resources and Suggested Activities

- **Suggested Mentor Texts:**
  1. Science Fusion Leveled Readers-Unit 5
- **Suggested Websites/Videos:**
  1. http://www.readworks.org/
  2. http://pbskids.org/plumlanding/
  3. http://www.e-learningforkids.org/science/grade/2/
  4. https://www.turtlediary.com/videos/second-grade/science.html

- **Suggested Models:**

  1. Design a Volcano: 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.
  2. Model a Flood: Flooding can happen quickly during events such as hurricanes and tsunamis. Flooding can cause rapid changes to the surface of the Earth.
  3. Model Erosion through drawings: 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.

- **Suggested Investigations:**

  1. 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.

  2. How Can Wind Change the Shape of the Land?

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.

  3. 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.

- **Suggested S.T.E.M. Activity:**

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. 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.

Connecting with 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. 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.

Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text. (2-ESS1-1), (K-2-ETS1-1) **RI.2.1**

Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-ESS1-1) **RI.2.3**

With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (2-ESS1-1), (K-2-ETS1-1) **W.2.6**

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-ESS1-1) **W.2.7**

Recall information from experiences or gather information from provided sources to answer a question. (2-ESS1-1), (K-2-ETS1-1) **W.2.8**

Recount or describe key ideas or details from a text read aloud or information presented orally or through other media. (2-ESS1-1) **SL.2.2**

Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-ESS2-1) **RI.2.3**

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. (K-2-ETS1-2) **SL.2.5**

Compare and contrast the most important points presented by two texts on the same topic. (2-ESS2-1) **RI.2.9**

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.

Reason abstractly and quantitatively. (2-ESS1-1), (2-ESS2-1), (K-2-ETS1-1) **MP.2**

Model with mathematics. (2-ESS1-1), (2-ESS2-1) **MP.4**

Use appropriate tools strategically. (2-ESS2-1, (K-2-ETS1-1) **MP.5**

Understand place value. (2-ESS1-1) **2.NBT.A**

Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem. (2-ESS2-1) **2.MD.B.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. (K-2-ETS1-1) **2.MD.D.10**

Modifications

(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).

NGSS and Foundations for the Unit

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)

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. (K-2-ETS1-2)

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

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions • Make observations from several sources to construct an evidence-based account for natural phenomena. (2-ESS1-1) • Compare multiple solutions to a problem. (2-ESS2-1)	**NGSS Standards and bullet points** **ESS1.C: The History of Planet Earth** 1. 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** 2. Wind and water can change the	**Stability and Change** 6. Things may change slowly or rapidly. (2-ESS1-1) 7. Things may change slowly or rapidly. (2-ESS2-1) **Structure and Function** 8. The shape and stability of structures of natural and designed objects are

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)	shape of the land. (2-ESS2-1) **ETS1.A: Defining and Delimiting Engineering Problems** 3. A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1) 4. Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1) 5. 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)	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** 9. 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)

Best Practices and Exemplars

Students with Disabilities, English Language Learners, and Gifted & Talented Students:
Differentiating instruction is a flexible process that includes the planning and design of instruction, how that instruction is delivered, and how student progress is measured. Teachers recognize that students can learn in multiple ways. By providing appropriately challenging learning, teachers can maximize success for all students.

Examples of Strategies and Practices that Support Students with Disabilities:
***Refer to students' IEP for specific modifications and accommodations**

- Use of visual and multisensory formats
- Use of assisted technology
- Use of prompts
- Modification of content and student products
- Testing accommodations
- Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:

- Adjusting the pace of lessons
- Curriculum compacting
- Inquiry-based instruction

- Independent study
- Higher-order thinking skills
- Interest-based content
- Student-driven instruction
- Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
***All WIDA Can Do Descriptors can be found at:** https://wida.wisc.edu/teach/can-do/descriptors

- Pre-teaching of vocabulary and concepts
- Visual learning, including graphic organizers
- Use of cognates to increase comprehension
- Teacher modeling
- Pairing students with beginning English language skills

with students who have more advanced English language skills

- Scaffolding
- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups
- Teacher think-aloud

Interdisciplinary connections are made across grades and content areas to model the integration of knowledge and skills in the real world.

21st Century Themes

- Global Awareness
- Environmental Literacy

- Health Literacy
- Civic Literacy
- Financial, Economic, Business, and Entrepreneurial Literacy

21st Century Skills

- Creativity and Innovation (E)
- Critical Thinking and Problem Solving (T) (A)
- Communication (E)
- Collaboration (E) (T)

Career Ready Practices:

- CRP1: Act as a responsible and contributing citizen and employee.
- CRP2: Apply appropriate academic and technical skills.
- CRP3: Attend to personal health and financial well-being.
- CRP4: Communicate clearly and effectively and with reason.
- CRP5: Consider the environmental, social and economic impacts of decisions.
- CRP6: Demonstrate creativity and innovation.
- CRP7: Employ valid and reliable research strategies.
- CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9: Model integrity, ethical leadership and effective management.
- CRP10: Plan education and career paths aligned to personal goals.
- CRP11: Use technology to enhance productivity.

- CRP12: Work productively in teams while using global competence.

9.1 Personal Financial Literacy
This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.

9.2 Career Awareness, Exploration, and Preparation
This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

9.3 Career and Technical Education
This standard outlines what students should know and be able to do upon completion of a CTE Program of Study

Technology Standards: Technology standards are embedded throughout all curricular units.

8.1 Educational Technology All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.

8.2 Technology Education, Engineering, Design and Computational Thinking - Programming
All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.