



Diocese of Alexandria ~ Catholic Schools

Where faith and knowledge grow



DIOCESE OF ALEXANDRIA

As the Diocese of Alexandria seeks to provide a comprehensive learning environment, we are charged to “Teach More” by showing how all learning flows from and relates to our Creator. In this way, we will give our teaching a deeper meaning and purpose than simply the content itself. With this as our goal, the Catholic Schools Office has intertwined our selected curricular standards with the Catholic Standards developed by the Cardinal Newman Society. Through the merging of these two curricula, English Language Arts, Mathematics, Science, and Social Studies, teachers will be provided a roadmap to guide student’s understanding and recognition of the relationship between learning and the connection to our God.

Thomas E. Roque, Sr.
Superintendent of Catholic Schools



DIOCESE OF ALEXANDRIA

Through comprehensive review of curricula from high performing districts throughout the United States in combination with parochial schools and Newman Cardinal Standards, the Curriculum Team for the Diocese of Alexandria has generated curricula for English Language Arts, Mathematics, Science, and Social Studies. The development of this framework is designed to guide the instructional path of teachers as they focus on the formation of their students in the areas of faith, academic excellence, responsible citizenry, and effective communication and collaboration. This process is a continuous improvement process with no defined beginning or end.

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Frameworks



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HOW TO USE

The frameworks are guides to instruction. The frameworks assist teachers in planning and pacing instruction. Specific dates or weeks that may be included in this document are for reference. Each school and teacher must consider the make-up of their students, focusing on the needs and strengths of each child when pacing and planning instruction.

The cycles for the year help pace instruction and ensure students have consistent coverage of the content. The duration (the suggested amount of time to spend on each cycle) does not accommodate for the scheduling of special events, inclement weather or school events. Teachers, with principal guidance, should adjust pacing as needed to accommodate for these events.

RESEARCH-BASED HIGH-YIELD PRACTICES FOR INSTRUCTION

These strategies have proven effective in affecting student learning and achievement gains. As you plan daily instruction, consider how and where to integrate these strategies into the instructional sequence. Effect size is in parentheses. Please refer to the works of John Hattie for a complete description of instructional effect size.

- Classroom Discussion/Discourse (.82)
- Teacher Clarity/making the learning visible with expectations for learning (.75)
- Reciprocal Teaching (.74)
- Feedback (.73)
- Metacognitive Strategies (.69)

Grade 2 - Science



THE DIOCESE
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Unit 1: RELATIONSHIPS IN HABITATS

Instructional Days: 25 days

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](#))

Unit Sequence

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

Concepts	Formative Assessment
<ul style="list-style-type: none">• 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.	<p><i>Students who understand the concepts can:</i></p> <ul style="list-style-type: none">• 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. <i>(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.)</i>

Unit Sequence

Part B: *What do plants need to live and grow?*

Concepts	Formative Assessment
<ul style="list-style-type: none">• Events have causes that generate observable patterns.• Plants depend on water and light to grow.	<p><i>Students who understand the concepts can:</i></p> <ul style="list-style-type: none">• 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. <i>(Note: Assessment is limited to one variable at a time.)</i>

Unit Sequence

Part C: Why do some plants rely on animals for reproduction?

Concepts	Formative Assessments
<ul style="list-style-type: none">• 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.	<p><i>Students who understand the concepts can:</i></p> <ul style="list-style-type: none">• 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.

Sample of Open Education Resources

[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.

Teacher Professional Learning Resources

[Teaching NGSS in Elementary School—Second Grade](#)

The presenters were Carla Sembal-Saul, Professor of Science Education at Penn State University, Mary Starr, Executive Director at Michigan Mathematics and Science Centers Network, and Kathy Renfrew, K-5 Science Coordinator, VT Agency of Education and NGSS Curator introduced the NGSS Web seminar Series for K-5 educators.

The seminar was introduced by Ted Willard, NSTA's Director for NGSS, on how Elementary School standards - and specifically for the Second Grade - fit into the framework in terms of core ideas and performance expectations. Carla, Mary and Kathy engaged with participants to gauge their familiarity with NGSS for the second grade, and provided a number of example activities and videos on how to implement it, e.g., explaining how solids and liquids respond in the presence of a heat source. The web seminar was then wrapped up by Ted Willard, who suggested a number of resources and events for participants to further develop their understanding of NGSS for the Second Grade, as well as other grade levels.

Visit the resource [collection](#).

[NSTA Web Seminar: Teaching NGSS in K-5: Constructing Explanations from Evidence](#)

Carla Zembal-Saul, Mary Starr, and Kathy Renfrew, provided an overview of the NGSS for K-5th grade. The web seminar focused on the three dimensional learning of the NGSS, while introducing CLAIMS-EVIDENCE-REASONING (CER) as a framework for introducing explanations from evidence. The presenters highlighted and discussed the importance of engaging learners with phenomena, and included a demonstration on using a KLEWS chart to map the development of scientific explanations of those phenomena.

To view related resources, visit the [resource collection](#).

[NGSS Core Ideas: Earth's Systems](#)

The presenter was Jill Wertheim from National Geographic Society. The program featured strategies for teaching about Earth science concepts that answer questions such as "What regulates weather and climate?" and "What causes earthquakes and volcanoes?"

Dr. Wertheim began the presentation by introducing a framework for thinking about content related to Earth systems. She then showed learning progressions for each concept within the Earth's Systems disciplinary core idea and shared resources and strategies for addressing student preconceptions. Dr. Wertheim also talked about changes in the way NGSS addresses these ideas compared to previous common approaches. Participants had the opportunity to submit questions and share their feedback in the chat.

Appendix A: 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
<p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(2-LS2-1) <p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> Make observations (firsthand or from media) to collect data that can be used to make comparisons. (2-LS4-1) <p>Developing and Using Models</p> <ul style="list-style-type: none"> Develop a simple model based on evidence to represent a proposed object or tool. (2-LS2-2) 	<p>LS4.D: Biodiversity and Humans</p> <ul style="list-style-type: none"> 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) <p>LS2.A: Interdependent Relationships in Ecosystems</p> <ul style="list-style-type: none"> 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) <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Events have causes that generate observable patterns. (2-LS2-1) <p>Structure and Function</p> <ul style="list-style-type: none"> The shape and stability of structures of natural and designed objects are related to their function(s). (2-LS2-2), (K-2-ETS1-2) <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Scientists look for patterns and order when making observations about the world. (2-LS4-1)

<p>Asking Questions and Defining Problems</p> <ul style="list-style-type: none"> • 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) 	<p>ideas for a problem's solutions to other people. (<i>secondary to 2-LS2-2</i>)</p> <p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> • 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) 	
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Grade 2 - Science



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Unit 2: PROPERTIES OF MATTER

Instructional Days: 25 Days

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](#))

Unit Sequence

- Part A:**
- ✓ *How can we sort objects into groups that have similar patterns?*
 - ✓ *Can some materials be a solid or a liquid?*

Concepts

- 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.

Formative Assessment

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.

Unit Sequence

Part B: What should the three little pigs have used to build their houses?

Concepts

- 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.

Formative Assessment

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.

Sample of Open Education Resources

[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.

Teacher Professional Learning Resources

[Using the NGSS Practices in the Elementary Grades](#)

The presenters were Heidi Schweingruber from the National Research Council, Deborah Smith from Penn State University, and Jessica Jeffries from State College Area School District. In this seminar the presenters talked about applying the scientific and engineering practices described in A Framework for K-12 Science Education in elementary-level classrooms.

[Teaching NGSS in K-5: Constructing Explanations from Evidence](#)

Carla Zembal-Saul, Mary Starr, and Kathy Renfrew, provided an overview of the NGSS for K-5th grade. The web seminar focused on the three dimensional learning of the NGSS, while introducing CLAIMS-EVIDENCE-REASONING (CER) as a framework for introducing explanations from evidence. The presenters highlighted and discussed the importance of engaging learners with phenomena, and included a demonstration on using a KLEWS chart to map the development of scientific explanations of those phenomena.

View the resource [collection](#).

[NSTA Web Seminar: NGSS Core Ideas: Matter and Its Interactions](#)

Dr. Krajcik began the presentation by defining disciplinary core ideas and discussing the value of using core ideas to build understanding across time. He also talked about the way disciplinary core ideas work together with the other components of *NGSS*: scientific and engineering practices and crosscutting concepts. The program featured strategies for teaching about physical science concepts that answer questions such as "How do particles combine to form the variety of matter one observes?" and "How do substances combine or change (react) to make new substances?" Dr. Krajcik talked about the disciplinary core ideas for Properties of Matter and shared examples of student work. Participants had the opportunity to ask questions and discuss ideas for classroom application with other participating teachers.

View the the resource [collection](#).

Appendix A: 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
<p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.(2-PS1-1) <p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2) <p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Analyze data from tests of an object or tool to determine if it works as intended. (K-2-ETS1-3) 	<p>PS1.A: Structure and Properties of Matter</p> <ul style="list-style-type: none"> 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) <p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2-ETS1-3) 	<p>Patterns</p> <ul style="list-style-type: none"> Patterns in the natural and human designed world can be observed. (2-PS1-1) <p>Cause and Effect</p> <ul style="list-style-type: none"> Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2) <p>Connections to Engineering, Technology, and Applications of Science</p> <p>Influence of Engineering, Technology, and Science, on Society and the Natural World</p> <ul style="list-style-type: none"> 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)

Grade 2 – Science



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Unit 3: CHANGES TO MATTER

Instructional Days: 25 Days

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)

Unit Sequence

Part A: *In what ways can an object made of a small set of pieces be disassembled and made into a new object?*

Concepts

- 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.

Formative Assessment

- 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.

Unit Sequence

Part B: *Can all changes caused by heating or cooling be reversed?*

Concepts

- 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.

Formative Assessment

- 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.
 - 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

Sample of Open Education Resources

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.

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.

Teacher Professional Learning Resources

Connections Between Practices in NGSS, Common Core Math, and Common Core ELA

The presenter was Sarah Michaels from Clark University. In this seminar Dr. Michaels talked about connecting the scientific and engineering practices described in A Framework for K-12 Science Education with the Common Core State Standards in Mathematics and English Language Arts.

Engineering Design as a Core Idea

The presenter was Cary Sneider, Associate Research Professor at Portland State University in Portland, Oregon. The seminar focused on the Core Idea of Engineering, led by Cary Sneider, Associate Research Professor at Portland State University. Cary explained the overall NGSS engineering components for K-2, MS and HS, and went through a number of practical examples of how teachers could develop modules and investigations for their students to learn them. Cary also spoke about the ways in which teachers could include cross-cutting engineering concepts to a number of classroom subjects. The seminar concluded with an overview of NSTA resources about NGSS available to teachers by Ted, and a Q & A session with Cary.

Visit the resource [collection](#).

NGSS Core Ideas: Matter and Its Interactions

The presenter was Joe Krajcik from Michigan State University. The program featured strategies for teaching about physical science concepts that answer questions such as "How do particles combine to form the variety of matter one observes?" and "How do substances combine or change (react) to make new substances?"

Dr. Krajcik began the presentation by defining disciplinary core ideas and discussing the value of using core ideas to build understanding across time. He also talked about the way disciplinary core ideas work together with the other components of NGSS: scientific and engineering practices and crosscutting concepts. Dr. Krajcik talked about the disciplinary core ideas for PS1 and shared examples of student work. Participants had the opportunity to ask questions and discuss ideas for classroom application with other participating teachers.

Visit the [resource collection](#).

Appendix A: 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
<p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1) <p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2-PS1-3) <p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Construct an argument with evidence to support a claim. (2-PS1-4) 	<p>PS1.A: Structure and Properties of Matter</p> <ul style="list-style-type: none"> 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) <p>PS1.B: Chemical Reactions</p> <ul style="list-style-type: none"> 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) 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Events have causes that generate observable patterns. (2-PS1-4) <p>Energy and Matter</p> <ul style="list-style-type: none"> Objects may break into smaller pieces and be put together into larger pieces, or change shapes. (2-PS1-3) <p>Connections to Nature of Science</p> <p>Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena</p> <ul style="list-style-type: none"> Science searches for cause and effect relationships to explain natural events. (2-PS1-4)

Grade 2 - Science



THE DIOCESE
of ALEXANDRIA

Unit 4: THE EARTH'S LAND AND WATER

Instructional Days: 40 Days

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](#))

Unit Sequence

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

Concepts	Formative Assessment
<ul style="list-style-type: none">• 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.	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none">• 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.

Unit Sequence

Part B: *In what ways can you represent the shapes and kinds of land and bodies of water in an area?*

Concepts

- 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.

Formative Assessment

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.*)

Sample of Open Education Resources

None found.

Teacher Professional Learning Resources

Teaching NGSS in K-5: Making Meaning through Discourse

Presenters were Carla Zembal-Saul, (Penn State University), Mary Starr, (Michigan Mathematics and Science Centers Network), and Kathy Renfrew (Vermont Agency of Education).

After a brief introduction by NSTA's Ted Willard about the Next Generation Science Standards (NGSS), Zembal-Saul, Starr, and Renfrew gave context to the NGSS specifically for K-5 teachers, discussing three-dimensional learning, performance expectations, and background information on the NGSS framework for K-5. The presenters also gave a number of examples and tips on how to approach NGSS with students, and took participants' questions. The web seminar ended with the presentation of a number of recommended NSTA resources for participants to explore.

View the resource [collection](#).

Evaluating Resources for NGSS: The EQUIP Rubric

The presenters were Brian J. Reiser, Professor of Learning Sciences in the School of Education and Social Policy at Northwestern University, and Joe Krajcik, Director of the CREATE for STEM Institute.

Ted Willard, NSTA's NGSS Director, introduced the web seminar by providing an overview of the Next Generation Science Standards, including how the standards were developed, which states have adopted them and which organization, including the NSTA, have been instrumental in providing assistance in the development of the NGSS. Ted also discussed the NSTA's commitment to helping teachers and educators understand the NGSS, so that teachers can begin implementing the new standards in their instructional practices. After this brief overview, Brian Reiser, Professor of Learning Sciences, School of Education at Northwestern University and Joe Krajcik, Director of CREATE for STEM Institute of Michigan State University introduced the Educators Evaluating Quality Instructional Products (EQUIP) Rubric.

The web seminar focused on how explaining how the EQUIP rubric can be used to evaluate curriculum materials, including individual lessons, to determine alignment of the lesson and/or materials with the NGSS. Three-dimensional learning was defined, highlighted and discussed in relation to the rubric and the NGSS. An emphasis was placed on how to achieve the conceptual shifts expectations of NGSS and three-dimensional learning using the rubric as a guide. Links to the lesson plans presented and hard copies of materials discussed, including the EQUIP rubric, were provided to participants. The web seminar concluded with an overview of NSTA resources on the NGSS available to teachers by Ted, and a Q & A with Brian Reiser and Joe Krajcik.

View the resource [collection](#).

NGSS Crosscutting Concepts: Systems and System Models

The presenter was Ramon Lopez from the University of Texas at Arlington. This was the seventh web seminar in a series of seven focused on the crosscutting concepts that are part of the Next Generation Science Standards (NGSS).

Appendix A: 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
<p>Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none"> 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) <p>Developing and Using Models</p> <ul style="list-style-type: none"> Develop a model to represent patterns in the natural world. (2-ESS2-2) 	<p>ESS2.C: The Roles of Water in Earth’s Surface Processes</p> <ul style="list-style-type: none"> Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. (2-ESS2-3) <p>ESS2.B: Plate Tectonics and Large-Scale System Interactions</p> <ul style="list-style-type: none"> Maps show where things are located. One can map the shapes and kinds of land and water in any area. (2-ESS2-2) 	<p>Patterns</p> <ul style="list-style-type: none"> Patterns in the natural world can be observed. (2-ESS2-2),(2-ESS2-3)

Grade 2 - Science



THE DIOCESE
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Unit 5: CHANGES TO THE EARTH'S LAND

Instructional Days: 25 Days

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)

Unit Sequence

Part A: What evidence can we find to prove that Earth events can occur quickly or slowly?

Concepts

- 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.

Formative Assessment

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.

Unit Sequence

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

Concepts

- 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.
- 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.

Formative Assessment

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
 - ✓ 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.

Sample of Open Education Resources

[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.

Teacher Professional Learning Resources

Assessment for the Next Generation Science Standards

The presenters were Joan Herman, Co-Director Emeritus of the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) at UCLA; and Nancy Butler Songer, Professor of Science Education and Learning Technologies, University of Michigan.

Dr. Herman began the presentation by summarizing a report by the National Research Council on assessment for the Next Generation Science Standards (NGSS). She talked about the development of the report and shared key findings. Next, Dr. Songer discussed challenges for classroom implementation and provided examples of tasks that can be used with students to assess their proficiency on the NGSS performance expectations. Participants had the opportunity to submit questions and share their feedback in the chat.

NGSS Crosscutting Concepts: Patterns

The presenter was Kristin Gunckel from the University of Arizona. Dr. Gunckel began the presentation by discussing how patterns fit in with experiences and explanations to make up scientific inquiry. Then she talked about the role of patterns in NGSS and showed how the crosscutting concept of patterns progresses across grade bands. After participants shared their ideas about using patterns in their own classrooms, Dr. Gunckel shared instructional examples from the elementary, middle school, and high school levels.

NGSS Crosscutting Concepts: Structure and Function

The presenters were Cindy Hmelo-Silver and Rebecca Jordan from Rutgers University. Dr. Hmelo-Silver and Dr. Jordan began the presentation by discussing the role of the crosscutting concept of structure and function within NGSS. They then asked participants to think about the example of a sponge and discuss in the chat how a sponge's structure relates to its function. The presenters introduced the Structure-Behavior-Function (SBF) theory and talked about the importance of examining the relationships between mechanisms and structures. They also discussed the use of models to explore these concepts. Participants drew their own models for one example and shared their thoughts about using this strategy in the classroom.

ESS.2 NGSS Core Ideas: Earth's Systems

The presenter was Jill Wertheim from National Geographic Society. The program featured strategies for teaching about Earth science concepts that answer questions such as "What regulates weather and climate?" and "What causes earthquakes and volcanoes?"

Dr. Wertheim began the presentation by introducing a framework for thinking about content related to Earth systems. She then showed learning progressions for each concept within the Earth's Systems disciplinary core idea and shared resources and strategies for addressing student preconceptions. Dr. Wertheim also talked about changes in the way NGSS addresses these ideas compared to previous common approaches.

Appendix A: 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
<p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> 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) <p>Asking Questions and Defining Problems</p> <ul style="list-style-type: none"> Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1) 	<p>ESS1.C: The History of Planet Earth</p> <ul style="list-style-type: none"> Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. (2-ESS1-1) <p>ESS2.A: Earth Materials and Systems</p> <ul style="list-style-type: none"> Wind and water can change the shape of the land. (2-ESS2-1) <p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1) 	<p>Stability and Change</p> <ul style="list-style-type: none"> Things may change slowly or rapidly. (2-ESS1-1) Things may change slowly or rapidly. (2-ESS2-1) <p>Structure and Function</p> <ul style="list-style-type: none"> The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-2) <p>Connections to Engineering, Technology, and Applications of Science</p>

<ul style="list-style-type: none"> Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1) <p>Developing and Using Models</p> <ul style="list-style-type: none"> Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2) 	<ul style="list-style-type: none"> 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) <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> 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) 	<p>Influence of Engineering, Technology, and Science on Society and the Natural World</p> <ul style="list-style-type: none"> Developing and using technology has impacts on the natural world. (2-ESS2-1) <p><i>Connections to Nature of Science</i></p> <p>Science Addresses Questions About the Natural and Material World</p> <ul style="list-style-type: none"> Scientists study the natural and material world. (2-ESS2-1)
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