



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.

Barbara Forest, M.A..
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Tracy Bock, Ed.S.

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 3- Science



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Unit 1: WEATHER AND CLIMATE

Instructional Days: 15 days

SUMMARY

What is the typical weather near our home?

How can we protect people from weather-related hazards?

In this unit of study, students organize and use data to describe typical weather conditions expected during a particular season. By applying their understanding of weather-related hazards, students are able to make a claim about the merit of a design solution that reduces the impacts of such hazards. 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 *asking questions and defining problems, analyzing and interpreting data, engaging in argument from evidence, 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 3-ESS2-1, 3-ESS2-2, 3-ESS3-1, and 3-5-ETS1-1.

Student Learning Objectives

Develop a model using an analogy, to describe how weather and climate are related. ([ESS2.D](#)) *[Note: This SLO is based on the disciplinary core ideas found in the Framework. It is intended to serve as a scaffold to 3-ESS2-1.]*

Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* ([3-ESS2-1](#))

Obtain and combine information to describe climates in different regions of the world. ([3-ESS2-2](#))

Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. *[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]* ([3-ESS3-1](#))

Unit Sequence

Part A: *Can we predict the kind of weather that we will see in the spring, summer, autumn, or winter?*

Concepts

- Patterns of change can be used to make predictions.
- People record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.

Formative Assessments

Students who understand the concepts can:

- Make predictions using patterns of change.
- Represent data in tables, bar graphs, and pictographs to reveal patterns that indicate relationships.
- Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *(Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.)* Examples of data could include:
 - ✓ Average temperature
 - ✓ Precipitation
 - ✓ Wind direction

Unit Sequence

Part B: *How can climates in different regions of the world be described?*

Concepts

- Patterns of change can be used to make predictions.
- Climate describes the range of an area's typical weather conditions and the extent to which those conditions vary over years.

Formative Assessments

Students who understand the concepts can:

- Make predictions using patterns of change.
- Obtain and combine information from books and other reliable media to explain phenomena.

Unit Sequence

Part C: How can we protect people from natural hazards such as flooding, fast wind, or lightening?

Concepts

- Cause-and-effect relationships are routinely identified, tested, and used to explain change.
- Science affects everyday life.
- People's needs and wants change over time, as do their demands for new and improved technologies.
- A variety of natural hazards result from natural processes (e.g., *flooding, fast wind, or lightening*).
- Humans cannot eliminate natural hazards but can take steps to reduce their impacts.
- Engineers improve technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones).
- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria).
- Different proposals for solutions can be compared on the basis of how well each one meets the criteria for success or how well each takes the constraints into account.

Formative Assessments

Students who understand the concepts can:

- Identify and test cause-and-effect relationships to explain change.
- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.
- Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. Examples of design solutions to weather-related hazards could include:
 - ✓ Barriers to prevent flooding
 - ✓ Wind-resistant roofs
 - ✓ Lightning rods
- Define a simple design problem that can be solved through the development of an object, tool, process, or system and include several criteria for success and constraints on materials, time, or cost.
- Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Sample of Open Education Resources

[Weather Science content for Kids and Teens](#): The National Weather Service has several education resources available at this website.

[NOAA Education Resources](#): The National Oceanic and Atmospheric Administration (NOAA) provides education resources at this website.

(Note: Students in grades Kindergarten, 4, and 5 make sense of weather and climate. Each model science unit related to Weather and Climate will include these two websites. Therefore, it is important that teachers of science in these grades to collaborate to prevent redundancy in the K-5 weather and climate curriculum.)

Teacher Professional Learning Resources

Teaching NGSS in Elementary School—Third Grade

Carla Zembal-Saul, Professor of Science Education at Penn State University, Mary Starr, Executive Director of Michigan Mathematics and Science Centers Network, Kathy Renfrew, K-5 Science Coordinator for VT Agency of Education and Kimber Hershberger, co-author of "What's Your Evidence?" introduced an overview of the NGSS for Third Grade. The web seminar began with explaining how to unpack the performance expectations. It continued with a focus on scientific practices in relation to the specific standard and performance expectations. Science talk - what it looks like and sounds like, and how to use it in the classroom, as well as claims, evidence and reasoning strategies were discussed.

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

Develop a model using an analogy, to describe how weather and climate are related. **(ESS2.D)** *[Note: This SLO is based on the disciplinary core ideas found in the Framework. It is intended to serve as a scaffold to 3-ESS2-1.]*

Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* **(3-ESS2-1)**

Obtain and combine information to describe climates in different regions of the world. **(3-ESS2-2)**

Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. *[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]* **(3-ESS3-1)**

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	Science and Engineering Practices	Science and Engineering Practices
<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>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) <p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Make a claim about the merit of a solution to a problem by citing relevant evidence about how it 	<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>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) <p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Make a claim about the merit of a solution to a problem by citing relevant evidence about how it 	<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>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) <p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Make a claim about the merit of a solution to a problem by citing relevant evidence about how it

<p>meets the criteria and constraints of the problem. (3-ESS3-1)</p> <p>Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none">• Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	<p>meets the criteria and constraints of the problem. (3-ESS3-1)</p> <p>Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none">• Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	<p>meets the criteria and constraints of the problem. (3-ESS3-1)</p> <p>Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none">• Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)
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Grade 3 - Science



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Unit 2: FORCES AND MOTION

Instructional Days: 20 Days

SUMMARY

How do equal and unequal forces on an object affect the object?

In this unit of study, students are able to determine the effects of balanced and unbalanced forces on the motion of an object. The crosscutting concepts of patterns and cause and effect are identified as organizing concepts for these disciplinary core ideas. In the third-grade performance expectations, students are expected to demonstrate grade-appropriate proficiency by planning and carrying out investigations. Students are expected to use these practices to demonstrate understanding of the core ideas.

Student Learning Objectives

Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. *[Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.]* *[Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]* **(3-PS2-1)**

Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. *[Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.]* *[Assessment Boundary: Assessment does not include technical terms such as period and frequency.]* **(3-PS2-2)**

How do equal and unequal forces on an object affect the object?

In this unit of study, students are able to determine the effects of balanced and unbalanced forces on the motion of an object. The crosscutting concepts of patterns and cause and effect are identified as organizing concepts for these disciplinary core ideas. In the third-grade performance expectations, students are expected to demonstrate grade-appropriate proficiency by planning and carrying out investigations. Students are expected to use these practices to demonstrate understanding of the core ideas.

Unit Sequence

Part A: How do scientists play soccer?

Concepts	Formative Assessment
<ul style="list-style-type: none">• Science investigations use a variety of methods, tools, and techniques.• Cause-and-effect relationships are routinely identified.• Objects in contact exert forces on each other.• Each force that acts on a particular object has both strength and a direction.• An object at rest typically has multiple forces acting on it, but they add to zero net force on the object.• Forces that do not sum to zero can cause changes in the object's speed or direction of motion. <i>(Qualitative and conceptual, but not quantitative, addition of forces are used at this level.)</i>	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none">• Identify cause-and-effect relationships.• Plan and conduct investigations collaboratively to produce data to serve as the basis for evidence.• Use fair tests in which variables are controlled and the number of trials considered.• Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. <i>(Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is also limited to gravity being addressed as a force that pulls objects down.) Examples could include:</i><ul style="list-style-type: none">✓ <i>An unbalanced force on one side of a ball can make it start moving.</i>✓ <i>Balanced forces pushing on a box from both sides</i>

Unit Sequence

Part B: Can we use patterns that we observed to predict the future?

Concepts	Formative Assessment
<ul style="list-style-type: none">• Science findings are based on recognizing patterns.• Patterns of change can be used to make predictions.• The patterns of an object's motion in various situations can be observed and measured.• When past motion exhibits a regular pattern, future motion can be predicted from it. (<i>Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.</i>)	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none">• Make predictions using patterns of change.• Make observations and/or measurements to produce data to serve as the basis of evidence for an explanation of a phenomenon.• Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. (<i>Assessment does not include technical terms such as period and frequency.</i>) <i>Examples of motion with a predictable pattern could include:</i><ul style="list-style-type: none">✓ <i>A child swinging in a swing.</i>✓ <i>A ball rolling back and forth in a bowl.</i>✓ <i>Two children on a seesaw.</i>

Sample of Open Education Resources

Puffing Forces: Students will predict and observe what happens when a force is applied to an object, and compare the relative effects of a force of the same strength on objects of different weights by using a straw to gently puff air at a ping pong ball then a golf ball and measuring the distance the ball travels with a ruler. Students will repeat this procedure using a harder puff. This lesson was adapted from the Utah Education Network <http://www.uen.org/Lessonplan/preview?LPid=14858>

Robo Arm: This fun activity is one of five in a series of space based engineering challenges developed by NASA and Design Squad where students are engaged in implementing the Engineering Design process to build a robotic arm that can lift a cup off a table using cardboard strips, brass fasteners, paper clips, straw, string, tape and a cup. The activity includes an instructor's guide, questioning techniques, discussion questions, extension activity, a rubric, and 3 short video clips that enhance the purpose of the activity and its relevance to NASA.

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: Motion and Stability: Forces and Interactions

Dr. Alonzo began the presentation by providing an overview of how disciplinary core ideas fit into the overall structure of NGSS. Then she and Mr. Robinson discussed common student preconceptions related to Motion and Stability: Forces and Interactions. They also showed how this disciplinary core idea progresses across grade bands. Participants had the opportunity to ask questions and discuss ideas for classroom application with other participating teachers.

View the resource [collection](#).

Science Object: Newton's First Law

This Science Object is the second of four Science Objects in the Force and Motion SciPack. It provides a conceptual and real-world understanding of Newton's First Law of Motion. All objects will maintain a constant speed and direction of motion unless an unbalanced outside force acts upon it. When an unbalanced force acts on an object, its speed or direction (or both) will change. The tendency of objects to maintain a constant speed and direction of motion (velocity) in the absence of an unbalanced force is known as inertia. Even in the most familiar, everyday situations, frictional forces can complicate the analysis of motion, although the basic principles still apply.

Appendix A: NGSS and Foundations for the Unit

Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. *[Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.]* *[Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]* **(3-PS2-1)**

Make observations and/or measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion. *[Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.]* *[Assessment Boundary: Assessment does not include technical terms such as period and frequency.]* **(3-PS2-2)**

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>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, using fair tests in which variables are controlled and the number of trials considered. (3-PS2-1) Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3-PS2-2) 	<p>PS2.A: Forces and Motion</p> <ul style="list-style-type: none"> Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object’s speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1) The patterns of an object’s motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships are routinely identified. (3-PS2-1) <p>Patterns</p> <ul style="list-style-type: none"> Patterns of change can be used to make predictions. (3-PS2-2) <p>Connections to Nature of Science</p> <p>Science Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science findings are based on recognizing patterns. (3-PS2-2) <p>Scientific Investigations Use a Variety of Methods</p> <ul style="list-style-type: none"> Science investigations use a variety of methods, tools, and techniques. (3-PS2-1)

	<p>Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2)</p> <p>PS2.B: Types of Interactions</p> <ul style="list-style-type: none">• Objects in contact exert forces on each other. (3-PS2-1)	
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Grade 3 - Science



THE DIOCESE
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Unit 3: ELECTRICAL AND MAGNETIC FORCES

Instructional Days: 15 Days

SUMMARY

How can we use our understandings about magnets be used to solve problems?

In this unit of study, students determine the effects of balanced and unbalanced forces on the motion of an object and the cause-and-effect relationships of electrical or magnetic interactions to define a simple design problem that can be solved with magnets. The crosscutting concept of *cause and effect*, and the *interdependence of science, engineering, and technology*, and the *influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *asking questions and defining problems*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 3-PS2-3, 3-PS2-4, and 3-5-ETS1-1.

Student Learning Objectives

Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. *[Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]* **(3-PS2-3)**

Define a simple design problem that can be solved by applying scientific ideas about magnets.* *[Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]* **(3-PS2-4)**

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. **(3-5-ETS1-1)**

Unit Sequence

Part A: What are the relationships between electrical and magnetic forces?

Concepts

- Cause-and-effect relationships are routinely identified, tested, and used to explain change.
- Electric and magnetic forces between a pair of objects do not require that the objects be in contact.
- The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.

Formative Assessment

Students who understand the concepts are able to:

- Identify and test cause-and-effect relationships in order to explain change.
- Ask questions that can be investigated based on patterns such as cause-and-effect relationships.
- Ask questions to determine cause-and-effect relationships in electric or magnetic interactions between two objects not in contact with each other.
(Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.)
- Magnetic forces could include:
 - ✓ The force between two permanent magnets;
 - ✓ The force between an electromagnet and steel paperclips;
 - ✓ The force exerted by one magnet versus the force exerted by two magnets.
- Cause-and-effect relationships could include:
 - ✓ How the distance between objects affects the strength of the force
 - ✓ How the orientation of magnets affects the direction of the magnetic force.

Unit Sequence

Part B: *How can we use our understandings about magnets be used to solve problems?*

Concepts

- Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process.
- People's needs and wants change over time, as do their demands for new and improved technologies.
- Electric and magnetic forces between a pair of objects do not require that the objects be in contact.
- The sizes of the forces in each situation depend on the properties of the objects and their distances apart.
- For forces between two magnets, the size of the force depends on their orientation relative to each other.
- Possible solutions to a problem are limited by available materials and resources (constraints).
- The success of a designed solution is determined by considering the desired features of a solution (criteria).
- Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

Formative Assessment

Students who understand the concepts are able to:

- Define a simple problem that can be solved through the development of a new or improved object or tool.
- Define a simple design problem that can be solved by applying scientific ideas about magnets (e.g., constructing a latch to keep a door shut or creating a device to keep two moving objects from touching each other).
- Define a simple design problem that can be solved through the development of an object, tool, process, or system, and include several criteria for success and constraints on material, time, or cost.
- Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Sample of Open Education Resources

[Investigating the Magnetic Force Field: Calculating the Magnetic Pull of a Magnet by Varying Distances](#): Students will investigate the magnetic pull of a bar magnet at varying distances with the use of paper clips. Students will hypothesize, conduct the experiment, collect the data, and draw conclusions. As a class, students will then compare each team's data and their interpretation of the results.

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: Motion and Stability: Forces and Interactions

The presenters were Alicia Alonzo from Michigan State University and Alex Robinson, a teacher at Thornapple Kellogg High School in Middleville, Michigan. The program featured strategies for teaching about physical science concepts that answer questions such as "How can one explain and predict interactions between objects and within systems of objects?"

Dr. Alonzo began the presentation by providing an overview of how disciplinary core ideas fit into the overall structure of NGSS. Then she and Mr. Robinson discussed common student preconceptions related to Motion and Stability: Forces and Interactions. They also showed how this disciplinary core idea progresses across grade bands. Participants had the opportunity to ask questions and discuss ideas for classroom application with other participating teachers.

View the resource [collection](#).

Appendix A: NGSS and Foundations for the Unit

Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. *[Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]* **(3-PS2-3)**

Define a simple design problem that can be solved by applying scientific ideas about magnets.* *[Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]* **(3-PS2-4)**

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. **(3-5-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>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>Asking Questions and Defining Problems</p> <ul style="list-style-type: none"> Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3) Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4) 	<p>PS2.B: Types of Interactions</p> <ul style="list-style-type: none"> Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3),(3-PS2-4) <p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> Possible solutions to a problem 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3) <p>Connections to Engineering, Technology, and Applications of Science</p> <p>Interdependence of Science, Engineering, and Technology</p> <ul style="list-style-type: none"> Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process.

<ul style="list-style-type: none">Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)	are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)	(3-PS2-4)
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Grade 3 - Science



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Unit 4: TRAITS

Instructional Days: 15 Days

SUMMARY

What kinds of traits are passed on from parent to offspring?

What environmental factors might influence the traits of a specific organism?

In this unit of study, students acquire an understanding that organisms have different inherited traits and that the environment can also affect the traits that an organism develops. The crosscutting concepts of *patterns* and *cause and effect* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *analyzing and interpreting data*, *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 3-LS3-1 and 3-LS3-2.

Student Learning Objectives

Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. *[Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]* [\(3-LS3-1\)](#)

Use evidence to support the explanation that traits can be influenced by the environment. *[Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]* [\(3-LS3-2\)](#)

Unit Sequence	
<i>Part A: What kinds of traits are passed on from parent to offspring?</i>	
Concepts	Formative Assessment
<ul style="list-style-type: none"> • Similarities and differences in patterns can be used to sort and classify natural phenomena (e.g., inherited traits that occur naturally). • Many characteristics of organisms are inherited from their parents. • Different organisms vary in how they look and function because they have different inherited information. 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Sort and classify natural phenomena using similarities and differences. <i>(Clarification: Patterns are the similarities and differences in traits shared between offspring and their parents or among siblings, with an emphasis on organisms other than humans).</i> • Analyze and interpret data to make sense of phenomena using logical reasoning. • Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. <i>(Assessment does not include genetic mechanisms of inheritance and prediction of traits, and is limited to nonhumans.)</i>
Unit Sequence	
<i>Part B: What environmental factors might influence the traits of a specific organism?</i>	
Concepts	Formative Assessment
<ul style="list-style-type: none"> • Cause-and-effect relationships are routinely identified and used to explain change. • Other characteristics, which can range from diet to learning, result from individuals' interaction with the environment. • Many characteristics involve both inheritance and environment. • The environment also affects the traits that an organism develops. 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Identify cause-and-effect relationships in order to explain change. • Use evidence (e.g., observations, patterns) to support an explanation. • Use evidence to support the explanation that traits can be influenced by the environment. Examples of the environment's effect on traits could include: <ul style="list-style-type: none"> ✓ Normally tall plants that grow with insufficient water are stunted. ✓ A pet dog that is given too much food and little exercise may become overweight.

Sample of Open Education Resources

[Guppies Galore:](#) Groups of students set up a small freshwater aquarium (made from gallon jars) that feature a male guppy, a female guppy, and a green plant. After the female guppy goes through her pregnancy and gives birth, the students will then observe, over time, the development of the fry into male and female guppies with characteristics similar to the parents.

Teacher Professional Learning Resources

[NSTA Web Seminar: *Teaching NGSS in Elementary School—Third Grade*](#)

The web seminar began with explaining how to unpack the performance expectations in third grade. It continued with a focus on scientific practices in relation to the specific standard and performance expectations. Science Talk - what it looks like and sounds like, and how to use it in the classroom, as well as claims, evidence and reasoning strategies were discussed. The web seminar concluded with an overview of NSTA resources on the *NGSS* available to teachers by Ted, and a Q & A with Carla, Mary, Kathy and Kimber.

[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.

[NGSS Core Ideas: Heredity: Inheritance and Variation of Traits](#)

The presenter was Ravit Golan Duncan of Rutgers University. The program featured strategies for teaching about life science concepts that answer questions such as "How are the characteristics of one generation related to the previous generation?" and "Why do individuals of the same species vary in how they look, function, and behave?"

Dr. Duncan began the presentation by discussing the importance of heredity as a disciplinary core idea. She then described how student learning should progress across grade levels and showed examples of common preconceptions. Dr. Duncan also shared strategies and resources for teaching about heredity. Participants had the opportunity to submit their questions and comments in the chat.

Visit the [resource collection](#).

Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. *[Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]* **(3-LS3-1)**

Use evidence to support the explanation that traits can be influenced by the environment. *[Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]* **(3-LS3-2)**

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	Science and Engineering Practices	Science and Engineering Practices
<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"> Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-2) 	<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"> Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-2) 	<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"> Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-2)

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Unit 5: CONTINUING THE CYCLE

Instructional Days: 10 Days

SUMMARY

Do all living things have the same life cycle?

Are there advantages to being different?

In this unit of study, students develop an understanding of the similarities and differences in organisms' life cycles. In addition, students use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. The crosscutting concepts of *patterns* and *cause and effect* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in *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 3-LS1-1 and 3-LS4-2.

Student Learning Objectives

Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. *[Clarification Statement: Changes organisms go through during their life form a pattern.] [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.] (3-LS1-1)*

Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. *[Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.] (3-LS4-2)*

Unit Sequence

Part A: Do all living things have the same life cycle?

Concepts

- Science findings are based on recognizing patterns.
- Similarities and differences in patterns can be used to sort and classify natural phenomena.
- Patterns of change can be used to make predictions.
- Reproduction is essential to the continued existence of every kind of organism.
- Plants and animals have unique and diverse life cycles.

Formative Assessment

Students who understand the concepts are able to:

- Sort and organisms (inherited traits) using similarities and differences in patterns.
- Make predictions using patterns of change.
- Develop models to describe phenomena.
- Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. (I.e., Changes organisms go through during their life form a pattern.) *(Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.)*

Unit Sequence

Part B: *Are there advantages to being different?*

Concepts	Formative Assessment
<ul style="list-style-type: none">• Cause-and-effect relationships are routinely identified and used to explain change.• Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none">• Identify cause-and-effect relationships in order to explain change.• Use evidence (e.g., observations, patterns) to construct an explanation.• Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. Examples of cause-and-effect relationships could include:<ul style="list-style-type: none">✓ Plants that have larger thorns than other plants may be less likely to be eaten by predators.✓ Animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.

Sample of Open Education Resources

[Let's Hear It For Ladybugs!](#)

This article describes a ladybug life cycle unit that incorporates language arts and science concepts. Students build on their prior knowledge of butterflies as they explore the metamorphosis of ladybugs. To create their final project, clay life cycle models, students synthesize what they learned from live observation and nonfiction texts.

[Simply Butterflies!](#)

This article gives suggestions for building a simple walk-in classroom butterfly observatory and using the observatory to hatch out Painted Lady butterflies as part of a four-week unit on life cycle stages.

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.

NGSS Core Ideas: Heredity: Inheritance and Variation of Traits

The presenter was Ravit Golan Duncan of Rutgers University. The program featured strategies for teaching about life science concepts that answer questions such as "How are the characteristics of one generation related to the previous generation?" and "Why do individuals of the same species vary in how they look, function, and behave?"

Dr. Duncan began the presentation by discussing the importance of heredity as a disciplinary core idea. She then described how student learning should progress across grade levels and showed examples of common preconceptions. Dr. Duncan also shared strategies and resources for teaching about heredity.

Appendix A: NGSS and Foundations for the Unit

Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. *[Clarification Statement: Changes organisms go through during their life form a pattern.] [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.]* **(3-LS1-1)**

Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. *[Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]* **(3-LS4-2)**

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>Developing and Using Models</p> <ul style="list-style-type: none"> Develop models to describe phenomena. (3-LS1-1) <p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2) 	<p>LS1.B: Growth and Development of Organisms</p> <ul style="list-style-type: none"> Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1) <p>LS4.B: Natural Selection</p> <ul style="list-style-type: none"> Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3-LS4-2) 	<p>Patterns</p> <ul style="list-style-type: none"> Patterns of change can be used to make predictions. (3-LS1-1) <p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships are routinely identified and used to explain change. (3-LS4-2),(3-LS4-3) <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science findings are based on recognizing patterns. (3-LS1-1)

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Unit 6: ORGANISMS AND THE ENVIRONMENT

Instructional Days: 15 Days

SUMMARY

Why don't we see alligators in the arctic?

In this unit of study, students develop an understanding of the idea that when the environment changes, some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die. The crosscutting concepts of *cause and effect* and the *interdependence of science, engineering, and technology* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in *engaging in argument from evidence*. Students are also expected to use this practice to demonstrate understanding of the core ideas.

This unit is based on 3-LS2-1 and 3-LS4-3.

Student Learning Objectives

Construct an argument that some animals form groups that help members survive. (3-LS2-1)

Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.] (3-LS4-3)

Unit Sequence

Part A: *In a particular habitat, why do some organisms survive well, some survive less well, and some not survive at all?*

Concepts	Formative Assessment
<ul style="list-style-type: none">• Cause-and-effect relationships are routinely identified and used to explain change.• Knowledge of relevant scientific concepts and research findings is important in engineering.• For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.• Organisms and their habitat make up a system in which the parts depend on each other.	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none">• Identify cause-and-effect relationships in order to explain change.• Construct an argument with evidence.• Construct an argument with evidence (e.g., needs and characteristics of the organisms and habitats involved) that in a particular habitat, some organisms can survive well, some can survive less well, and some cannot survive at all.

Sample of Open Education Resources

[Muskox Maneuvers](#)

In this activity, students create a physical model showing how muskoxen work together as a group to protect their young from predators (wolves).

[Musk Ox Save Calf from Wolves Video](#)

In this short video, Arctic wolves attack a musk ox calf on Canada's Ellesmere Island, but the herd rushes to its defense by forming a defensive circle around the calves.

[Insects That Work Together](#)

This nonfiction book summarizes how some insects work together to increase their chances of survival. Details are provided on four types of insects: honeybees, hive wasps (hornets, yellow jackets, and paper wasps), termites, and ants. A short section on insect migration and building a hive model are also included.

[Battle at Kruger: Water Buffalo Save Calf from Lions Video](#)

This short video captures student imagination and elicits ideas about how groups of organisms work together for survival. The video contains real footage of a pack of lions attack on a water buffalo calf. The footage filmed by amateur tourists features a surprising plot twist (featuring a crocodile), and exciting finale with the water buffalo herd rescues the calf and chases off the lions.

[A Walk in the Desert \(Biomes of North America\)](#)

This nonfiction text describes the climate, soil, plants and animals of the North American deserts. It provides detailed information on how plants and animals adapt and survive there.

[A Walk in the Deciduous Forest \(Biomes of North America\)](#)

This nonfiction text describes the climate, soil, plants and animals of the North American deciduous forests. It provides detailed information on how plants and animals adapt and survive there.

[A Walk in the Rain Forest \(Biomes of North America\)](#)

This nonfiction text describes the climate, soil, plants and animals of the North American rain forests. It provides detailed information on how plants and animals adapt and survive there.

[A Walk in the Prairie \(Biomes of North America\)](#)

This nonfiction text describes the climate, soil, plants and animals of the North American prairies. It provides detailed information on how plants and animals adapt and survive there.

[A Walk in the Tundra \(Biomes of North America\)](#)

This nonfiction text describes the climate, soil, plants and animals of the North American tundra. It provides detailed information on how plants and animals adapt and survive there.

[A Walk in the Boreal Forest \(Biomes of North America\)](#)

This nonfiction text describes the climate, soil, plants and animals of the North American boreal forests. It provides detailed information on how plants and animals adapt and survive there.

[A Journey into the Ocean \(Biomes of North America\)](#)

This nonfiction text describes the organisms and features of the ocean environment. It provides detailed information on how plants and animals adapt and survive there.

[Journey Into an Estuary \(Biomes of North America\)](#)

This nonfiction text describes the features and plants and animals of North American estuaries. It provides detailed information on how plants and animals adapt and survive there.

Teacher Professional Learning Resources

NGSS Crosscutting Concepts: Stability and Change

The presenter was Brett Moulding, director of the Partnership for Effective Science Teaching and Learning. Mr. Moulding began the web seminar by defining stability and change and discussing the inclusion of this concept in previous standards documents such as the National Science Education Standards (NSES). Participants brainstormed examples of science phenomena that can be explained by using the concept of stability and change. Some of their ideas included Earth's orbit around the Sun, carrying capacity of ecosystems, and replication of DNA. Mr. Moulding then discussed the role of stability and change within NGSS. Participants again shared their ideas in the chat, providing their thoughts about classroom implementation of this crosscutting concept.

NGSS Core Ideas: Ecosystems: Interactions, Energy, and Dynamics

The presenters were Andy Anderson and Jennifer Doherty of Michigan State University. This was the ninth web seminar in a series focused on the disciplinary core ideas that are part of the Next Generation Science Standards (NGSS). The program featured strategies for teaching about life science concepts that answer questions such as "How do organisms interact with the living and nonliving environments to obtain matter and energy?" and "How do matter and energy move through an ecosystem?"

Dr. Anderson and Dr. Doherty began the presentation by discussing the two main strands of the ecosystems disciplinary core idea: community ecology and ecosystem science. They talked about common student preconceptions and strategies for addressing them. Next, Dr. Anderson and Dr. Doherty shared learning progressions for this core idea, showing how student understanding builds from elementary through high school. Last, the presenters described approaches for teaching about ecosystems and shared resources to use with students.

Visit the [resource collection](#).

NGSS Core Ideas: Biological Evolution: Unity and Diversity

The presenter was Cindy Passmore. The program featured strategies for teaching about life science concepts that answer questions such as "How are the characteristics of one generation related to the previous generation?" and "Why do individuals of the same species vary in how they look, function, and behave?"

Following an overview of the web seminar's main topics to be covered, Cindy Passmore discussed what makes LS4 a "core" idea and how its subsections A, B, C and D should be approached as being related to one another, rather than sequenced elements to be taught one after the other. Cindy then spoke about the concept of using models to explain and make sense of the natural world through two detailed examples about the Peppered moth and the Galapagos finches.

View the [resource collection](#).

Appendix A: NGSS and Foundations for the Unit

Construct an argument that some animals form groups that help members survive. (3-LS2-1)

Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. *[Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]* (3-LS4-3)

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	Science and Engineering Practices	Science and Engineering Practices
<p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> • Construct an argument with evidence, data, and/or a model. (3-LS2-1) • Construct an argument with evidence. (3-LS4-3) 	<p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> • Construct an argument with evidence, data, and/or a model. (3-LS2-1) • Construct an argument with evidence. (3-LS4-3) 	<p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> • Construct an argument with evidence, data, and/or a model. (3-LS2-1) • Construct an argument with evidence. (3-LS4-3)

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Unit 7: USING EVIDENCE TO UNDERSTAND CHANGE IN ENVIRONMENTS

Instructional Days: 15 Days

SUMMARY

What do fossils tell us about the organisms and the environments in which they lived?

In this unit of study, students develop an understanding of the types of organisms that lived long ago and also about the nature of their environments. Students develop an understanding of the idea that when the environment changes, some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die. The crosscutting concepts of *systems and system models; scale, proportion, and quantity; and the influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *asking questions and defining problems, analyzing and interpreting data, 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 3-LS4-1, 3-LS4-4, and 3-5-ETS1-1.

Student Learning Objectives

Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. *[Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.]* ([3-LS4-1](#))

Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.* *[Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]* ([3-LS4-4](#))

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. ([3-5-ETS1-1](#))

Unit Sequence

Part A: What do fossils tell us about the organisms and the environments in which they lived?

Concepts	Formative Assessment
<ul style="list-style-type: none">• Observable phenomena exist from very short to very long periods of time.• Science assumes consistent patterns in natural systems.• Some kinds of plants and animals that once lived on Earth are no longer found anywhere.• Fossils provide evidence about the types of organisms that lived long ago, and also about the nature of their environments.	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none">• Observe that phenomena exist from very short to very long periods of time.• Analyze and interpret data to make sense of phenomena using logical reasoning.• Analyze and interpret data from fossils (e.g., type, size, distributions of fossil organisms) to provide evidence of the organisms and the environments in which they lived long ago. <i>(Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.)</i> Examples of fossils and environments could include:<ul style="list-style-type: none">✓ Marine fossils found on dry land;✓ Tropical plant fossils found in Arctic areas; or✓ Fossils of extinct organisms.

Unit Sequence

Part B: What happens to the plants and animals when the environment changes?

Concepts	Formative Assessment
<ul style="list-style-type: none">• A system can be described in terms of its components and their interactions.• People’s needs and wants change over time, as do their demands for new and improved technologies.• Populations live in a variety of habitats, and change in those habitats affects the organisms living there.• When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, others move into the transformed environment, and some die.• Possible solutions to a problem are limited by available materials and resources (constraints).• The success of a designed solution is determined by considering the desired features of a solution (criteria).• Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none">• Describe a system in terms of its components and interactions.• Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of a problem.• Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. (Assessment is limited to a single environmental change and does not include the greenhouse effect or climate change.) Examples of environmental changes could include changes in<ul style="list-style-type: none">✓ Land characteristics,✓ Water distribution,✓ Temperature,✓ Food, or✓ Other organisms.• Define a simple design problem that can be solved through the development of an object, tool, process, or system and that includes several criteria for success and constraints on materials, time, or cost.• Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost.

Sample of Open Education Resources

[Mass Environmental Change](#): In this lesson, students explore what happens to organisms when they cannot meet their needs due to changes in the environment. They categorize scenario cards representing different changes to an environment, then discuss in a whole group. Using what they have learned, they write about how changes to the environment can affect organisms. The resource link takes you to a full unit titled Effects of Changes in an Environment on the Survival of Organisms, of which Mass Environmental Change is a lesson.

Teacher Professional Learning Resources

[NGSS Crosscutting Concepts: Energy and Matter—Flows, Cycles, and Conservation](#)

The presenters were Charles W. (Andy) Anderson and Joyce Parker from Michigan State University. Dr. Anderson and Dr. Parker began the web seminar by discussing the role of energy and matter as a crosscutting concept. They talked about energy and matter at different scales, from the atomic to the macroscopic. The presenters shared information about how students learn about this crosscutting concept and how to address preconceptions. They then described instructional strategies such as modeling that can help students better understand the flow of energy and matter.

[NGSS Crosscutting Concepts: Scale, Proportion, and Quantity](#)

The presenters were Amy Taylor and Kelly Riedinger from the University of North Carolina Wilmington. Dr. Taylor began the presentation by discussing the definition of scale. Next, Dr. Riedinger talked about the role of scale, proportion, and quantity in NGSS. Participants shared their own experiences teaching about scale in the classroom before the presenters described additional instructional strategies that can provide students with a real-world understanding of this crosscutting concept. Dr. Taylor and Dr. Riedinger showed examples of activities from elementary, middle, and high school. They shared video clips and other resources that can help educators build their capacity for teaching about scale.

[NGSS Core Ideas: Ecosystems: Interactions, Energy, and Dynamics](#)

The presenters were Andy Anderson and Jennifer Doherty of Michigan State University. This was the ninth web seminar in a series focused on the disciplinary core ideas that are part of the Next Generation Science Standards (NGSS). The program featured strategies for teaching about life science concepts that answer questions such as "How do organisms interact with the living and nonliving environments to obtain matter and energy?" and "How do matter and energy move through an ecosystem?"

Dr. Anderson and Dr. Doherty began the presentation by discussing the two main strands of the ecosystems disciplinary core idea: community ecology and ecosystem science. They talked about common student preconceptions and strategies for addressing them. Next, Dr. Anderson and Dr. Doherty shared learning progressions for this core idea, showing how student understanding builds from elementary through high school.

Last, the presenters described approaches for teaching about ecosystems and shared resources to use with students.

Visit the [resource collection](#).

[NGSS Core Ideas: Biological Evolution: Unity and Diversity](#)

The presenter was Cindy Passmore. The program featured strategies for teaching about life science concepts that answer questions such as "How are the characteristics of one generation related to the previous generation?" and "Why do individuals of the same species vary in how they look, function, and behave?"

Following an overview of the web seminar's main topics to be covered, Cindy Passmore discussed what makes LS4 a "core" idea and how its subsections A, B, C and D should be approached as being related to one another, rather than sequenced elements to be taught one after the other. Cindy then spoke about the concept of using models to explain and make sense of the natural world through two detailed examples about the Peppered moth and the Galapagos finches. View the [resource collection](#).

Appendix A: NGSS and Foundations for the Unit

Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. *[Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.]* *[Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.]* **(3-LS4-1)**

Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.* *[Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.]* *[Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]* **(3-LS4-4)**

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. **(3-5-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	Science and Engineering Practices	Science and Engineering Practices
<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-LS4-1) <p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-LS4-4) <p>Asking Questions and Defining Problems</p> <ul style="list-style-type: none"> Define a simple design problem that can be solved through the 	<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-LS4-1) <p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-LS4-4) <p>Asking Questions and Defining Problems</p> <ul style="list-style-type: none"> Define a simple design problem that can be solved through the 	<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-LS4-1) <p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-LS4-4) <p>Asking Questions and Defining Problems</p> <ul style="list-style-type: none"> Define a simple design problem

<p>development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)</p>	<p>development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)</p>	<p>that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)</p>
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