

NGSS Example Bundles
2nd Grade – Topic Model – Bundle 1
Water

This is the first bundle of the 2nd Grade Topic Model. Each bundle has connections to the other bundles in the course, as shown in the [Course Flowchart](#).

Bundle 1 Question: *This bundle is assembled to address the questions “What patterns related to water exist in the natural world?”*

Summary

The bundle organizes performance expectations with a focus on helping students build understanding of patterns and the effects of water. Instruction developed from this bundle should always maintain the three-dimensional nature of the standards, and is not limited to the practices and concepts directly linked with any of the bundle performance expectations.

Connections between bundle DCIs

The idea that heating or cooling a substance may cause changes that can be observed (PS1.B as in 2-PS1-4) connects to the idea that different kinds of matter exist and many of them can be either solid or liquid, depending on temperature (PS1.A as in 2-PS1-1). These concepts both connect to the idea that water exists as solid ice and in liquid form (ESS2.C as in 2-ESS2-3).

Through the topic of water, these ideas also connect to the concepts that there are many different kinds of living things in any area, and they exist in different places on land and in water (LS4.D as in 2-LS4-1), and that one can map the shapes and kinds of land and water in any area (ESS2.B as in 2-ESS2-2).

The engineering design idea that asking questions, making observations, and gathering information are helpful in thinking about problems (ETS1.A as in K-2-ETS1-1) could connect to multiple science concepts, such as that different kinds of matter exist and many of them can be either solid or liquid, depending on temperature (PS1.A as in 2-PS1-1) or that there are many different kinds of living things in any area, and they exist in different places on land and in water (LS4.D as in 2-LS4-1). The first connection could be made by having students ask questions, make observations, and gather information about different kinds of matter and their states before designing a solution to a problem that involves matter. The second connection could be made when students are given a problem to solve regarding animal habitats. Before attempting to solve the problem, students will want to ask questions, make observations, and gather information about the many different kinds of living things in the given area.

Bundle Science and Engineering Practices

Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the practices of asking questions and defining problems (K-2-ETS1-1); developing and using models (2-ESS2-2); planning and carrying out investigations (2-LS4-1 and 2-PS1-1); engaging in argument from evidence (2-PS1-4); and obtaining, evaluating, and communicating information (2-ESS2-3). Many other practice elements can be used in instruction.

Bundle Crosscutting Concepts

Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the crosscutting concepts of Patterns (2-ESS2-2, 2-ESS2-3, and 2-PS1-1) and Cause and Effect (2-PS1-4). Many other crosscutting concepts elements can be used in instruction.

All instruction should be three-dimensional.

Performance Expectations

2-PS1-1. 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.]

<p>Performance Expectations (Continued)</p> <p>2-PS1-4 and 2-ESS2-2 are partially assessable.</p>	<p>2-PS1-4. 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.]</p> <p>2-LS4-1. 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.]</p> <p>2-ESS2-2. 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.]</p> <p>2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.</p> <p>K-2-ETS1-1. 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.</p>
<p>Example Phenomena</p>	<p>Glaciers get smaller in the summer.</p> <p>Many different kinds of living things can be observed in a pond.</p>
<p>Additional Practices Building to the PEs</p>	<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). <p>Students could <i>ask questions based on observations</i> [that] <i>there are many different kinds of living things in any area</i> to find more information about the natural world. 2-LS4-1</p> <p>Developing and Using Models</p> <ul style="list-style-type: none"> Develop and/or use a model to represent amounts, relationships and/or patterns in the natural and designed world(s). <p>Students could develop a model to represent relationships [between the] <i>temperature</i> [of] <i>different types of matter and</i> [whether they are] <i>solid or liquid</i>. 2-PS1-1</p> <p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> Make predictions based on prior experiences. <p>Students could <i>make predictions based on</i> [their] <i>prior experiences</i> [about] <i>changes caused</i> [by] <i>heating or cooling a substance</i> [and whether] <i>these changes are reversible</i>. 2-PS1-4</p> <p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Record information (observations, thoughts, and ideas). <p>Students could <i>record observations</i> [made when looking at] <i>maps</i>, [which] <i>show where things are located</i> [and] <i>the shapes and kinds of land and water in any area</i>. 2-ESS2-2</p> <p>Using Mathematical and Computational Thinking</p> <ul style="list-style-type: none"> Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs. <p>Students could <i>describe, measure, and/or compare</i> [the number of] <i>different kinds of living things in any area</i> and <i>display the data using simple graphs</i>. 2-LS4-1</p>

Additional Practices Building to the PEs (Continued)	<p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> ● Use information from observations (firsthand or from media) to construct an evidence-based account of natural phenomena. Students could <i>use information from observations to construct an evidence-based account</i> [that] water exists as solid ice and in liquid form. 2-ESS2-3 <p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> ● Construct an argument with evidence to support a claim. Students could <i>construct an argument with evidence to support a claim</i> [that] water [can be] <i>found in the ocean, rivers, lakes, and ponds</i>. 2-ESS2-3 <p>Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none"> ● Describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea. Students could <i>describe how specific images support the idea</i> [that] sometimes changes [caused by] heating or cooling a substance are reversible and sometimes they are not. 2-PS1-4
Additional Crosscutting Concepts Building to the PEs	<p>Patterns</p> <ul style="list-style-type: none"> ● Patterns in the natural and designed world(s) can be observed, used to describe phenomena, and used as evidence. Students could <i>observe</i> [and identify] patterns of different kinds of living things [that] exist in different places on land and in water [and can] <i>use</i> [the patterns] <i>to describe phenomena</i>. 2-LS4-1 <p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> ● Relative scales allow objects and events to be compared and described (e.g., bigger and smaller; hotter and colder). Students could describe how <i>relative scales allow objects</i> [such as the] location and shape of land and water [on a] map to be compared and described. 2-ESS2-2 <p>Stability and Change</p> <ul style="list-style-type: none"> ● Some things stay the same while other things change. Students could identify that, [after] heating or cooling substances, <i>some things change</i> [back] <i>while other things stay the same</i> [(such as changes that cannot be reversed)]. 2-PS1-4
Additional Connections to Nature of Science	<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. Students could describe how they <i>looked for patterns</i>, [just like] <i>scientists, when making observations about</i> [how] water exists as solid ice and in liquid form. 2-ESS2-3 <p>Science is a Way of Knowing</p> <ul style="list-style-type: none"> ● Scientific knowledge informs us about the world. Students could describe how their <i>scientific knowledge</i> [about] different kinds of matter, [which] <i>can be described and classified by observable properties informs</i> [them] <i>about the world</i>. 2-PS1-1

2-PS1-1 Matter and Its Interactions

Students who demonstrate understanding can:

- 2-PS1-1. 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.]

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

Science and Engineering Practices**Planning and Carrying Out Investigations**

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

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

Disciplinary Core Ideas**PS1.A: Structure and Properties of Matter**

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

Crosscutting Concepts**Patterns**

- Patterns in the natural and human designed world can be observed.

Observable features of the student performance by the end of the grade:

1	Identifying the phenomenon under investigation	
	a	Students identify and describe* the phenomenon under investigation, which includes the following idea: different kinds of matter have different properties, and sometimes the same kind of matter has different properties depending on temperature.
	b	Students identify and describe* the purpose of the investigation, which includes answering a question about the phenomenon under investigation by describing* and classifying different kinds of materials by their observable properties.
2	Identifying the evidence to address the purpose of the investigation	
	a	Students collaboratively develop an investigation plan and describe* the evidence that will be collected, including the properties of matter (e.g., color, texture, hardness, flexibility, whether it is a solid or a liquid) of the materials that would allow for classification, and the temperature at which those properties are observed.
	b	Students individually describe* that:
		<ul style="list-style-type: none"> i. The observations of the materials provide evidence about the properties of different kinds of materials. ii. Observable patterns in the properties of materials provide evidence to classify the different kinds of materials.
3	Planning the investigation	
	a	In the collaboratively developed investigation plan, students include:
		<ul style="list-style-type: none"> i. Which materials will be described* and classified (e.g., different kinds of metals, rocks, wood, soil, powders). ii. Which materials will be observed at different temperatures, and how those temperatures will be determined (e.g., using ice to cool and a lamp to warm) and measured (e.g., qualitatively or quantitatively). iii. How the properties of the materials will be determined. iv. How the materials will be classified (i.e., sorted) by the pattern of the properties.
	b	Students individually describe* how the properties of materials, and the method for classifying them, are relevant to answering the question.
4	Collecting the data	
	a	According to the developed investigation plan, students collaboratively collect and record data on the properties of the materials.

2-PS1-4 Matter and Its Interactions

Students who demonstrate understanding can:

- 2-PS1-4.** 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.]

The performance expectation above was 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
Engaging in Argument from Evidence Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s). <ul style="list-style-type: none"> Construct an argument with evidence to support a claim. <p>-----</p> <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. 	PS1.B: Chemical Reactions <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. 	Cause and Effect <ul style="list-style-type: none"> Events have causes that generate observable patterns.

Observable features of the student performance by the end of the grade:	
1	Supported claims
a	Students make a claim to be supported about a phenomenon. In their claim, students include the idea that some changes caused by heating or cooling can be reversed and some cannot.
2	Identifying scientific evidence
a	Students describe* the given evidence, including: <ul style="list-style-type: none"> i. The characteristics of the material before heating or cooling. ii. The characteristics of the material after heating or cooling. iii. The characteristics of the material when the heating or cooling is reversed.
3	Evaluating and critiquing the evidence
a	Students evaluate the evidence to determine: <ul style="list-style-type: none"> i. The change in the material after heating (e.g., ice becomes water, an egg becomes solid, solid chocolate becomes liquid). ii. Whether the change in the material after heating is reversible (e.g., water becomes ice again, a cooked egg remains a solid, liquid chocolate becomes solid but can be a different shape). iii. The change in the material after cooling (e.g., when frozen, water becomes ice, a plant leaf dies). iv. Whether the change in the material after cooling is reversible (e.g., ice becomes water again, a plant leaf does not return to normal).
b	Students describe* whether the given evidence supports the claim and whether additional evidence is needed.
4	Reasoning and synthesis
a	Students use reasoning to connect the evidence to the claim. Students describe* the following chain of reasoning: <ul style="list-style-type: none"> i. Some changes caused by heating or cooling can be reversed by cooling or heating (e.g., ice that is heated can melt into water, but the water can be cooled and can freeze back into ice [and vice versa]).

	ii.	Some changes caused by heating or cooling cannot be reversed by cooling or heating (e.g., a raw egg that is cooked by heating cannot be turned back into a raw egg by cooling the cooked egg, cookie dough that is baked does not return to its uncooked form when cooled, charcoal that is formed by heating wood does not return to its original form when cooled).
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2-LS4-1 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

- 2-LS4-1. 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.]

The performance expectation above was 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 Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.</p> <ul style="list-style-type: none"> Make observations (firsthand or from media) to collect data which can be used to make comparisons. <p>-----</p> <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. 	<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. 	

Observable features of the student performance by the end of the grade:		
1	Identifying the phenomenon under investigation	
	a	Students identify and describe* the phenomenon and purpose of the investigation, which includes comparisons of plant and animal diversity of life in different habitats.
2	Identifying the evidence to address the purpose of the investigation	
	a	Based on the given plan for the investigation, students describe* the following evidence to be collected: <ul style="list-style-type: none"> i. Descriptions* based on observations (firsthand or from media) of habitats, including land habitats (e.g., playground, garden, forest, parking lot) and water habitats (e.g., pond, stream, lake). ii. Descriptions* based on observations (firsthand or from media) of different types of living things in each habitat (e.g., trees, grasses, bushes, flowering plants, lizards, squirrels, ants, fish, clams). iii. Comparisons of the different types of living things that can be found in different habitats.
	b	Students describe* how these observations provide evidence for patterns of plant and animal diversity across habitats.
3	Planning the investigation	
	a	Based on the given investigation plan, students describe* how the different plants and animals in the habitats will be observed, recorded, and organized.
4	Collecting the data	
	a	Students collect, record, and organize data on different types of plants and animals in the habitats.

2-ESS2-2 Earth's Systems

Students who demonstrate understanding can:

- 2-ESS2-2. 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.]*

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

Science and Engineering Practices

Developing and Using Models

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

- Develop a model to represent patterns in the natural world.

Disciplinary Core Ideas

ESS2.B: Plate Tectonics and Large-Scale System Interactions

- Maps show where things are located. One can map the shapes and kinds of land and water in any area.

Crosscutting Concepts

Patterns

- Patterns in the natural world can be observed.

Observable features of the student performance by the end of the grade:

1	Components of the model
a	Students develop a model (i.e., a map) that identifies the relevant components, including components that represent both land and bodies of water in an area.
2	Relationships
a	In the model, students identify and describe* relationships between components using a representation of the specific shapes and kinds of land (e.g., playground, park, hill) and specific bodies of water (e.g., creek, ocean, lake, river) within a given area.
b	Students use the model to describe* the patterns of water and land in a given area (e.g., an area may have many small bodies of water; an area may have many different kinds of land that come in different shapes).
3	Connections
a	Students describe* that because they can map the shapes and kinds of land and water in any area, maps can be used to represent many different types of areas.

2-ESS2-3 Earth's Systems

Students who demonstrate understanding can:

2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.

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

Science and Engineering Practices

Obtaining, Evaluating, and Communicating Information

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

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

Disciplinary Core Ideas

ESS2.C: The Roles of Water in Earth's Surface Processes

- Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.

Crosscutting Concepts

Patterns

- Patterns in the natural world can be observed.

Observable features of the student performance by the end of the grade:

1	Obtaining information	
a	Students use books and other reliable media as sources for scientific information to answer scientific questions about:	
	i.	Where water is found on Earth, including in oceans, rivers, lakes, and ponds.
	ii.	The idea that water can be found on Earth as liquid water or solid ice (e.g., a frozen pond, liquid pond, frozen lake).
	iii.	Patterns of where water is found, and what form it is in.
2	Evaluating Information	
a	Students identify which sources of information are likely to provide scientific information (e.g., versus opinion).	

K-2-ETS1-1 Engineering Design

Students who demonstrate understanding can:

- K-2-ETS1-1.** 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.

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

Science and Engineering Practices**Asking Questions and Defining Problems**

Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions.

- Ask questions based on observations to find more information about the natural and/or designed world(s).
- Define a simple problem that can be solved through the development of a new or improved object or tool.

Disciplinary Core Ideas**ETS1.A: Defining and Delimiting Engineering Problems**

- A situation that people want to change or create can be approached as a problem to be solved through engineering.
- 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.

Crosscutting Concepts**Observable features of the student performance by the end of the grade:**

1	Addressing phenomena of the natural or designed world	
a	Students ask questions and make observations to gather information about a situation that people want to change. Students' questions, observations, and information gathering are focused on:	
i.	A given situation that people wish to change.	
ii.	Why people want the situation to change.	
iii.	The desired outcome of changing the situation.	
2	Identifying the scientific nature of the question	
a	Students' questions are based on observations and information gathered about scientific phenomena that are important to the situation.	
3	Identifying the problem to be solved	
a	Students use the information they have gathered, including the answers to their questions, observations they have made, and scientific information, to describe* the situation people want to change in terms of a simple problem that can be solved with the development of a new or improved object or tool.	
4	Defining the features of the solution	
a	With guidance, students describe* the desired features of the tool or object that would solve the problem, based on scientific information, materials available, and potential related benefits to people and other living things.	