GRADE 2

Second-grade students begin the school year with prior knowledge and skills that enable them to formulate answers to questions as they expand their comprehension of the world around them. Through continued exploration, they develop an understanding of the observable properties of materials and apply this understanding to the acquisition of new information and the construction of new models.

Students in Grade 2 learn disciplinary core ideas from the three scientific domains of Physical, Life, and Earth and Space Sciences while demonstrating their learning in the context of the content standards for this grade level. In Physical Science, students explore the physical properties and structure of matter. In Life Science, students explore plant needs and interactions within their habitats. In Earth and Space Science, students observe and identify Earth's events and physical features. The disciplinary core ideas of the Engineering, Technology, and Applications of Science (ETS) domain are integrated within the content standards of the three scientific domains and are denoted with an asterisk (*).

Grade 2 content standards provide students with opportunities for appropriate exploration and observation of the world around them. Through guided participation in specific engineering design projects, they find answers regarding how properties of materials determine appropriate uses, how plants depend on animals for seed dispersal and pollination, and how to address changes caused by Earth events.

Grade 2: Structure and Properties of Matter

(Matter and Its Interactions)

Students will:

AL.2.1 - Conduct an investigation to describe and classify various substances according to physical properties (e.g., milk being a liquid, not clear in color, assuming shape of its container, mixing with water; mineral oil being a liquid, clear in color, taking shape of its container, floating in water; a brick being a solid, not clear in color, rough in texture, not taking the shape of its container, sinking in water).

AL.2.2 - Collect and evaluate data to determine appropriate uses of materials based on their properties (e.g., strength, flexibility, hardness, texture, absorbency).*

AL.2.3 - Demonstrate and explain how structures made from small pieces (e.g., linking cubes, blocks, building bricks, creative construction toys) can be disassembled and then rearranged to make new and different structures.

AL.2.4 - Provide evidence that some changes in matter caused by heating or cooling can be reversed (e.g., heating or freezing of water) and some changes are irreversible (e.g., baking a cake, boiling an egg).

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 flexibility. Patterns could include the similar properties that different materials share.]
2-PS1-2	**Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*** [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [*Assessment Boundary: Assessment of quantitative measurements is limited to length.*]
2-PS1-3	**Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.** [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]
2-PS1-4	**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.]

Grade 2: Structure and Properties of Matter

(Matter and Its Interactions)

The performance expectations were 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.(2-PS1-1)

Analyzing and Interpreting Data

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

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

Constructing Explanations and Designing Solutions

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

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

Engaging in Argument from Evidence

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

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

Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Science searches for cause and effect relationships to explain natural events. (2-PS1-4)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1)
- Different properties are suited to different purposes. (2-PS1-2),(2-PS1-3)
- A great variety of objects can be built up from a small set of pieces. (2-PS1-3)

PS1.B: Chemical Reactions

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

Crosscutting Concepts

Patterns

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

Cause and Effect

- Events have causes that generate observable patterns. (2-PS1-4)
- Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2)

Energy and Matter

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

Connections to Engineering, Technology, and Applications of Science

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

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

Connections to other DCIs in second grade: N/A

Articulation of DCIs across grade-levels:

4.ESS2.A (2-PS1-3); **5.PS1.A** (2-PS1-1),(2-PS1-2),(2-PS1-3); **5.PS1.B** (2-PS1-4); **5.LS2.A** (2-PS1-3)

Common Core State Standards Connections:

ELA/Literacy —

RI.2.1	Ask and answer such questions as *who, what, where, when, why,* and *how* to demonstrate understanding of key details in a text. (2-PS1-4)
RI.2.3	Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-PS1-4)
RI.2.8	Describe how reasons support specific points the author makes in a text. (2-PS1-2),(2-PS1-4)
W.2.1	Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., *because, and, also*) to connect opinion and reasons, and provide a concluding statement or section. (2-PS1-4)
W.2.7	Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-PS1-1),(2-PS1-2),(2-PS1-3)
W.2.8	Recall information from experiences or gather information from provided sources to answer a question. (2-PS1-1),(2-PS1-2),(2-PS1-3)

Mathematics —

MP.2	Reason abstractly and quantitatively. (2-PS1-2)
MP.4	Model with mathematics. (2-PS1-1), (2-PS1-2).
MP.5	Use appropriate tools strategically. (2-PS1-2)

Grade 2: Structure and Properties of Matter

(Matter and Its Interactions)

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

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Grade 2: Interdependent Relationships in Ecosystems

(Ecosystems: Interactions, Energy, and Dynamics)

Students will:

AL.2.5 - Plan and carry out an investigation, using one variable at a time (e.g., water, light, soil, air), to determine the growth needs of plants.

AL.2.6 - Design and construct models to simulate how animals disperse seeds or pollinate plants (e.g., animals brushing fur against seed pods and seeds falling off in other areas, birds and bees extracting nectar from flowers and transferring pollen from one plant to another).*

AL.2.7 - Obtain information from literature and other media to illustrate that there are many different kinds of living things and that they exist in different places on land and in water (e.g., woodland, tundra, desert, rainforest, ocean, river).

Students who demonstrate understanding can:

2-LS2-1	**Plan and conduct an investigation to determine if plants need sunlight and water to grow.** [*Assessment Boundary: Assessment is limited to testing one variable at a time.*]
2-LS2-2	**Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.***
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.*]

Grade 2: Interdependent Relationships in Ecosystems

(Ecosystems: Interactions, Energy, and Dynamics)

The performance expectations were 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 simple model based on evidence to represent a proposed object or tool. (2-LS2-2)

Planning and Carrying Out Investigations

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

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-LS2-1)
- Make observations (firsthand or from media) to collect data which can be used to make comparisons. (2-LS4-1)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

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

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Plants depend on water and light to grow. (2-LS2-1)
- Plants depend on animals for pollination or to move their seeds around. (2-LS2-2)

LS4.D: Biodiversity and Humans

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

ETS1.B: Developing Possible Solutions

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

Crosscutting Concepts

Cause and Effect

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

Structure and Function

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

Connections to other DCIs in second grade: N/A

Articulation of DCIs across grade-levels:

K.LS1.C (2-LS2-1); **K.ESS3.A** (2-LS2-1); **K.ETS1.A** (2-LS2-2); **3.LS4.C** (2-LS4-1); **3.LS4.D** (2-LS4-1); **5.LS1.C** (2-LS2-1); **5.LS2.A** (2-LS2-2),(2-LS4-1)

Common Core State Standards Connections:

ELA/Literacy —

W.2.7	Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-LS2-1),(2-LS4-1)
W.2.8	Recall information from experiences or gather information from provided sources to answer a question. (2-LS2-1),(2-LS4-1)
SL.2.5	Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (2-LS2-2)

Mathematics —

MP.2	Reason abstractly and quantitatively. (2-LS2-1),(2-LS4-1)
MP.4	Model with mathematics. (2-LS2-1),(2-LS2-2),(2-LS4-1)
MP.5	Use appropriate tools strategically. (2-LS2-1)
2.MD.D.10	Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (2-LS2-2),(2-LS4-1)

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Grade 2: Earth's Systems: Processes that Shape the Earth

(Earth's Systems)

(Earth and Human Activity)

Students will:

AL.2.8 - Make observations from media to obtain information about Earth events that happen over a short period of time (e.g., tornados, volcanic explosions, earthquakes) or over a time period longer than one can observe (e.g., erosion of rocks, melting of glaciers).

AL.2.9 - Create models to identify physical features of Earth (e.g., mountains, valleys, plains, deserts, lakes, rivers, oceans).

AL.2.10 - Collect and evaluate data to identify water found on Earth and determine whether it is a solid or a liquid (e.g., glaciers as solid forms of water; oceans, lakes, rivers, streams as liquid forms of water).

AL.2.11 - Examine and test solutions that address changes caused by Earth's events (e.g., dams for minimizing flooding, plants for controlling erosion).*

Students who demonstrate understanding can:

2-ESS1-1 **Use information from several sources to provide evidence that Earth events can occur quickly or slowly.** [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [*Assessment Boundary: Assessment does not include quantitative measurements of timescales.*]

2-ESS2-1 **Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*** [Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]

2-ESS2-2 **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.*]

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

Grade 2: Earth's Systems: Processes that Shape the Earth

(Earth's Systems)

(Earth and Human Activity)

The performance expectations were 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. (2-ESS2-2)

Constructing Explanations and Designing Solutions

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

- Make observations from several sources to construct an evidence-based account for natural phenomena. (2-ESS1-1)
- Compare multiple solutions to a problem. (2-ESS2-1)

Obtaining, Evaluating, and Communicating Information

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

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

Disciplinary Core Ideas

ESS1.C: The History of Planet Earth

- Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. (2-ESS1- 1)

ESS2.A: Earth Materials and Systems

- Wind and water can change the shape of the land. (2-ESS2-1)

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

- Maps show where things are located. One can map the shapes and kinds of land and water in any area. (2-ESS2-2)

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

- Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. (2-ESS2-3)

ETS1.C: Optimizing the Design Solution

- Because there is always more than one possible solution to a problem, it is useful to compare and test designs. *(secondary to 2-ESS2-1)*

Crosscutting Concepts

Patterns

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

Stability and Change

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

Connections to Engineering, Technology, and Applications of Science

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

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

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

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

Connections to other DCIs in second grade:

2.PS1.A (2-ESS2-3)

Articulation of DCIs across grade-bands:

K.ETS1.A (2-ESS2-1); **3.LS2.C** (2-ESS1-1); **4.ESS1.C** (2-ESS1-1); **4.ESS2.A** (2-ESS1-1),(2-ESS2-1); **4.ESS2.B** (2-ESS2-2); **4.ETS1.A** (2-ESS2-1); **4.ETS1.B** (2-ESS2-1);**4.ETS1.C** (2-ESS2-1); **5.ESS2.A** (2-ESS2-1); **5.ESS2.C** (2-ESS2-2),(2 -ESS2-3)

Common Core State Standards Connections:

ELA/Literacy —

RI.2.1	Ask and answer such questions as *who*, *what*, *where*, *when*, *why*, and *how* to demonstrate understanding of key details in a text. (2-ESS1-1)
RI.2.3	Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-ESS1-1),(2-ESS2-1)
RI.2.9	Compare and contrast the most important points presented by two texts on the same topic. (2-ESS2-1)
W.2.6	With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (2-ESS1-1),(2-ESS2-3)
W.2.7	Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-ESS1-1)
W.2.8	Recall information from experiences or gather information from provided sources to answer a question. (2- ESS1-1),(2-ESS2-3)
SL.2.2	Recount or describe key ideas or details from a text read aloud or information presented orally or through other media. (2-ESS1-1)
SL.2.5	Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (2-ESS2-2)

Mathematics —

MP.2	Reason abstractly and quantitatively. (2-ESS1-1),(2-ESS2-1),(2- ESS2-2)
MP.4	Model with mathematics. (2-ESS1-1),(2-ESS2-1),(2-ESS2-2)
MP.5	Use appropriate tools strategically. (2-ESS2-1)
2.NBT.A	Understand place value. (2-ESS1-1)
2.NBT.A.3	Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. (2- ESS2-2)

Grade 2: Earth's Systems: Processes that Shape the Earth

(Earth's Systems)

(Earth and Human Activity)

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

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Grade 2: Engineering Design

Engineering, technology, and science core disciplinary ideas are integrated into grade level science performance expectations.

Students will:

AL.2.2 - Collect and evaluate data to determine appropriate uses of materials based on their properties (e.g., strength, flexibility, hardness, texture, absorbency).*

AL.2.6 - Design and construct models to simulate how animals disperse seeds or pollinate plants (e.g., animals brushing fur against seed pods and seeds falling off in other areas, birds and bees extracting nectar from flowers and transferring pollen from one plant to another).*

AL2.11 - Examine and test solutions that address changes caused by Earth's events (e.g., dams for minimizing flooding, plants for controlling erosion).*

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.**
K-2-ETS1-2	**Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.**
K-2-ETS1-3	**Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.**

Grade 2: Engineering Design

Engineering, technology, and science core disciplinary ideas are integrated into grade level science performance expectations.

The performance expectations were 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). (K-2-ETS1-1)
- Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)

Developing and Using Models

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 simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)

Analyzing and Interpreting Data

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

- Analyze data from tests of an object or tool to determine if it works as intended. (K-2-ETS1-3)

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. (K-2-ETS1-1)
- Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1)
- Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1)

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-2)

ETS1.C: Optimizing the Design Solution

- Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2-ETS1-3)

Crosscutting Concepts

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-2)

Connections to K-2-ETS1.A: Defining and Delimiting Engineering Problems include:
Kindergarten: K-PS2-2, K-ESS3-2
Connections to K-2-ETS1.B: Developing Possible Solutions to Problems include:
Kindergarten: K-ESS3-3, **First Grade:** 1-PS4-4, **Second Grade:** 2-LS2-2
Connections to K-2-ETS1.C: Optimizing the Design Solution include:
Second Grade: 2-ESS2-1

Articulation of DCIs across grade-levels:
3-5.ETS1.A (K-2-ETS1-1),(K-2-ETS1-2),(K-2-ETS1-3); **3-5.ETS1.B** (K-2-ETS1-2),(K-2-ETS1-3); **3-5.ETS1.C** (K-2-ETS1-1),(K-2-ETS1-2),(K-2-ETS1-3)

Common Core State Standards Connections:

ELA/Literacy —

RI.2.1	Ask and answer such questions as *who, what, where, when, why,* and *how* to demonstrate understanding of key details in a text. (K-2-ETS1-1)
W.2.6	With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (K-2-ETS1-1),(K-2-ETS1-3)
W.2.8	Recall information from experiences or gather information from provided sources to answer a question. (K-2-ETS1-1),(K-2-ETS1-3)
SL.2.5	Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (K-2-ETS1-2)

Mathematics —

MP.2	Reason abstractly and quantitatively. (K-2-ETS1-1),(K-2-ETS1-3)
MP.4	Model with mathematics. (K-2-ETS1-1),(K-2-ETS1-3)
MP.5	Use appropriate tools strategically. (K-2-ETS1-1),(K-2-ETS1-3)
2.MD.D.10	Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. (K-2-ETS1-1),(K-2-ETS1-3)

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.