Building Blocks of Science®

A New Generation, 2nd Edition

Lesson Concepts

18 NEW Units!

Designed for Today's Busy Classroom

CAROLINA®

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Research and Inquiry-Based Teaching

Research shows that inquiry-based curriculum materials, in comparison with traditional teaching methods, work better to help students engage in, reflect on, and apply the disciplinary core ideas in science and perform better on assessments than traditional methods alone.

What Is Inquiry-Based Science?

Coherent Instruction Compatible with the NGSS

Inquiry-based science is an approach to science education that allows students to actively construct meaningful knowledge rather than passively acquire facts.

The Building Blocks of Science® approach to the integrative three dimensions of the Next Generation Science Standards* (NGSS) requires students to have these firsthand experiences. Building these experiences into 30-minute class sessions means you'll always have time for science in your classroom.

Do Your Students Learn Best by Doing?

Building Blocks of Science®: A New Generation is a K–5 program built on the principles of research that state students learn best by doing science. Building Blocks of Science weaves NGSS science content, science and engineering practices, and crosscutting concepts into meaningful hands-on experiences, where students become scientists with investigative and problem-solving skills, critical thinking skills, and work in real-world team environments.

The Program for Today's Learner and Today's Standards!

18 NEW Inquiry-Based Program Units K–5

- Written to explicitly address 100% of the Next Generation Science Standards
- 30-minute class sessions (totaling 4–6 weeks of instruction) to accommodate the demands of today's classroom
- Informational texts to support student understandings
- Formative and summative assessments to match the rigor of today's learning environment

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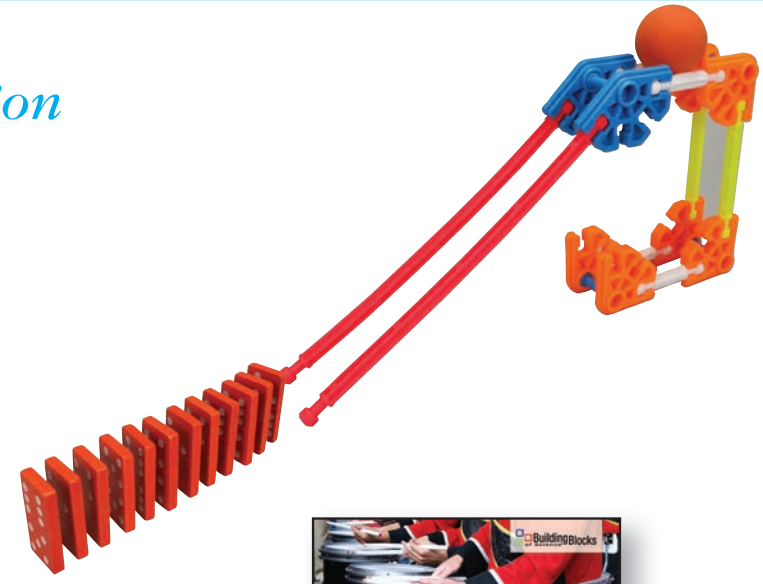
K–5 Scope and Sequence

Building Blocks of Science®

	Physical	Life	Earth & Space
Kindergarten	**Push, Pull, Go** *K-PS2-1; K-PS2-2*	**Living Things and Their Needs** *K-LS1-1; K-ESS2-2; K-ESS3-1; K-ESS3-3*	**Weather and Sky** *K-PS3-1; K-PS3-2; K-ESS2-1; K-ESS3-2*
1st Grade	**Light and Sound Waves** *1-PS4-1; 1-PS4-2; 1-PS4-3; 1-PS4-4*	**Exploring Organisms** *1-LS1-1; 1-LS1-2; 1-LS3-1*	**Sky Watchers** *1-ESS1-1; 1-ESS1-2*
2nd Grade	**Matter** *2-PS1-1; 2-PS1-2; 2-PS1-3; 2-PS1-4*	**Ecosystem Diversity** *2-LS2-1; 2-LS2-2; 2-LS4-1*	**Earth Materials** *2-ESS1-1; 2-ESS2-1; 2-ESS2-2; 2-ESS2-3*
3rd Grade	**Forces and Interactions** *3-PS2-1; 3-PS2-2; 3-PS2-3; 3-PS2-4*	**Life in Ecosystems** *3-LS1-1; 3-LS2-1; 3-LS3-1; 3-LS3-2; 3-LS4-1; 3-LS4-2; 3-LS4-3; 3-LS4-4*	**Weather and Climate Patterns** *3-ESS2-1; 3-ESS2-2; 3-ESS3-1*
4th Grade	**Energy Works!** *4-PS3-1; 4-PS3-2; 4-PS3-3; 4-PS3-4; 4-PS4-1; 4-PS4-3; 4-ESS3-1*	**Plant and Animal Structures** *4-LS1-1; 4-LS1-2; 4-PS4-2*	**Changing Earth** *4-ESS1-1; 4-ESS2-1; 4-ESS2-2; 4-ESS3-2*
5th Grade	**Structure and Properties of Matter** *5-PS1-1; 5-PS1-2; 5-PS1-3; 5-PS1-4*	**Matter and Energy in Ecosystems** *5-PS3-1; 5-LS1-1; 5-LS2-1; 5-ESS2-1; 5-ESS2-2; 5-ESS3-1*	**Earth and Space Systems** *5-PS2-1; 5-ESS1-1; 5-ESS1-2*
	Science	Science	Science

Teach all of your science standards in just 30 minutes a day!

1 *Inquiry-Based Instruction*



2 *Informational Text*

Each Informational Text Includes:

- Unit-Specific Science Core Ideas
- Science and Engineering Practices
- Crosscutting Concepts
- On-Level Readability

Kindergarten Titles in Big Book Format

3 *Online Visual Learning*

Includes Lesson Plans and Focus Questions!

Online Visual Learner Support

Tigtag is a complete online resource for teaching the Next Generation Science Standards in grades K–5. Tigtag's short films, classroom visuals, practical activities, and assessment tools cover specific objectives pertaining to STEM and the Next Generation Science Standards. Using this digital resource in your classroom will enrich your current resources and Building Blocks of Science hands-on investigations.

Each unit contains:

- 1 or more curriculum videos
- 1 context film
- 4–5 shorter tidbit videos
- Summaries of each video
- List of main learning points
- Extensive support materials in the Teacher Toolbox

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Living Things and Their Needs Grade K

Performance Expectations: K-LS1-1; K-ESS2-2; K-ESS3-1; K-ESS3-3

Unit Concepts

Starting with what kindergartners know about living and non-living things, they explore the needs of living things through pumpkin seed germination and plant growth. They also **design investigations** to determine which habitat bessbugs prefer. Students make firsthand observations of how living things can change their environment to meet their needs. By the end of the unit, they **apply what they've learned** about needs to **design and communicate solutions** that will reduce human impact on the environment.

Lesson Summaries

Lesson 1: Living and Non-Living Things

In this pre-assessment lesson, students classify objects as living and non-living. They discuss the similarities among all living things and what living things need in order to live. They plant their own seeds and observe bessbugs.

Lesson 2: Needs of Living Things

Students continue to **observe and describe patterns** of what plants and animals need to survive by **designing and performing two investigations**. First, the class sets up an investigation to determine what plants need to grow well. By varying the growing conditions and observing the effects of these conditions on the plants over several days, students will determine plants' needs for survival. Next, students investigate habitat and food preferences of the bessbugs. Students continue to monitor and record the growth of their pumpkin plants.

Lesson 3: Living Things and Their Environment

Students are introduced to the term "environment," and discover that it is a **system** made up of plants, animals, and their surroundings. Through multiple activities, students observe the changes that plants and animals make to their surroundings to meet their needs. At the end of the lesson, students **draw a model** of one way that a plant or animal interacts with and changes its environment to meet its needs. Students continue to monitor and record the growth of their pumpkin plants.

Lesson 4: Protecting the Environment

In this final lesson, students review what they have learned about living things during the unit. They revisit and revise their responses to the opening questions from Lesson 1. They will relate their understanding of what living things do and need to live to their pumpkin plants by revisiting their final journal entry. Students are asked to think about how humans change their local environment and how those changes can be both positive and negative. Students work in pairs to **brainstorm solutions** to help reduce the impact humans have on their local environment. They make posters to **communicate these solutions** to their classmates.

Exploring Organisms Grade 1

Performance Expectations: 1-LS1-1; 1-LS1-2; 1-LS3-1

Unit Concepts

First graders start learning about basic needs for survival as they look at themselves, their parents, and at bean plants. They **see patterns** in how offspring are similar to their parents. Students begin to learn about **structure and function** by focusing on insects. Finally, they **design a solution** to a real problem faced by human parents as they raise their offspring by their design, mimicking animal or plant structures that are used for survival.

Lesson Summaries

Lesson 1: Needs for Survival

This lesson is designed to pre-assess what students already know about living things and their needs. Students discuss what seeds typically need to survive, and then plant their own bean seeds. Then, they discuss the difference between living and non-living things. Students' misconception of the word "dead" is addressed at this time. After a sorting activity, the class discusses characteristics that make something living and create a list of requirements of living things. Finally, students **observe** various plant and animal structures and determine which need(s) each structure assists with to help that organism survive.

Lesson 2: Raising Young

Students **apply the knowledge** they gained in Lesson 1 to the behaviors that exist between animal parents and their offspring. This lesson focuses on how many animal offspring rely on their parents to help them meet their basic needs for survival, such as food and water. Students begin by looking at human parents and offspring. Based on their own experiences, students discuss which basic needs a baby, child, teenager, and an adult can provide for themselves and which needs they need to rely on their parents for. Students **apply these concepts** to other animal species and discover that many animals care for their young. **Using a variety of books and media clips**, students begin to notice **patterns** in the behaviors of animal parents and offspring. By the end of the lesson, students understand that many offspring communicate through vocalizations and other behaviors to express being hungry, tired, scared, and cold. Students also understand that parents react to these behaviors by protecting the offspring, feeding them, teaching them, and by displaying encouragement and affection.

Lesson 3: Parents and Their Young

Using photos and their own **prior knowledge as evidence**, students **observe and discuss** how humans look similar to their parents. They also **compare** the appearance of mature animals to that of their young, recognizing similarities. During these comparison activities, students begin to notice the **pattern** that offspring look similar but not identical to their parents, and they **construct an evidence-based explanation** of this concept. Students then **observe** their bean plants and compare their plant to a more mature "parent" plant, noting similarities and differences. To build on this concept for plants, students observe various photo cards, recognizing that plants, like animals, are similar but not identical to their parents.

Lesson 4: Structures and Functions for Survival

In this final lesson, students explore plant and animal structures. Using their bean plants, students **identify different structures** and how they help the plant survive in its environment. Students investigate and **determine the function** of several common animal structures, then diving deeper, brainstorm other animal structures they have observed predicting what it would be used for. Students observe 10 additional insects, investigating the various body parts, predicting the function each serves. To end the lesson, small groups work together to **design a solution** to a real problem faced by human parents while they raise their offspring by applying what they know about animal and plant **structures and functions** used for survival.

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Ecosystem Diversity, 2nd Edition Grade 2

Performance Expectations: 2-LS2-1; 2-LS2-2; 2-LS4-1

Unit Concepts

What do living things need to survive? Seeds are planted, variables are manipulated, and students learn about how organisms survive in different habitats. A dried bee serves as a **model** to simulate bee behavior with plants. Students **build and study a model** of a terrestrial and an aquatic habitat, then determine how human impact could be a problem for each of them. Integrating literacy skills, students then create public education campaigns to teach others how their actions could **affect** habitats.

Lesson Summaries

Lesson 1: Organisms and Habitats

This lesson begins with an informal pre-assessment in which students brainstorm and list living things and what they need to survive. As a class, students view various habitat cards and discuss the **patterns** of the basic characteristics of all habitats, aquatic or terrestrial. Student groups have the opportunity to identify specific habitats and describe what makes each habitat unique. During an interactive reading activity, students learn more about the characteristics of different climates and what living things need in order to survive in those climates. The lesson concludes with students recognizing the differences between living and non-living things, and they begin to understand that the physical characteristics of living things are related to the climates in which they live.

Lesson 2: Plant Growth

Through the discussions and activities in Lesson 1, students have **built an understanding** that plants are living things and have specific needs that help them grow. By planting seeds and manipulating variables, they clearly **see the effects** that the physical environment has on plant growth. Students learn that although all plants have the same basic needs, the environment in which they live can **have an effect on** a plant's ability to survive. Through **observations and discussions** of plants that are found in different habitats, students **gain a basic understanding** of plants' ability to adapt to their environment.

Lesson 3: Plant and Animal Interactions

Students learn how animals help in seed dispersal by acting out the process using model seeds. Through **dialogue and interactions** between group members, students discover many ways that seeds can be moved from the flower to a location where they can grow into a new plant. Students next **observe** the characteristics of insects more thoroughly. They examine the body of a dried bee, and simulate the bee behavior of flying from one plant to another to develop an understanding of how bees use their bodies to pollinate plants. During an interactive reading activity, students learn more about the various methods of seed dispersal. The lesson concludes with students realizing the important role that plants and animals play in each other's lives and they begin to understand that neither could exist without the other.

Lesson 4: Diversity of Life

In this lesson, groups **use the understanding** of habitats gained in the previous lessons to **plan and construct** their own habitat. Half the class will create terrestrial habitats and the other half will create aquatic habitats. Then, students will **observe** all of the habitats and **evaluate whether** the organisms would actually be able to survive in the habitats as designed or if **modifications are necessary**.

Lesson 5: Human Impact

In this final lesson, students learn about various human actions that can **affect** a habitat. As they participate in an interactive reading activity, they discuss which of those human actions could happen in the habitat where they live. Students then look back at the habitat that they created in the classroom and come up with examples of ways that each of the human actions discussed could **affect** the habitat. Groups choose the human action that could have the largest negative impact on their habitat. Finally, they **create a public education campaign** to **teach others** about how their actions can **affect** local habitats.

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Life in Ecosystems, 2nd Edition Grade 3

Performance Expectations: 3-LS1-1; 3-LS2-1; 3-LS3-1; 3-LS3-2; 3-LS4-1–4

Unit Concepts

Watch imaginations take flight as students explore ecosystems and how plants and animals adapt. Expanding on what they know about what living things need to survive, students learn about healthy ecosystems with butterfly larvae and Wisconsin Fast Plants®. They start to look at inheritance and traits as well as adaptation, **creating models** of different types of beaks to determine what kind of food sources work best for different birds. Fossils reveal how organisms **change over time** as the environment changed. By the end of the unit, students **apply science concepts to design** a new animal.

Lesson Summaries

Lesson 1: Observing Life in an Ecosystem

Earth has a variety of ecosystems that are home to diverse plants and animals, each of which is well adapted to its environment. This unit begins with a pre-assessment to discover students' overall knowledge of Earth's ecosystems and some common adaptations associated with organisms in these environments. To begin their explorations, students are introduced to butterfly larvae and begin growing Wisconsin Fast Plants®, which they will **observe** daily throughout the unit to observe life cycles and adaptations firsthand. Students then investigate the benefits of living in a group versus leading a solitary lifestyle.

Lesson 2: Inheritance and Variation of Traits

This lesson moves from learning about life cycles to learning about the traits that offspring inherit from their parents. Students **observe** that humans have many traits in common, but that they also have many differences that make each person unique. Students explore the differences between an inherited trait and an acquired trait and start to **observe** how the environment plays a role in the development of an individual. Students then **investigate and analyze** variations that can occur between members of a species and begin to understand that these differences play a role in the chances of survival.

Lesson 3: Adaptations

Students **investigate** physical and behavioral adaptations, both of which help organisms to better survive in their environments. Students focus on beak adaptations in four birds, which help determine what types of foods those organisms can eat. Students **use a variety of tools to simulate** beak structures and begin to understand that animals are specially adapted to the food sources available within their habitats. Students also simulate predator-prey relationships and the adaptations that both groups have, such as camouflage, to help them survive.

Lesson 4: Environmental Influences

Students **investigate** how the environment plays a role in the development and survival of organisms. Investigation helps students **draw the conclusion** that both inherited information and the environment help shape an organism's traits. This leads to the idea that some organisms are better adapted than others in an environment, and those better adapted individuals have an increased chance of survival. Students also have the opportunity to make **predictions and inferences** about plant and animal responses to major environmental changes, such as temperature change.

Lesson 5: Learning from Fossils

In this final lesson, students **observe** how organisms **change over time**. They **conclude** that not all organisms are alive today and that some were alive millions of years ago. Students **analyze** fossil structures and **infer** which present-day species could have descended from them. Students also **analyze and interpret** a fossil distribution map **to conclude** that the environment **changes over time** and that living things must adapt or go extinct when these changes occur. In a culminating activity, students **apply the major concepts** from all five lessons **to design** a new animal species. Students **present the facts** about their animal to the class using a poster, by creating a book, or using another visual medium of their choice.

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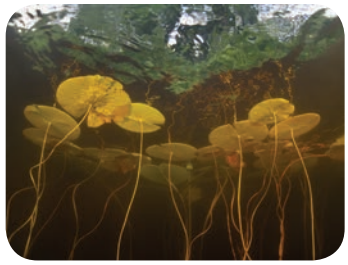

Plant and Animal Structures, 2nd Edition Grade 4

Performance Expectations: 4-LS1-1; 4-LS1-2; 4-PS4-2

Unit Concepts

Nothing grabs student interest like dissection, and it's a great way to learn about **structures**. This unit begins by expanding what students know about plant and animal structures and how they help organisms survive. They will experience up-close study of the **internal and external structures** of plants and animals by dissecting seeds and plants, a preserved squid, a sheep brain, and a cow eye. Then they'll **apply this knowledge, creating a model** of the eye and explaining the path light takes as the brain helps us see the world.

Lesson Summaries

Lesson 1: What Do We Know About Plant and Animal Parts?

Students understand that plants and animals are different from one another. Lesson 1 begins with a class brainstorming session about the **structures** that plants and animals could have that allow them to better survive in their environment. After brainstorming, students sort images of various structures into categories based on what they believe is the purpose of each structure. Finally, students plant radish seeds using just a paper towel, water, and a plastic bag.

Lesson 2: Animal Structures

Students **investigate** the difference between internal and external structures found within different animal species. Students come to understand the importance of these structures and how they relate to the survival, growth, and reproduction of that species. Students begin by exploring external structures. After **applying the concept** of external structures to humans, students identify structures on a preserved squid specimen. Students then **investigate** internal structures in animals. To help strengthen understanding of what goes on internally, students explore a diagram and dissect their squid to view its unique internal structures.

Lesson 3: Plant Structures

This lesson begins with a review of the **external structures** of a plant **and their functions**. To do this, students examine their radish plants from Lesson 1 and **identify the structures** that are helping the plant survive. Students then investigate the internal structures of a plant. They perform a seed dissection to look closely at the parts of a seed that enable a new plant to grow. Students then explore the veins of a plant, which help move materials around the plant's body. They observe these veins firsthand using celery, carnations, and colored water. To conclude, students read to learn more about different structures found in the flower and how they aid in reproduction, then they dissect a flower to explore these structures firsthand.

Lesson 4: Animal Senses

This lesson focuses on the five senses and the brain's role in processing information gathered by the senses. Students review this concept by performing an activity that engages all five senses. Next, students **explore the structure** of the brain and how **information** is sent to the brain for **processing, developing the understanding** that we then react to the information in different ways. Students more closely explore the brain's structure through an interactive sheep brain dissection. Finally, students reengage their five senses through a series of activities, this time **explaining** the brain's role in the processing and response.

Lesson 5: Exploring the Eye

Students extend the knowledge gained about the brain in Lesson 4 and begin to dig deeper into how we are able to see the world around us. To begin, students are pre-assessed on what they already know about the human eye. This leads to a discussion about the significance of light when it comes to viewing images. Students then participate in an interactive cow eye dissection to explore the main **structures** within an eye that allow animals to view the world around them. Students **apply what they learn from observing** the internal structures of the eye to a diagram of the eye, following the path of light from the object all the way to the brain. Finally, students investigate the backwards, upside-down image the eye creates and how the brain corrects this as it processes the information that it is sent.

Lesson 6: Structure and Function

In this final lesson, students **display the knowledge they have gained** throughout the unit by participating in a **culminating project-based assessment**. Groups work together to **design and build a three-dimensional eye model**. Students are expected to **explain**—to the teacher or to the class—the path that light takes into the eye and how animals are able to see images. Students then **describe** the brain's role in helping animals see the world around them.

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Matter and Energy in Ecosystems, 2nd Edition Grade 5

Performance Expectations: 5-PS3-1; 5-LS1-1; 5-LS2-1; 5-ESS2-1; 5-ESS2-2; 5-ESS3-1

Unit Concepts

Students begin by focusing on the interdependence of living and non-living things in an ecosystem. They **make a sun oven** to follow the energy transfer of the sun's energy as it heats up a marshmallow. Then students dissect an owl pellet to see which organisms are consumed for energy at the top of the food chain. They also cultivate a worm tank to see what decomposers do for an ecosystem. By the end of the unit, students **analyze the causes and effects** of agriculture, fossil fuels, technology, and factories on ecosystems.

Lesson Summaries

Lesson 1: Energy for Life

This unit begins with a pre-assessment to gauge what students already know about living and non-living things, and to start them thinking about the interdependence among them. Lesson 1 focuses on the sun's energy and the nitrogen **cycle**, which are two non-living factors essential for life. By **making a sun oven**, students see how energy from the sun is transferred and can heat up marshmallows. Students **apply their understanding** of the way water is recycled in the environment in the water cycle to the way nutrients are recycled. To **make the connection** that nitrogen cycles through the environment just as water **cycles** through the environment, students participate in a simulation where they act as nitrogen molecules moving from place to place.

Lesson 2: Producers

In this lesson, students review the different parts of a plant and use iodine as an identifier **to test for** starch in potatoes and plants. They use a potato to **observe** how iodine changes color when it is exposed to starch. By doing so, they discover that starch is present in a plant as a result of the plant making its own food during the process of photosynthesis. Students then **apply what they've learned** about starch and iodine **to investigate** which abiotic factor is important for making starch in a plant. In a controlled experiment, students **make predictions** to see if air, water, or sunlight contributes to the production of starch by withholding each from the same type of plant, introducing students to the importance of using a control during a scientific investigation. After a period of time, students use iodine to test for the presence of starch. **Based on their assessment** of the reaction that each plant has, **students determine** that sun is the factor in producing starch in plants, thereby relating the flow of energy from the sun to plants.

Lesson 3: Consumers

Students begin **developing an understanding** of energy transfer among organisms by assembling a food chain energy pyramid. To strengthen their understanding of how consumers get energy from other consumers, students dissect an owl pellet to discover which types of organisms are consumed for energy by the consumers at the top of the food chain. To prepare to delve more deeply into the interdependence of organisms in an ecosystem, students identify the need for niches and competition among consumers by emulating birds hunting and eating different types of food at different times of the day.

Lesson 4: Decomposers

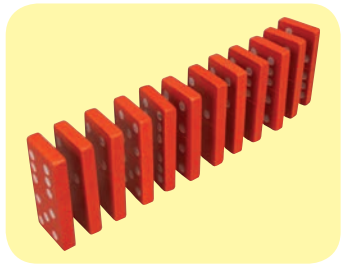
In this lesson, students **observe** decomposers in action. By cultivating a worm tank, they are able to evaluate the contributions worms have on the environment. They **investigate** what happens within a few days after placing dead organic matter in a plastic tank with worms. In a controlled experiment, students **compare changes** in the worm tank with those in a tank containing the same materials but no worms, reinforcing the importance of using a control during a scientific investigation. The results of the controlled experiment help students **make the connection** to the **flow of energy** in an ecosystem when they conclude that worms have broken down the organic matter in the tank.

Lesson 5: Food Webs

In this lesson, students **connect the ideas they uncovered** in previous lessons **to discover** that the organisms in an ecosystem are interdependent on one another. First, they determine the flow of energy among the specific organisms living in the same region. The types of organisms living in an ecosystem vary depending on the location and on the resources available in the region. Then students make a food web, connecting each organism to the next to discover that a food web stretches beyond a simple food chain, showing the many places energy is moving in an ecosystem. The lesson concludes with students **designing** a real ecosystem using soil, plants, and insects.

Lesson 6: Human Impact

Students **research** ways humans can inadvertently hurt an ecosystem. They read a nonfiction text about factories, fossil fuels, agriculture, or technology. They **analyze** the needs and problems that human inventions cause, **determine the consequences** of these actions on the environment, and try to **formulate solutions**. After completing the **analysis of their research**, students **devise an alternative solution to the** human need or **problem** and **communicate their ideas** in a presentation to the class. Students also create a public service announcement to persuade people to make changes to protect the environment.



Push, Pull, Go, 2nd Edition Grade K

Performance Expectations: K-PS2-1; K-PS2-2

Unit Concepts

Kindergartners bring their love of building to fun investigations of the forces that move them. This introduction to physics integrates math and measurement as students build swings, tops, and ramps with Kid K'NEX® building pieces. By the end of the unit, they **apply what they've learned, engineering their own motion invention**.

Lesson Summaries

Lesson 1: Push, Pull, Roll

In Lesson 1, students **explore** force and motion using student-built toys made with Kid K'NEX® building pieces. Students **observe** the motion and path of a ball rolling down a ramp and record the distance using non-standard measurement. Students complete three Student Activity Sheets during this lesson. Student Activity Sheet 1A: Sort and Count helps familiarize students with the building pieces. Student Activity Sheet 1B: What I Built allows students to **document what they create**, and Student Activity Sheet 1C: How Far? helps students **record data** as they explore **measuring distance**.

Lesson 2: Push, Pull, Swing

In Lesson 2, students **build** a toy swing set that moves and use it to **explore patterns** of movement related to force. Student Activity Sheet 2: Push, Pull, Swing helps students **describe** the swing set and its motion.

Lesson 3: Push, Pull, Tumble

Students use dominoes in Lesson 3 to **explore the result** of force transferred from one object to another. Student Activity Sheet 3: Dominoes and a Push provides students with another opportunity to **describe their design** and the motion of the **system** they **build**.

Lesson 4: Push, Pull, Spin

In Lesson 4, students further explore force as they **build** a toy top that spins and use the top to **investigate** spinning motion. Student Activity Sheet 4: Spinning Tops helps students **record their ideas** about the motion of spinning and how the top moves.

Lesson 5: Push, Pull, Invent

In Lesson 5, students have access to all the materials used in previous lessons to **construct a model** (an invention, Rube Goldberg-style) that is set in motion with a push or a pull. Students complete Student Activity Sheet 5A: My Invention, which **documents the order of the steps** they followed to **design and build** their invention. Student Activity Sheet 5B: Forces and Motion allows students to link a specific motion with one of the objects that they built during the unit. Both sheets are helpful assessment tools in this concluding lesson.

Light and Sound Waves, 2nd Edition Grade 1

Performance Expectations: 1-PS4-1–4

Unit Concepts

First graders begin to learn about waves in the world by **exploring** the properties of light and sound. At the end of the unit, students are ready to **engineer a communication device**. They identify the transmitter, the receiver, and the code in this transfer of energy—using either light or sound. Then they **present** it and **describe ways to improve it**. Engineering in action!

Lesson Summaries

Lesson 1: The Properties of Light

Students begin by holding a brainstorming session regarding what they know about light and its sources. They **discuss** how light is important for many reasons such as providing energy for living organisms and heating the earth. Students then make **observations** inside a pinhole box to determine that objects can be seen only when illuminated.

Lesson 2: Transparent, Translucent, Opaque

In this lesson, students **investigate** how light interacts with different materials. Students use a flashlight to **compare** how light travels through three types of materials and which materials cast a shadow. They record the information that they collect during several investigations in a working vocabulary book and on Student Activity Sheet: Transparent, Translucent, or Opaque? Students **use these tools to assess their understanding** of the concepts of clear (transparent), cloudy (translucent), and dark (opaque) objects.

Lesson 3: Reflection: Bouncing Beams

In the opening discussion, students recall that light travels in straight lines, discuss that light must enter the eye in order for an object to be seen, and speculate on how the direction in which a light beam shines might be changed. Students then participate in several activities to learn about the law of reflection. First, they use flashlights and mirrors **to demonstrate** reflection. Then, they **explore** how reflections change when observed using curved, flexible mirrors compared with plane mirrors. Finally, students begin **developing an understanding** about the line of reflection and extend this geometric concept using handprints and letters and multiple mirrors.

Lesson 4: Vibrations and Sound

In Lesson 4, the class shifts its focus from light to sound. In this introductory lesson on sound, students will **see the relationship** between waves and sound by **observing** vibrations on a drum. After observing that the vibrations cause sound waves, they will **experiment** and **observe** that the length of a vibrating object **affects** the sound that is produced.

Lesson 5: How Does Sound Travel?

To further **develop the understanding** that sound travels in waves, students use solid objects and string **to demonstrate** the movement of sound. Students experience a sound being transferred by waves directly to their ears and then listen for the sound of the vibrations from the same object to be transferred to their ear at the other end of a string. Students then use a device through which they can transmit voice waves.

Lesson 6: Communicating with Light and Sound

In this final lesson, students learn about different forms of communication and **develop the understanding** that all communication requires a transmitter, a receiver, and code to transfer the information. Students work in pairs **to apply what they have learned** in the unit **to design and build** a communication device that uses either light or sound. Once they have constructed their device, they will **demonstrate** how their device works to the class **and describe** ways they might **improve on their design**.

PHYSICAL
Science

Matter, 2nd Edition Grade 2

Performance Expectations: 2-PS1-1–4

Unit Concepts

Students **explore** solids, liquids, and gases and their different properties. They **investigate** changes in state (both physical and chemical) using real-world examples. What happens when you chill or heat coconut oil? What makes popcorn pop? Matter and energy have never been so tasty!

Lesson Summaries

Lesson 1: Same Pieces, Different Look

Everything that we can see or feel is made up of smaller parts, from buildings to automobiles to living things. In this lesson, students assemble a pyramid-like structure, then disassemble it and make other structures from its parts to learn how the parts fit together. Students also subtract and add parts to see how different arrangements can result in different things. This helps set up the idea that all **matter is made of particles** and that different combinations of particles result in different structures.

Lesson 2: What's the Matter?

Matter can be observed in three states: solid, liquid, and gas. This lesson begins with a pre-assessment to determine students' prior knowledge of the states of matter in which water can be found. They **observe and organize** the different states of water. As they **observe and record** different characteristics of each state of matter, students **make the connection** between the states of matter and the differing arrangement of molecules in each state.

Lesson 3: Solids, Liquids, and Mixtures

By **observing** the varying behaviors of different solids and liquids, students **conclude** that their characteristics can also vary. They discover that solids can be malleable and that liquids can vary in thickness and fluidity, or viscosity. Students test viscosity of liquids by measuring the time it takes for a solid to move through them in a graduated cylinder. Students build on their understanding of states of matter by creating mixtures. They **observe** the outcome of combining solids with solids and solids with liquids.

Lesson 4: Describing Matter

Matter has different properties. Metals tend to be hard but malleable, conduct heat and electricity, and have shiny or reflective surfaces. Wood tends to be hard but porous, insulates against electricity and low heat, and has a dull surface. Foam tends to be soft, filled with air, and lightweight. Paper tends to be neither hard nor soft, is highly malleable, and absorbs liquids. Students are tasked with **describing** these properties, as well as with understanding how these properties can be used in materials.

Lesson 5: Heating Matter

When something melts or freezes, **energy** is being put into or taken out of it. To heat something, energy must be added. To freeze something, energy must be withdrawn. Some substances change state during the process of heating or freezing but return to their previous state once the energy levels go back to normal. Other substances change and can never go back to the way they were before. In this lesson, students heat and freeze coconut oil to **observe** how it changes state with the addition and subtraction of energy.

PHYSICAL
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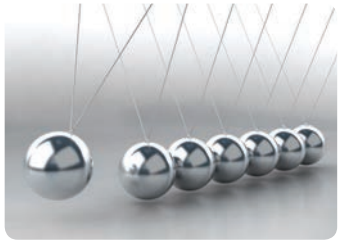

Forces and Interactions, 2nd Edition Grade 3

Performance Expectations: 3-PS2-1–4

Unit Concepts

What makes a toy car go? What makes it stop? This unit looks at forces, with an emphasis on friction, mass, and magnetism. It concludes by asking students to **complete a design task**: a **model** to sort out scrap metal from trash, a magnetic door latch, a magnet-based device to keep two moving objects from touching each other, or a "magic trick" to make a paper clip float in the air.

Lesson Summaries

Lesson 1: Balanced Forces

Students begin their study with an inquiry-based pre-unit assessment in which they balance objects on a scale. They learn that all objects on Earth have the force of gravity being applied to them at all times, and based on Newton's third law of motion, whatever surface an object is resting on has an equal but opposite force to gravity pushing on it. Students **make a scale** from a beam board and masses and **use it to investigate** different forces that can be applied to keep objects at rest.

Lesson 2: Unbalanced Forces

Building on the law of inertia, students **investigate** the unbalanced forces that set objects in motion. They **determine** forces that are applied to a moving object to make it stop moving by setting a toy car in motion, and **conclude** that friction is a force that causes a resistance in movement. **By testing** the movement of the car against different surfaces, students learn that different textures of surfaces have different coefficients of friction that cause different changes in the motion of the car.

Lesson 3: Changes in Motion

In this lesson, students **apply the concept** of unbalanced forces to an object. They secure small masses to the end of a string attached to a car to observe how fast the car will go as the force being applied increases with the amount of mass. They learn that adding a load to the car will slow down the movement and will require more force to be applied to make the car move.

Lesson 4: Magnetism and Electricity

Students **investigate** how magnets create a force field that can either attract (pull) or repel (push) objects toward or away from them. They **examine** the movement of magnets to determine that opposite poles attract and same poles repel each other. Once students have a firm grasp on magnetism, they **apply this concept** to understand that positive and negative electric charges create the same attraction or repulsion based on the type of charge. Opposite charges attract each other, while same charges repel. A Take-Home Science Activity gives students the opportunity to test the negative and positive charges of simple household items at home by investigating which items attract each other and which repel.

Lesson 5: Magnetic Solutions

This final lesson provides students with the opportunity to assess their knowledge of forces and the interactions between forces. First, students reinforce what they have learned about forces, including gravity and magnetism, and how various forces interact. Then, in a **culminating engineering challenge**, groups **design a model** using magnetism as the **solution to a problem**. Groups select a problem to tackle and **design two models that solve the problem** using magnetism. They then **compare their models**, **select the best solution to the problem**, and **present this model** to their classmates.

PHYSICAL *Science*

Energy Works!, 2nd Edition Grade 4

Performance Expectations: 4-PS3-1–4; 4-PS4-1; 4-PS4-3; 4-ESS3-1

Unit Concepts

Focusing on themselves, students review different kinds of energy and how it's converted in a **system**: energy their bodies produce, potential and kinetic energy, the motion of waves, plus alternative forms of energy. They engineer a waterwheel, then a wind turbine. By the end of the unit, they can **pose a question** they've wondered about and **engineer a device to answer it**.

Lesson Summaries

Lesson 1: Where Do You Get Your Energy?

Students focus on themselves to begin their study of energy: they are both receivers and users of energy. They discuss and map out their ideas about where their energy comes from and how their bodies transform it so they are able to engage in different types of activities. Students take a survey of the different types of energy they **observe** in the classroom. They **record** their findings on Student Activity Sheet 1 as a pre-unit assessment.

Lesson 2: What Are Potential Energy and Kinetic Energy?

Students continue to **explore** the idea that energy has many forms. The teacher introduces the concept that energy may be classified into two broad categories: kinetic (moving) energy and potential (stored) energy. The class participates in several interactive demonstrations that show the differences between potential and kinetic energy.

Lesson 3: How Can We Show Energy Is Transferred and Converted?

Students grapple with the concept of how energy is converted into other forms by identifying examples of conversion. Students **investigate energy** firsthand, which enables them to explore various forms of **energy** and how they are converted and **transferred** to other forms within a **system**.

Lesson 4: How Does Energy Move in Water Waves?

Students take a closer look at waves as one of the ways energy moves. They **apply what they learned** about **energy transfer** in Lesson 3 by setting up a **model to investigate** how waves of energy move through water in an up-and-down motion, and explore the factors that can change the way a wave moves. Students also use **patterns** to **transfer information** via signals and relate that to practical applications of waves.

Lesson 5: What Are Alternative Forms of Energy?

In an opening discussion, students learn about alternative forms of energy: solar energy, geothermal energy, wind energy, water energy, and biomass. They weigh the relative advantages and disadvantages of alternative energy sources versus fossil fuels. Then **students assemble** two constructions: one that uses wind, and another that uses water. They discuss how wind energy or water energy can be transferred to their apparatus, and then how that energy is transformed into mechanical energy. Throughout the activities, students are encouraged to **record new ideas and questions** they might investigate in Lesson 6.

Lesson 6: What Have We Learned About Energy?

Working in teams, students **plan a demonstration or an experiment** and then **design and construct** their own apparatus to show different types of energy and the transfer of energy. Teams **present** their projects and **explain** their inventions to the rest of the class. As a post-unit assessment, students complete Student Activity Sheet 1: Energy Hunt again. They compare their post-unit sheet with the one they completed in Lesson 1 to measure their own progress from the beginning to the end of the unit.

PHYSICAL *Science*

Structure and Properties of Matter, 2nd Edition Grade 5

Performance Expectations: 5-PS1-1–4

Unit Concepts

Start laying the groundwork for middle school chemistry with this unit that builds on student understanding of the properties of matter, changes of state, physical and chemical changes, and conservation of matter. By the end of the unit, students **apply what they've learned** to a **real-world engineering project**. They devise a water purification system—a great application of chemistry to a timely problem!

Lesson Summaries

Lesson 1: What Is Matter?

Students focus on their familiar environment to begin the study of matter. They examine types of matter and differentiate among solids, liquids, and gases. They perform activities to **observe and/or measure** mass and volume in samples of these three states of matter. Through facilitated discussion, students **compare and contrast their observations to develop conclusions**.

Lesson 2: How Can Matter Change State?

Students continue to explore states of matter, participating in interactive demonstrations using water as the sample material. Students **observe and explain** characteristics of water in each state and also **describe the changes** from one phase to another. The class participates in several interactive demonstrations that reinforce the differences among the common states of matter.

Lesson 3: What Are Physical Properties of Matter?

Students **expand their understanding** of physical properties. Through teacher demonstrations and hands-on interactivities, students **explore** buoyancy, hardness, magnetism, and viscosity. Class experiences also provide the opportunity to note several other observable properties, such as color, density, opacity, luster, reflectivity, malleability, brittleness, and flexibility.

Lesson 4: What Are Mixtures and Solutions?

Working in teams, students **examine, combine, separate, and evaluate** mixtures and solutions of solid and liquid matter. During three related activities, students manipulate materials to **observe** that, when matter is combined in mixtures and even appears to vanish in solutions, the amount of matter is conserved.

Lesson 5: What Are Physical and Chemical Changes?

Students have already learned that matter can change state—a physical change—but the particles remain the same type of matter. Now students will **identify** the specific signs that a chemical change has occurred. Through **activities and discussion**, they are introduced to the concept that some combinations of matter (or matter and energy) produce changes that alter the smallest particles of the matter, transforming it into an entirely different substance.

Lesson 6: What Have We Learned About the Structure and Properties of Matter?

Working in teams, **students plan, build, test, and evaluate a system** to separate the materials in a mixture of muddy, colored water. Teams make a poster and use it to **present their systems** and **explain their solution** to the class. As a post-unit assessment, students revisit activity sheets from the lesson to note how many facts, strategies, and observations they utilized in the **design of their own model solution to the problem**.

Weather and Sky, 2nd Edition Grade K

Performance Expectations: K-PS3-1; K-PS3-2; K-ESS2-1; K-ESS3-2

Unit Concepts

It all starts with "What's the weather today?" Then kindergartners quickly move beyond by **keeping records**, using Venn diagrams to contrast the daytime and nighttime sky, looking for **patterns in their data**, and developing thermometer skills. As a final activity, they **engineer** a way to prevent the sun from warming the earth.

Lesson Summaries

Lesson 1: What's That in the Sky?

To introduce *Weather and Sky*, students become familiar with gathering direct **observations** of the sky during different times of day. Students **predict and record** the objects they think will appear in the daytime sky on a class chart. Then students go outside to make direct **observations** of the daytime sky and **record/describe** what they see. They **share their findings** with their peers and **discuss** how the weather feels outside, introducing words such as "temperature" and "weather." Students **predict and record** the objects they think will appear in the nighttime sky on an additional chart. During the Family Science Activity: Nighttime Sky, students make **direct observations** of the nighttime sky and **record/describe** what they see. They return the next day prepared to **share their observations** with their peers. Students use a Venn diagram to compare and contrast the daytime and nighttime skies. Using adhesive notes, they draw an item that was not mentioned that can be observed in the sky, and classify the object as one that can be observed in the daytime sky, nighttime sky, or both.

Lesson 2: Weather Watchers

Lesson 2 introduces students to the four main weather features studied throughout this unit: temperature, wind, precipitation, and cloud cover. The activity begins with a pre-assessment to find out what students already know about weather and words to describe the weather, and discusses how they plan their daily activities and clothing choices around the weather for the day. The class weather pocket chart and weather cards are introduced, allowing students to become familiar with the science words and weather symbols that they will use throughout the unit and on their daily observations. The weather features are introduced and discussed one at a time so students can develop a familiarity with the features and how to record weather observations using charts and weather symbols. Once the features have been introduced, students take turns being weather **collectors and reporters** for the class. They make **direct observations** of the weather features daily, **record** the class observations by placing the weather cards on the weather pocket chart, and **record observations** in their science notebooks.

Lesson 3: Weather Reporting and Safety

Lesson 3 culminates all of the weather features introduced in *Weather and Sky* and provides each child an opportunity to **report** his or her science notebook **observations**, including all of the vocabulary words and descriptors from the unit. Students **analyze** their weather data in their notebooks and **look for patterns** and connections among weather features. They compare their weather **observations and data collection** with their peers' through discussion and movement. Students are introduced to extreme or dangerous weather conditions, such as floods, tornadoes, hurricanes, lightning, and thunderstorms. They **create a tornado model** and discuss how to prepare for tornadoes and floods. Students practice a tornado drill and discuss ways to stay safe during severe weather. They **create a flood model** and discuss the connection between flash flooding and soil absorption. A Family Science Activity allows students to share with their families what they have learned about staying safe during severe weather situations. They **create a weather safety kit** and share their collections with their peers.

Lesson 4: Warming the Earth

Students use the class weather pocket chart in a discussion on temperature. They **record** all ideas regarding temperature on a class chart, focusing on tools that measure temperature, and the vocabulary words "hot," "warm," "cool," and "cold." Students interact using a plastic outdoor thermometer and a thermometer model as standard tools to measure temperature. Then they dress characters for the weather according to the temperature outside and **provide explanations to support their reasoning**. After they become familiar with different thermometers used to measure temperature, students place the plastic thermometer outside to be warmed by the sun. After a while, they **observe** the thermometer as a class outdoors. Then students use the thermometer **model to analyze** changes in a thermometer's appearance as the temperature becomes warmer and colder.

Lesson 5: Staying Cool

In Lesson 5, students learn more about the **effects** of the sun. They discuss what the sun provides, including heat and energy, and that it affects objects by making them warm. Through class discussion, they learn ways for people to make themselves warmer or cooler, as well as how to warm up or cool down objects that are sitting in the sun's rays. Part of the process of cooling things down is to block the source of the energy that is heating them up. Another is to find a way to create air that will counteract the source of the energy. Students consider examples of how to achieve cooling things down in multiple ways. Students are separated into the same groups they formed in Lesson 4, Activity C. They choose one of the plastic cups of substrate from that activity and must select a way to prevent it from being warmed by the sun. Once students have selected which approach they want to take, they **design and implement** their plan. Afterward, they **test** it **multiple times** to see if and how it works.

Sky Watchers, 2nd Edition Grade 1

Performance Expectations: 1-ESS1-1; 1-ESS1-2

Unit Concepts

By looking up and studying what they see, students build on their understanding of day and night, seasons, shadows, and the Moon's patterns. In an area of science often filled with misconceptions, students use their bodies to actively **model** these systems. In the final activity, they **create models to teach a lesson** on what we know about the Sun, the Moon, or how both affect Earth.

Lesson Summaries

Lesson 1: What Can We See in the Sky?

Students begin **observing and discussing** what they already know about Earth and objects that they see in the sky, including the Sun, the Moon, and the planets. Students then make direct **observations** of objects in day and night skies, and **use** those **observations to compare and contrast** the similarities and differences.

Lesson 2: Rotating Day and Night

Students begin building an understanding of a series of earth science concepts. Using **models** and participating in active demonstrations, they come to discover that Earth's rotation on its axis is the cause of day and night. Students focus on making direct **observations** of **predictable patterns**, specifically the concept of day and night.

Lesson 3: Revolution and the Seasons

Students demonstrate Earth's revolution around the Sun using string and Earth **models**. They expand on the concepts of rotation and revolution in an outdoor session in which they use chalk and active movement to map the solar system and show the movement of the Sun and Earth within it. During this lesson, students confront the misconception that seasons result from the distance between Earth and the Sun. Students use their Earth **model** and a light source to begin **to explore** the tilt of Earth on its axis and how this tilt (relative to the Sun) results in seasonal differences. Students **discuss** how seasons are related to how a location faces the Sun's rays, which results in light and heat. They learn that the more directly into the Sun's rays a location is facing, the more light and heat are available to that area. Conversely, the less directly a location faces the Sun's rays, the less light and heat is available.

Lesson 4: Shadows and the Sun

Students **analyze** shadows to learn more about two important effects the Sun has on Earth: heat and light. They set up an Earth **model** outdoors in a sunny area and **record and analyze** a shadow's position and movement over a period of time. After **analyzing the data**, students **discuss** how the Sun's position appears to change over the course of a day's time due to the rotation of Earth. Students then **set up an experiment** to compare temperatures in direct sunlight and in shaded areas. They **use thermometers to gather temperature data** in order **to conclude** that the Sun's rays heat Earth.

Lesson 5: The Moon and Its Patterns

Students are introduced to the phases of the Moon. Through direct **observation**, students **analyze** the **repeating patterns** of the Moon's phases. This lesson compares and contrasts the full and new moons, and discusses the illumination of the Moon and its connection with the four main Moon phases. Students also review the concepts of rotation and revolution as they begin to understand how the Moon moves relative to Earth and the Sun. The class represents the Sun-Earth-Moon system using active student **models**. A Moon Journal provides an opportunity for families to **record direct observations** of the Moon together.

Lesson 6: Our Place in Space

This final lesson gives students the opportunity to act as teachers as they **review and act out** each of the concepts about the Sun-Earth-Moon systems that they have been introduced to during the unit. The lesson concludes with **a brainstorming session** to show what students know about the Sun, Earth, and Moon, and a visit back to Lesson 1 and what they knew when they began the unit.

Earth Materials, 2nd Edition Grade 2

Performance Expectations: 2-ESS1-1; 2-ESS2-1–3

Unit Concepts

Water, rocks, sand, soil, wind—put them all together and you get erosion. By working with a **variety of materials**, students **engineer designs** to slow erosion on sand dunes. They **build models** of glaciers and canyons to see the **effects** of water and ice on soil. They also **analyze** their local soil. In the concluding activity, students **design** an island, incorporating water and land forms, then share how erosion will happen in this **model**.

Lesson Summaries

Lesson 1: Water World

In Lesson 1, students **build an understanding** of the relevance that water has on Earth. Since water plays a part in shaping land, it is important to know where water can be found and how water cycles on Earth. Students use **maps, models, and graphs** to discover where and how water impacts Earth. The class is introduced to the Land and Water Card Set, which they will use to explore landforms and bodies of water throughout the unit.

Lesson 2: Rock Attributes: How Are Rocks Different?

This lesson focuses on one natural earth material: rocks. Students **explore** the different types of rocks—igneous, sedimentary, and metamorphic—found in a Rock Study Kit, and classify rocks by a variety of attributes and properties. In a Family Science Activity, students find rocks at home and bring in one rock for a class rock museum. Students explore the rocks in the museum and **create a Venn diagram** to classify the museum samples.

Lesson 3: What Is Sand?

In an opening discussion, students **share their prior knowledge** of sand. Working in pairs, students **explore** the properties of sand, rocks, and gravel, and realize that sand is made when rocks break down by **erosion over time**. Students also compare the attributes of wet and dry sand. Students begin to **understand** that water and wind can change earth materials **over time**. Finally, the class explores how vegetation and moist sand on sand dunes can slow or stop wind erosion, and they **design solutions** to wind erosion by creating a wind barrier. Students **engage in discussions and record their findings** on activity sheets, on class charts, and/or in their science notebooks throughout the lesson.

Lesson 4: What Is Soil?

The lesson begins with students sharing their prior knowledge of soil and making preliminary **observations**. Using many of the same strategies they practiced in Lesson 3, students work in pairs to explore the properties of soil. They make more complex comparisons: dry soil is compared with wet soil, and soil is compared with sand. Students **record** these observations, and then the class sets up a settling jar to observe over time. Students take a trip to the schoolyard to collect local soil. Students also observe the local soil they collected and try to identify components such as sand, silt, clay, and loam. In a final activity, students learn about soil erosion and the **effects** on the land when soil is eroded by wind and water. They also learn about **solutions** to slow down or stop the effects of soil erosion.

Lesson 5: Changes in the Land

In this lesson, students continue to **explore** how earth materials such as rocks and minerals, sand, soil, and water are **constantly changing** the land through erosion. They also continue to build on their understanding that wind and water can change the shape of the land. Students expand their exploration of landforms and bodies of waters by continuing to use the Land and Water Card Set. Students **investigate** how glaciers shape and change the land over time and how a river forms a canyon.

Lesson 6: Making Model Landforms

Students continue to review landforms and bodies of water using the Land and Water Card Set. As a culminating post-assessment activity, students **apply what they've learned to develop a plan to build a model** island, incorporating bodies of water and landforms. Students **present their** landform **model** individually to the class, and convey the impact erosion will have on at least one of the landforms in their model.

Weather and Climate Patterns, 2nd Edition Grade 3

Performance Expectations: 3-ESS2-1; 3-ESS2-2; 3-ESS3-1

Unit Concepts

This weather unit takes full advantage of the intersection of science, literacy, and math. Students **calculate average** temperatures and **measure** rainfall, temperature, and wind—then **create and present** a local news weather forecast. They also **research** natural weather hazards. By the end of the unit, students **formulate a plan** to reduce the impact of a weather hazard and **design a solution**.

Lesson Summaries

Lesson 1: What's the Weather?

Students learn what weather is and how to measure different aspects of it. In a pre-unit assessment, students discuss different types of weather that they have observed. Through **investigation**, students uncover ways meteorologists use tools to measure rainfall, wind, and temperature. They also touch upon the science of forecasting.

Lesson 2: Weather Data

Students begin this lesson by learning how to **calculate averages**. They are then provided temperatures for a specific period of time. The students then use what they have learned about averages to calculate both the daily and the weekly average for the temperature during that time. Next, they **use local media to determine** how much precipitation their area has received over a five-day period. Working in groups of four, they **put together a report** about the weather in their area, then **create a mock newscast** to **deliver** that **information** to their classmates.

Lesson 3: Weather Patterns

Students **observe** daily weather **patterns** in their area, then **compare the data they collect** to data they collected in the previous lesson. Working in pairs, they will **construct** a rain gauge. At the end of each day, they **observe** the rain gauge and determine how much and what type of precipitation has fallen. After **making a record of their findings**, they are asked to **predict** what the weather will be like the following week. During that week, they again **record their observations** of daily weather patterns, and afterward **compare the actual** weather that occurred **to their predictions**.

Lesson 4: Weather vs. Climate

Students relate weather to climate, learning that climate refers to a region's weather over a period of time. They learn the five parts to Earth's climate system—atmosphere, biosphere, cryosphere, hydrosphere, and land surface. Students also identify polar, temperate, and tropical climate zones. They **investigate** how Earth's climate system and climate zones interact. Finally, students **apply their knowledge** to the climatic conditions of an assigned region and of their own community.

Lesson 5: Hazardous Weather

Students learn about various types of natural hazards, including heavy rain and thunderstorms, lightning, tornadoes, hurricanes, flooding, and snowstorms. Working in pairs, students then select one kind of natural hazard and perform additional **research** to learn everything they can about it. They then **formulate a plan to reduce the impact** of their weather-related hazard. Part of that plan includes a **design solution**. Using mathematics, they correctly measure their design solution to scale and incorporate a list of materials they need to implement it.

Lesson 6: Impact of Weather

Students revisit, examine, refine, and re-present their designs from Lesson 5. During these presentations their classmates **critique and evaluate** the merit of their revisions. A general rubric is used in the evaluation of these revisions.

Changing Earth, 2nd Edition Grade 4

Performance Expectations: 4-ESS1-1; 4-ESS2-1; 4-ESS2-2; 4-ESS3-2

Unit Concepts

Building on students' knowledge of soil and erosion, this unit introduces how the distinctive features of the earth came to be. The layers of the earth, tectonic plates, and the rock cycle add to student understanding of erosion and the systems that make up Earth. **Stream tables** are taken to the next level as students **create their own maps** of their river systems. Where did all that eroded sediment go? Students also **build** their own sedimentary rock as they learn how deltas form and grow.

Lesson Summaries

Lesson 1: What Is the Earth Made Of?

Students review what they already know about the layers of the earth and the natural movement of the earth's surface. They **make a model** of the layers of the earth and understand that the crust is made up of plates lying on top of molten liquid rock, and that the crust is only a small fraction of the earth's mass.

Lesson 2: Rock Formations and Patterns

In this lesson, students **apply what they have learned** about moving plates to the way rocks are formed in the rock cycle. During the earth's natural processes, rocks are continuously recycled by being repeatedly heated, eroded, and compacted. Students will **simulate** this process by applying similar changes to crayons to **model** the processes of the rock cycle. Through this activity, students see that each type of rock can be formed from any other type of rock.

Lesson 3: Weathering and Erosion

In this lesson, students use a stream table to **investigate** the effects of erosion on the earth and to **develop an understanding** about how eroded sediment is part of the rock cycle. They also recognize that water erosion is another way the different land features of the earth are formed as they use their stream tables to investigate canyon formation. During the formation of the canyon, sediment is deposited, and students observe the sediments move and settle at the mouth of the river.

Lesson 4: Mapping Earth

Students identify notable attributes of landforms **using a three-dimensional relief map** of the United States and come to recognize the differences in elevation in the different landforms on Earth. They learn that geologists use such maps to better understand the earth around them. To this end, students **make their own plastic maps**, charting the river systems created by their stream tables.

Lesson 5: Changing Earth

Students shift their attention from what happens to rock during erosion to how rock is formed by the deposition as a result of erosion. Using their **stream tables** from Lesson 4, students repeat the process of erosion with different colored materials and observe the results of the deposited sediment. By the end of the lesson, students have **created** a rock made of several layers and have developed an understanding of what the sequence of the layers can tell them about the order in which the layers were formed.

Lesson 6: Living on a Changing Earth

This lesson will help you assess what students have learned about Earth's landforms. Students **apply what they have learned** about the changes that create unique landforms to solve problems of erosion. They also **apply what they learn to predict** the impact, positive or negative, on natural systems and humans.

Earth and Space Systems, 2nd Edition Grade 5

Performance Expectations: 5-PS2-1; 5-ESS1-1; 5-ESS1-2

Unit Concepts

This study of the universe and Sun-Earth-Moon systems naturally integrates math and literacy into hands-on science lessons. Students **design scale models**, then **gather data** and **express it in bar graphs and circle graphs**. As they study water, they calculate the ratio of salt to fresh water on Earth. Literacy comes in as students research and report on how **systems on Earth interact with systems in space**.

Lesson Summaries

Lesson 1: What's Earth's Place in the Universe?

To stimulate prior knowledge, students begin by discussing the **systems** in space of which Earth is a part. They complete a class concept map as a pre-unit assessment, relating space **systems** and the interactions of their parts to **patterns** that are observable on Earth. Students **produce a model** to relate the distance from Earth to relative brightness of the Sun and other stars. Then students calculate the difference in size of the Sun and Earth and **design scale models** that accurately represent the **ratio of their relative size**.

Lesson 2: How Do the Sun, Earth, and Moon Interact?

Students add the Moon to their evaluation of objects in Earth's space system, first examining **scale**. Through interactive demonstrations, they learn about the **effects** of gravity and examine how Earth's spherical shape and orbit around the Sun are caused by the pull of gravity. Students **construct a clay model** to represent the revolution of Earth around the Sun and the revolution of the Moon around Earth. They explore the **cause** of seasons by measuring the angle of Earth's tilted axis and **modeling** the planet's changing position relative to the Sun throughout the year.

Lesson 3: Patterns of Change

Through graphing and hands-on activities, students explore how movements of Earth and the Moon cause **observable patterns**. They review the concepts of rotation and revolution, then **organize and analyze data** on the changing number of daylight hours during the year to relate this **pattern** with the changing position of Earth in its orbit around the Sun. Student use a model to explore Moon phases. Then they **investigate and graph** how shadows change throughout a day. As a mid-unit assessment, students revisit the concept map from Lesson 1 and suggest changes based on what they have learned so far.

Lesson 4: Earth's Systems

Working in groups, students take a jigsaw approach to learning about the characteristics of Earth's major systems and their interactions. They **conduct research** individually (or in pairs) about their assigned **system** and **share their findings** with their group. As a group, they merge what they have learned and use it to **plan, prepare, and deliver a presentation** through which they educate the class about their assigned **system**. Student pairs demonstrate understanding of some ways Earth's systems interact by making a terrarium.

Lesson 5: Water on Earth

Students calculate to determine the ratio of fresh water to salt water on Earth and use their calculations to make a circle graph. Then **they use additional data to make a bar graph** of Earth's freshwater distribution. Students access prior knowledge of water cycle processes and **through hands-on investigation develop a model** of the water cycle to **observe and record evidence** of processes of evaporation and condensation. Through demonstration and class discussions, students **analyze** environmental consequences of water cycle processes.

Lesson 6: Protecting Earth's Systems

Working in groups, students take a jigsaw approach to learning about how communities apply science to protect Earth's major systems. Pairs **research** the issues their assigned **system** faces and **share their findings** with their group. As a group, pairs merge what they have learned and use it to **plan, prepare, and deliver a presentation** through which they educate the class about the problems of their system. Pairs then **research** how a chosen community applies science to protect Earth's **systems**, resources, and environments. Finally, pairs research how the communities in which they live do the same, and they present ways that they too can help protect the resources and environment around them.

Lesson 7: What Have We Learned About Earth and Space Systems?

Prompted by sets of key terms, students **develop questions** that, taken together, survey the content of the unit. They work independently to **produce models** or example **displays** that **answer their questions** and then **join their projects in a class display**. As a post-unit assessment, students revisit and expand the concept map from Lesson 1.

Building Blocks of Science®

K–5 Scope and Sequence

All NEW Program!

	Physical	Life	Earth & Space
Kindergarten	**Push, Pull, Go** *K-PS2-1; K-PS2-2*	**Living Things and Their Needs** *K-LS1-1; K-ESS2-2; K-ESS3-1; K-ESS3-3*	**Weather and Sky** *K-PS3-1; K-PS3-2; K-ESS2-1; K-ESS3-2*
1st Grade	**Light and Sound Waves** *1-PS4-1; 1-PS4-2; 1-PS4-3; 1-PS4-4*	**Exploring Organisms** *1-LS1-1; 1-LS1-2; 1-LS3-1*	**Sky Watchers** *1-ESS1-1; 1-ESS1-2*
2nd Grade	**Matter** *2-PS1-1; 2-PS1-2; 2-PS1-3; 2-PS1-4*	**Ecosystem Diversity** *2-LS2-1; 2-LS2-2; 2-LS4-1*	**Earth Materials** *2-ESS1-1; 2-ESS2-1; 2-ESS2-2; 2-ESS2-3*
3rd Grade	**Forces and Interactions** *3-PS2-1; 3-PS2-2; 3-PS2-3; 3-PS2-4*	**Life in Ecosystems** *3-LS1-1; 3-LS2-1; 3-LS3-1; 3-LS3-2; 3-LS4-1; 3-LS4-2; 3-LS4-3; 3-LS4-4*	**Weather and Climate Patterns** *3-ESS2-1; 3-ESS2-2; 3-ESS3-1*
4th Grade	**Energy Works!** *4-PS3-1; 4-PS3-2; 4-PS3-3; 4-PS3-4; 4-PS4-1; 4-PS4-3; 4-ESS3-1*	**Plant and Animal Structures** *4-LS1-1; 4-LS1-2; 4-PS4-2*	**Changing Earth** *4-ESS1-1; 4-ESS2-1; 4-ESS2-2; 4-ESS3-2*
5th Grade	**Structure and Properties of Matter** *5-PS1-1; 5-PS1-2; 5-PS1-3; 5-PS1-4*	**Matter and Energy in Ecosystems** *5-PS3-1; 5-LS1-1; 5-LS2-1; 5-ESS2-1; 5-ESS2-2; 5-ESS3-1*	**Earth and Space Systems** *5-PS2-1; 5-ESS1-1; 5-ESS1-2*
	Science	Science	Science

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