Phenomena-Based Investigations with Digital Support— in 30-Minute Lessons

Building Blocks OF SCIENCE™ | 3D

LEARNING PROGRESSIONS

Unit Phenomena, Objectives, and Scaffolding for Grades K–5

CAROLINA®
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Learning Framework

Phenomenon-based investigations with digital support in 30-minute lessons!

Building Blocks OF SCIENCE™ | 3D

Kindergarten	**Push, Pull, Go** *K-PS2-1; K-PS2-2; K-2-ETS1-1; K-2-ETS1-2*	**Living Things and Their Needs** *K-LS1-1; K-ESS2-2; K-ESS3-1; K-ESS3-3; K-2-ETS1-2*	**Weather and Sky** *K-PS3-1; K-PS3-2; K-ESS2-1; K-ESS3-2; K-2-ETS1-1; K-2-ETS1-2*
1st Grade	**Light and Sound Waves** *1-PS4-1; 1-PS4-2; 1-PS4-3; 1-PS4-4; K-2-ETS1-1; K-2-ETS1-2*	**Exploring Organisms** *1-LS1-1; 1-LS1-2; 1-LS3-1; K-2-ETS1-2*	**Sky Watchers** *1-ESS1-1; 1-ESS1-2*
2nd Grade	**Matter** *2-PS1-1; 2-PS1-2; 2-PS1-3; 2-PS1-4; K-2-ETS1-1; K-2-ETS1-2*	**Ecosystem Diversity** *2-LS2-1; 2-LS2-2; 2-LS4-1; K-2-ETS1-2; K-2-ETS1-3*	**Earth Materials** *2-PS1-1; 2-ESS1-1; 2-ESS2-1; 2-ESS2-2; 2-ESS2-3; K-2-ETS1-1; K-2-ETS1-2*
3rd Grade	**Forces and Interactions** *3-PS2-1; 3-PS2-2; 3-PS2-3; 3-PS2-4; 3-5-ETS1-1; 3-5 ETS1-2*	**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; 3-5-ETS1-2*	**Weather and Climate Patterns** *3-ESS2-1; 3-ESS2-2; 3-ESS3-1; 3-5-ETS1-2*
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; 3-5 ETS1-2; 3-5-ETS1-3*	**Plant and Animal Structures** *4-LS1-1; 4-LS1-2; 4-PS4-2; 3-5-ETS1-2*	**Changing Earth** *4-ESS1-1; 4-ESS2-1; 4-ESS2-2; 4-ESS3-2; 3-5-ETS1-2*
5th Grade	**Structure and Properties of Matter** *5-PS1-1; 5-PS1-2; 5-PS1-3; 5-PS1-4; 3-5-ETS1-2*	**Matter and Energy in Ecosystems** *5-PS3-1; 5-LS1-1; 5-LS2-1; 5-ESS2-1; 5-ESS3-1; 3-5-ETS1-3*	**Earth and Space Systems** *5-PS2-1; 5-ESS1-1; 5-ESS1-2; 5-ESS2-1; 5-ESS2-2; 5-ESS3-1; 3-5-ETS1-2*

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What does three-dimensional learning look like?

The Next Generation Science Standards are clear—students need hands-on, three-dimensional learning experiences.

Students actively engage in **hands-on investigations** that integrate Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts that support **making sense of phenomena—every day**

Unit topics build upon **anchoring phenomenon** that can be related to the real world

Lessons **coherently and progressively build** students' abilities to meet performance expectations and have **strong connections with English Language Arts and Math**

What can this look like in your classroom?

Students gaining exposure to NGSS topics in science through observing, questioning, and investigating phenomenon

Hands-on, 3-dimensional investigations that integrate the SEPs, DCIs, and CCCs

All students experiencing success with the essential knowledge and skills in the NGSS

Successfully implement three-dimensional learning in 30-minute lessons.

The structure and resources of a Building Blocks of Science 3D unit support teachers with all the instructional materials they need to teach and assess the NGSS.

An **Anchoring Phenomenon**, introduced through a narrative and through a unit-specific phenomena video, kicks off each unit's first lesson, piquing students' interest and encouraging them to generate questions around the phenomena. Students review the video at the end of the unit and are challenged to answer those questions by citing evidence from the unit's investigations.

Each subsequent lessons begin by introducing an **investigative phenomenon** that relates to the lesson topic. Students generate questions and try to answer those questions after working through the lesson's investigations.

Hands-on investigations integrate the SEPs, DCIs, and CCCs, working together to support students in making sense of phenomena.

What You'll Find in a Learning Progression Chart

Push, Pull, Go

Unit Overview

Motion and force are observable every day, but students may not be aware of different types of motion and the forces that cause them. In ***Push, Pull, Go*** students explore this important relationship through inquiry, discussion, engineering, and problem solving. Students also practice using descriptive words, building structures, measuring distance, making predictions, and identifying systems. Throughout a series of five lessons, students manipulate models to learn about motion and draw conclusions about force, energy, gravity, and friction.

A summary of the concepts a unit explores and the connections of those concepts to real-world applications.

Unit Anchoring Phenomenon

Movement is important as students learn about the world them. Playgrounds provide abundant opportunities for stu manipulate, observe, and interact with objects and syst students may begin to notice patterns in movement. Th phenomenon for ***Push, Pull, Go*** is recognizing forces and resulting motions on the playground.

The main focus of the unit, presented through a real-world event or occurrence, that provides a common context for all students to begin asking questions about the science concepts presented in the unit.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	You and your friend are playing catch with a ball. Oh, no! You miss the ball! The ball keeps rolling. The ball rolls down a hill. The ball rolls fast. The ball rolls far. Finally, the ball stops. What does this make you wonder?	Let's swing! You kick your legs back and forth. The swing start Your friend gives you a pu move faster. You swing yo side-to-side. The swing b to twist. The swing st down. The swing stop this make you wonder?
OBJECTIVES	■ Begin building an age-appropriate understanding of force and motion. ■ Observe, measure, and record the change in position of an object over time. ■ Explore the movement of a rolling ball and begin to build an understanding that motion is predictable (the ball travels in a straight line until a force stops it or changes its direction).	■ Explore changes in position and motion by pushing and p ■ Demonstrate that the gre force (push or pull), th change in motion. ■ Begin to collect evidence invisible force of gravity.
SCAFFOLDING Students should know:	↓ Motion is caused by forces, which include pushes and pulls. ↓ The amount of force applied to an object will affect the way it moves. ↓ Rolling and bouncing are types of motion. ↓ The speed or direction of an object will change by adding force. ↓ The distance an object will move depends on the amount of force applied to it. ↓ Objects in motion have more energy than objects that are still.	↓ Swinging, rolling, and bouncing are types of motion. ↓ Swinging motion is affect amount of force applied b or pull. ↓ The speed of a swing the amount of force used push or pull. ↓ The motion of a swing is t back-and-forth, but the direction can change by adding force. ↓ A swing is a system.

A lesson-specific scenario that helps students engage with and generate questions about the lesson topic. At the end of the lesson, students review the phenomenon and answer their questions.

What students will do during the lesson. Objectives build coherently from one lesson to the next.

Each lesson prepares students for the next. The concepts students explore in each lesson build progressively throughout the unit.

Coherent Learning Progressions—Every Lesson, Every Unit

The following charts detail the learning progression of each unit in the building Blocks of Science 3D program for Grades K–5. Each chart describes the unit's central phenomenon and lists the investigative phenomena, objectives, and scaffolding for each lesson.

The **Unit Overview** places each unit into a real-world context, providing examples of unit concepts in our everyday lives.

The **Anchoring Phenomenon**, the main focus of the unit, is introduced to students in the first lesson of each unit though a narrative and a short video that provides real-world context, piques student interest, and prompts students to generate their own questions. Students revisit the phenomena video and their recorded questions again at the end of the unit, prompting them to make connections between the anchoring phenomenon and its applications beyond the scope of the unit's investigations.

Investigative Phenomena are presented to students at the beginning of each lesson to encourage them to develop additional questions. At the end of each lesson, the class revisits these questions and uses evidence collected during the lesson's investigations to address them and to make connections to the lesson's investigative phenomenon.

Objectives describe what students will be doing and learning during lesson investigations. Lesson investigations incorporate hands-on investigation, literacy connections, math connections, student discourse, and notebooking to build content knowledge and skills. Lesson objectives build coherently and progressively throughout the unit.

Scaffolding integrated systematically into each unit and lesson illustrates students' progression toward stronger understanding of content by building their knowledge using hands-on learning to reinforce concepts. This guided process informs instruction and reveals opportunities for differentiation for both below-level and above-level learners.

Push, Pull, Go

Unit Overview

Motion and force are observable every day, but students may not be aware of different types of motion and the forces that cause them. In *Push, Pull, Go* students explore this important relationship through inquiry, discussion, engineering, and problem solving. Students also practice using descriptive words, building structures, measuring distance, making predictions, and identifying systems. Throughout a series of five lessons, students manipulate models to learn about motion and draw conclusions about force, energy, gravity, and friction.

Unit Anchoring Phenomenon

Movement is important as students learn about the world around them. Playgrounds provide abundant opportunities for students to manipulate, observe, and interact with objects and systems. In time, students may begin to notice patterns in movement. The anchoring phenomenon for *Push, Pull, Go* is recognizing forces and their resulting motions on the playground.

	LESSON 1	LESSON 2	
INVESTIGATIVE PHENOMENA	You and your friend are playing catch with a ball. Oh, no! You miss the ball! The ball keeps rolling. The ball rolls down a hill. The ball rolls fast. The ball rolls far. Finally, the ball stops. What does this make you wonder?	Let's swing! You kick your legs back and forth. The swing starts moving. Your friend gives you a push. You move faster. You swing your legs side-to-side. The swing begins to twist. The swing starts to slow down. The swing stops. What does this make you wonder?	
OBJECTIVES	■ Begin building an age-appropriate understanding of force and motion. ■ Observe, measure, and record the change in position of an object over time. ■ Explore the movement of a rolling ball and begin to build an understanding that motion is predictable (the ball travels in a straight line until a force stops it or changes its direction).	■ Explore changes in position and motion by pushing and pulling. ■ Demonstrate that the greater the force (push or pull), the greater the change in motion. ■ Begin to collect evidence about the invisible force of gravity.	
SCAFFOLDING Students should know:	↓ Motion is caused by forces, which include pushes and pulls. ↓ The amount of force applied to an object will affect the way it moves. ↓ Rolling and bouncing are types of motion. ↓ The speed or direction of an object will change by adding force. ↓ The distance an object will move depends on the amount of force applied to it. ↓ Objects in motion have more energy than objects that are still.	↓ Swinging, rolling, and bouncing are types of motion. ↓ Swinging motion is affected by the amount of force applied by a push or pull. ↓ The speed of a swing depends on the amount of force used during the push or pull. ↓ The motion of a swing is typically back-and-forth, but the direction can change by adding force. ↓ A swing is a system.	

	LESSON 3	LESSON 4	LESSON 5
	You wait to go down the slide. It's finally your turn. You slide down fast! Oh, no! Your friends are standing at the bottom of the slide. You can't stop sliding. You slide into one friend. He starts to fall. He falls into another friend. She falls over. What does this make you wonder?	You and your friends want to ride the merry-go-round. You need someone to push it. Your teacher will push the merry-go-round! Your teacher pushes. The merry-go-round starts moving. You hold on tight. Your teacher pushes it many times. The merry-go-round is moving very fast! You are getting dizzy! Your teacher stops pushing. The merry-go-round slows down. It comes to a stop. What does this make you wonder?	Have you ever seen an obstacle course? They use many types of equipment or skills. Some obstacle courses include running. Some include climbing. Others include balancing. People try to complete the obstacle course as quickly as they can. They don't stop moving until they reach the end. Anyone can design an obstacle course! You can design one at your playground. What does this make you wonder?
	■ Demonstrate that a force is any push or pull. ■ Investigate and demonstrate that force causes an object to start moving, stop moving, or change direction. ■ Predict and explore what happens if a component of a system in motion is missing or not working properly. ■ Build on the understanding that position and motion can be changed by pushing and pulling objects. ■ Gather evidence that it takes a push or pull to change the motion of objects. ■ Build an understanding that objects move in different patterns (e.g., straight line, zigzag, curved line).	■ Build on the concept that the greater the force applied to an object, the greater the change in the object's motion. ■ Describe motion over time by exploring the motion—the slowing and the stopping—of a spinning top. ■ Continue to compare patterns of movement such as sliding, rolling, and spinning. ■ Begin building an understanding that it takes a force (a push or pull) to change the motion of objects.	■ Apply concepts explored in Lessons 1–4 to build a motion invention (model) that works. ■ Describe how force and motion work together in the model. ■ Demonstrate the effect of missing or nonworking parts of a system. ■ Evaluate learning from throughout the unit about force and motion, and compare that knowledge to initial ideas from the beginning of the unit.
	↓ Tumbling, swinging, rolling, and bouncing are types of motion. ↓ To make an object tumble, a force must be applied. ↓ A system includes all the components that are affected by a force and set into motion. ↓ The speed and direction in which an object tumbles are affected by the forces applied. ↓ Objects that tumble into still objects may cause the still objects to move. ↓ An object that tumbles faster has more energy.	↓ Spinning, twirling, tumbling, swinging, rolling, and bouncing are types of motion. ↓ A top displays a spinning motion, which requires a push force to start. ↓ A top is a system of spinning motion. ↓ In order to change the direction of spinning or twirling, an additional force must be applied. ↓ The speed of spinning can be changed by applying different amounts of force. ↓ The faster an object spins, the more energy it has.	↓ There are many types of motion, which are all caused by forces. ↓ Systems can be combined to create one large system of motion. ↓ Increasing the amount of force at the beginning of a system will increase the speed of the motion throughout the system. ↓ Problems should be fixed to improve an invention. ↓ Force affects the motion, speed, direction, and distance an object travels. ↓ Gravity and friction slow objects that are in motion.

Living Things and Their Needs

Unit Overview

Our world includes living and nonliving things that interact in their environments. Every living thing has needs that it must meet if it is to live and grow. *Living Things and Their Needs* provides hands-on, inquiry-based investigations focused on phenomena that support ideas related to the preferred living habits of living things. Through a series of four lessons, students identify living and nonliving things, their needs, and the ways that living things can change their environment.

Unit Anchoring Phenomenon

All living things have similar needs for survival, including access to water, food, shelter, and air. When asked what a "need" is, students may list wants, or luxuries. Through this unit's explorations, students begin to understand that a need is a requirement for successful growth and survival. The anchoring phenomenon for *Living Things and Their Needs* is recognizing the needs of living things and their behaviors to obtain them.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	There are many plants in Penelope's garden. There are also rocks and soil. Some of the plants have bright flowers. Bees and butterflies sit on the bright flowers. Penelope plants seeds in the garden. She digs a hole in the soil. She puts the seeds in the hole. Penelope worries that rabbits will find the seeds. What does this make you wonder?	A few days after Penelope plants the seeds, there are more plants in her garden. The seeds have sprouted from the ground. Some of the plants in the garden have flowers. Some of the plants have tomatoes. All the plants have leaves. The plants in the shade are small. The plants in the Sun are big. A rabbit finds the garden. The rabbit eats a tomato. The rabbit eats the leaves of a plant. The rabbit prefers to eat the leaves. What does this make you wonder?
OBJECTIVES	■ Identify living and nonliving things. ■ Make observations and describe the patterns of living things. ■ Plant a pumpkin seed, and make predictions about what plants need to grow. ■ Observe bessbugs and describe their habitat.	■ Observe and identify the needs of living things. ■ Make predictions about the growth of plants in different conditions. ■ Determine the habitat preferences of bessbugs. ■ Monitor and collect data about plants.
SCAFFOLDING Students should know:	↓ Our world includes living and nonliving things. ↓ Examples of living things include plants and animals; humans are animals. ↓ Living things do similar things, like grow and eat, and need similar things, like air and water. ↓ A seed will grow into a plant. ↓ A habitat is a home for a living thing. ↓ Bessbugs are animals, specifically insects, that live in wet habitats.	↓ A prediction is a good guess about something. ↓ A seed without water, sunlight, or soil may not grow successfully. ↓ A preference is what you like. ↓ All living things have preferences for things, such as their habitat and the food they eat. ↓ Data is information or observations used to describe something, such as the height of a plant. ↓ Plants that have access to sunlight, soil, and water tend to be larger than plants that do not have access to those resources.

	LESSON 3	LESSON 4
	It is cloudy. It starts to rain. Penelope's garden becomes very wet. Penelope does not see any rabbits, bees, or butterflies. The rain stops. The Sun comes out. The rabbits drink from puddles nearby. Penelope checks her garden. The plants have grown bigger. One plant starts to grow between two rocks. A caterpillar eats the leaves on the plant. What does this make you wonder?	Penelope's garden is very big. It is full of plants. There are flowers. There are tomatoes. There are peppers. Penelope picks the plants from the soil. She sells the flowers, tomatoes, and peppers at the market. The rabbits, bees, caterpillars, and butterflies leave to find another garden. What does this make you wonder?
	■ Describe the needs of living things and explain how the environment provides them. ■ Observe different environments and identify the relationships among plants, animals, and their surroundings. ■ Use evidence and observations to draw a model of how a plant or an animal interacts with its environment. ■ Monitor and collect data about plants.	■ Monitor and collect data about plants to draw conclusions about their growth. ■ Review the needs of living things and how living things change the environment. ■ Discuss ways that humans impact their local environment. ■ Design solutions to reduce human impact on the local environment.
	↓ An environment is the living and nonliving things in a specific area. ↓ Living things can change their environment. ↓ The actions of living things can have beneficial or detrimental effects on the environment. ↓ Seeds will become plants, which increase in height and grow more leaves as they develop. ↓ Plants thrive when they have access to light, soil, and water.	↓ Plants and animals are living things. ↓ Living things have preferences for their habitat and may be able to change their environment. ↓ All living things grow, need energy, can reproduce, and respond to their environment. ↓ Plants continue to become taller or grow more leaves if they are provided with water, sunlight, and soil. ↓ Humans impact their environment in good and bad ways. ↓ By making good choices, humans can protect the environment instead of harm it.

NOTES

Weather and Sky

Unit Overview

Step outside or look out the window, and you can observe weather. Weather is observable every day, but students may not be aware of the different types of weather conditions that can be monitored, or that data can be collected and analyzed to predict weather and identify weather patterns. Some types of weather are dangerous, and preparing for those dangers is important for protecting life and property. In *Weather and Sky*, students learn to observe weather and explore patterns in weather, dangerous weather, and the Sun as Earth's main source of light and heat through investigation, discussion, and problem-solving. Students make observations and predictions, collect and analyze data, plan and carry out investigations, and practice engineering skills.

Unit Anchoring Phenomenon

Weather impacts what we do every day, from the way we dress to the activities we do. Is it hot? Cold? Windy? Rainy? The more students interact with their surroundings, the more they will notice patterns in weather conditions where they live. The anchoring phenomenon for *Weather and Sky* is recognizing how weather affects our daily lives.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	You are on the school playground. You look up at the sky and see the Moon! This seems strange to you because the Sun is out, too. What does this make you wonder?	You have plans to meet your friends at the playground this afternoon. You are very excited because when you wake up it is warm and sunny outside. You're all ready to go when your mom tells you to grab a sweatshirt. What does this make you wonder?
OBJECTIVES	■ Begin building an age-appropriate understanding about weather. ■ Observe and record patterns and scale of objects that can be observed in the sky including clouds, Sun, and Moon. ■ Describe the changes in temperature over the course of a day.	■ Describe activities that take place during specific weather conditions. ■ Discuss the effects of weather on human activities. ■ Observe and record daily weather changes. ■ Identify patterns in weather features. ■ Analyze and graph weekly weather data.
SCAFFOLDING Students should know:	↓ Some objects can be seen during the daytime, some at nighttime, and some at both times. ↓ Some objects in the sky are bigger than others, and objects such as the Sun, Moon, and stars are very far away. ↓ Temperature can change over the course of a day.	↓ Temperature, cloud cover, wind, and precipitation are four weather conditions. ↓ Temperature is how hot or cold an object or area is. ↓ Cloud cover is the amount of sky that is blocked by clouds. ↓ Wind is the movement of air. ↓ Precipitation is any form of water that falls from the sky. ↓ Weather can be observed to look for patterns.

	LESSON 3	LESSON 4	LESSON 5
	You are on the playground at recess. Suddenly the clouds get very dark, the wind picks up, and you hear thunder. Your teacher calls the class inside. What does this make you wonder?	You are drawing on the sidewalk with chalk. The sidewalk feels very warm. When you finish your picture, you go and sit under a nearby tree. You notice that the ground under the tree is much cooler than the sidewalk. What does this make you wonder?	Your family goes out for ice cream. You order one scoop of vanilla and one scoop of strawberry together on one cone. You get your ice cream cone and take it outside to eat. You notice that your ice cream is melting more quickly than you can eat it. It's dripping onto the sidewalk! What does this make you wonder?
	■ Analyze collected weather data for patterns and connections. ■ Use models to explain two types of dangerous weather, floods and tornadoes. ■ Discuss weather safety and analyze ways to stay safe during a variety of weather conditions. ■ Describe how weather forecasting can help people avoid the serious impacts of dangerous weather. ■ Participate in a practice drill as a preventive measure for tornadoes.	■ Identify a thermometer as a tool to measure temperature. ■ Describe how temperature can change during the day. ■ Identify the Sun as Earth's main source of light and heat. ■ Explore how different materials can be affected by heat.	■ Describe the effects of the Sun on an object. ■ Investigate, design, and build a structure to reduce the warming effect of sunlight on Earth's surface. ■ Evaluate learning from throughout the unit about weather, and compare that knowledge to initial ideas from the beginning of the unit.
	↓ Weather can be dangerous. ↓ If too much rain falls at one time and can't be soaked up by the soil, flooding can occur. ↓ Tornadoes can form during severe thunderstorms. ↓ Weather forecasts can help people prepare for dangerous weather. ↓ It is important to prepare for dangerous weather before it happens.	↓ The Sun is Earth's main source of light and heat energy. ↓ A thermometer is a tool that is used to measure temperature. ↓ Placing objects in sunlight will affect their temperature. ↓ Placing objects in shade will affect their temperature.	↓ An engineer is someone who uses science to solve problems or fulfill needs. ↓ Energy from the Sun warms Earth's atmosphere and contributes to Earth's weather. ↓ There are ways to design an object to block sunlight or cool the air to reduce the Sun's warming effect. ↓ Problems should be fixed to improve a design solution.

Light and Sound Waves

Unit Overview

Humans are constantly in the process of communicating, or gathering and sharing information from the world around us. Many of the technologies we use to communicate every day depend on light and sound; students can observe many examples of this in their daily interactions, including fire alarms, traffic lights, cell phones, and music. In the six lessons in *Light and Sound Waves*, students are introduced to concepts underlying light and sound and how they can be used to communicate. Students explore these concepts through investigation, discussion, and problem solving. Students practice making predictions, providing evidence and observations, and designing and testing plans.

Unit Anchoring Phenomenon

Humans are constantly communicating, or gathering and sharing information about the world around us. From birth, we are inundated with visual and audible messages. Technology such as television, cell phones, and the Internet help us communicate over long and short distances. Even our methods of transportation and safety depend on various forms of communication involving sound and light such as horns, flashing lights, and sirens. The anchoring phenomenon for *Light and Sound Waves* is recognizing how light and sound are used to communicate.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	You are waiting for the school bus to pick you up for school. Suddenly, you hear sirens—it's a fire truck, but you can't see it yet. The sirens get louder, and now you can see the flashing lights. The cars on the street pull over to the side. The fire truck speeds by. The flashing lights are bright and the sirens are loud! What does this make you wonder?	It's getting cloudy and dark outside. A storm is on the way. You see a flash of light and then hear a low rumble—a thunderclap. It starts raining. As the rain falls harder, the flashes of light continue, and the thunderclaps get louder. Boom, crack! That last thunderclap rattled the windows. What does this make you wonder?
OBJECTIVES	■ Begin building an age-appropriate understanding of light and sound. ■ Identify patterns between vibrations and waves. ■ Carry out an investigation to explore what causes vibrations, waves, and sound. ■ Observe that light is needed to for objects to be visible. ■ Compare and give examples of natural and artificial light sources.	■ Make predictions, plan investigations, and make connections between the vibrations of matter and sound waves. ■ Explore how changes in the speed of vibrations influence the pitch of sounds. ■ Recognize that waves can vary in intensity and influence the volume of sounds.
SCAFFOLDING Students should know:	↓ Communication is sharing and receiving information about the world around us. ↓ Vibrations are disturbances of matter. ↓ Light, sound, and water can move in waves. ↓ To be seen, objects must have a light source or be illuminated by a light source. ↓ Light sources can be natural or artificial.	↓ Vibrations can make sound, and sound can also cause matter to vibrate. ↓ A change in the speed of vibrations causes a change in sound. The faster the vibration, the higher the sound's pitch. ↓ The slower the vibration, the lower the sound's pitch. ↓ Volume is a measure of intensity of a sound wave.

	LESSON 3	LESSON 4	LESSON 5
	You hear a phone ringing in the classroom. It's a call from the front office letting the teacher know that you are being excused for a dentist appointment. The front office is far away from your classroom, yet your teacher was able to hear the voice on the other end of the phone very clearly. What does this make you wonder?	It's bedtime. You're not a big fan of the dark, so you have a night-light in your room that turns on automatically when it is dark in the room. You notice that you can see objects near the night-light pretty well, but it's hard to see anything in the rest of the room. What does this make you wonder?	You're on the playground for recess. The Sun is out, and it feels warm on your face. After some time, you go sit under a tree to cool off. As you look out onto the playground, you notice that the swings, slide, and jungle gym are all different colors. The Sun's bright light is bouncing off the slide. Under the slide and under the tree your resting beneath, there are shadows on the ground. What does this make you wonder?
	■ Plan and carry out an investigation to explore how sound can travel through different materials. ■ Use evidence to explain how to communicate a sound message through solids using a string phone. ■ Describe patterns between how sound travels through air and through a solid from a sender's voice to a receiver's ear to be heard.	■ Recognize that light generally travels from its source in straight, narrow lines called rays. ■ Make a prediction about how light is used to illuminate objects, and test the prediction. ■ Construct explanations for and make connections between light sources and how they illuminate objects. ■ Explain the fundamentals of how we can see an object.	■ Predict what materials will allow light to pass through them. ■ Test the prediction by placing objects made of different materials in the path of light. ■ Explain how an object that blocks light creates a shadow. ■ Analyze data to classify objects as transparent, translucent, or opaque based on how light passes through them. ■ Work collaboratively to design and test a plan to change the direction of light using a reflective object.
	↓ Sound needs a material—a solid, a liquid, or a gas—to travel through. ↓ For a sound to be heard, a sound wave must travel to the ear and vibrate the eardrum. The vibrations are sent as a message to the brain. ↓ Sound waves travel more quickly through solids and liquids than through air.	↓ An object needs to be illuminated by a light source, which can be natural or artificial, in order to be visible. ↓ When light rays from a light source hit an object, we are able to see the object because the light is reflected to our eyes.	↓ Transparent materials let almost all light pass through, translucent materials let some light pass through, and opaque materials reflect or scatter light. ↓ Opaque and translucent materials will produce shadows. Opaque materials will produce a dark shadow, and translucent materials will produce a faint shadow. ↓ The appearance of a shadow changes as the angle and distance of the light source changes. ↓ The direction of light rays can change when they hit an object that has a reflective surface.

Light and Sound Waves

Unit Anchoring Phenomenon

Humans are constantly communicating, or gathering and sharing information about the world around us. From birth, we are inundated with visual and audible messages. Technology such as television, cell phones, and the Internet help us communicate over long and short distances. Even our methods of transportation and safety depend on various forms of communication involving sound and light such as horns, flashing lights, and sirens. The anchoring phenomenon for *Light and Sound Waves* is recognizing how light and sound are used to communicate.

LESSON 6

INVESTIGATIVE PHENOMENA

Communicating with people around the world has become quicker and easier with the use of technology. We can send an email, text message, or video to almost anywhere in the world in seconds. Every day we see images on television, watch a video on our phone, or listen to music on the Internet. What does this make you wonder?

OBJECTIVES

- Provide evidence from previous investigations to discuss patterns among light, sound, and communication.
- Use concepts learned from the unit to design, build, and test a device that uses light or sound to communicate over a distance.
- Demonstrate for classmates how the communication device works and, after peer feedback, discuss how to optimize the device.
- Make connections between the model device and actual communication technology.
- Evaluate learning from throughout the unit about communication, light, and sound, and compare that knowledge to initial ideas from the beginning of the unit.
- Complete a self-assessment to evaluate progress.

SCAFFOLDING
Students should know:

- Communication involves three components: a transmitter, a receiver, and a code.
- Communication can involve light, sound, or a combination of both.
- An engineer is someone who uses science to solve problems or needs.
- Examples of communication with light and sound can be seen in our everyday lives.

NOTES

Exploring Organisms

Unit Overview

Our world is composed of living and nonliving things that are in constant interaction. All living organisms have the same basic needs for survival: air, food, water, and shelter (space). How organisms access resources to meet these needs differs greatly. Plants and animals have specific structures to suit their specific needs and environments. Some organisms receive care from their parents that helps them reach adulthood. The hands-on, inquiry-based investigations of *Exploring Organisms* focus on phenomena that support concepts related to the growth, survival, and reproduction of organisms. Through a series of four lessons, students identify structures that are unique to different organisms, explain life cycles and parent–offspring relationships, and draw conclusions about the characteristics, or traits, of organisms and how those traits indicate family relationships. Students make comparisons between all these concepts and their own human abilities and needs.

Unit Anchoring Phenomenon

Students may have experience caring for something, such as a garden or a pet, and can recognize some of the needs that plants and animals have. However, they may not make connections between those needs and their own needs. All living things have parents and express the same foundational needs: air, water, food, and shelter. Beyond these similarities, different types of plants and animals vary in their dependence on parents, patterns of growth, and structures. The anchoring phenomenon for *Exploring Organisms* is the survival of plants and animals based on their environment and access to resources.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	You plant three different seeds in your backyard. One seed is planted in soil in the sunlight; it is supposed to grow into a sunflower. The second seed is planted in soil in the shade; it is supposed to grow into an oak tree. The third seed is planted in a pot with soil. The pot is put in a place with no sunlight. The seed is supposed to grow into a cactus. A few weeks later, you notice that only the sunflower and the oak tree plants have grown. The sunflower is much taller than the oak tree and has more leaves. What does this make you wonder?	You are helping to choose a class pet. One of your friends wants to get a fish. Another friend suggests baby chickens. Your teacher explains that the class pet must be able to communicate and easily adapt to the classroom environment. What does this make you wonder?
OBJECTIVES	■ Distinguish between living and nonliving things in the environment. ■ Identify the needs of living things. ■ Draw connections between body structures and their functions to explain how they are used to meet an organism's needs. ■ Recognize patterns in structures and their functions. ■ Set up an environment and make predictions about the growth of a bean plant.	■ Draw conclusions about insects based on their observable structures. ■ Identify plant and animal adaptations and how they are influenced by the environment. ■ Mimic organisms' structures to explain their adaptations.
SCAFFOLDING Students should know:	↓ Living and nonliving things exist on Earth. ↓ Nonliving things have never been alive, but they do interact with living things, which are alive or have been alive at one time. ↓ All living things, or organisms, have the same basic needs: air, water, food, and shelter. ↓ Plants begin as seeds. ↓ Organisms have body parts, or structures, that help them survive and meet their needs.	↓ Insects are animals, and their bodies often display similar patterns. ↓ Organisms have adaptations, which are structures and repetitive behaviors that help them survive in a specific environment. ↓ Adaptations vary for organisms in different environments. ↓ Humans have structures that allow them to communicate in complex ways. ↓ Organisms have specialized structures that help them to survive in their environments.

	LESSON 3	LESSON 4	LESSON 5
	Outside of the school, a goose lays its eggs. The mother goose sits on the eggs all day long. The father goose guards the mother and the eggs. The eggs hatch! Tiny goslings sit in the nest. You decide to take a closer look. The mother and father goose hiss and squawk at you. They bring food to their babies. Later, they lead the baby geese to a pond. They walk in a line behind the mother. What does this make you wonder?	Chicken eggs come in different varieties. Some are white, others are brown. Some eggs have speckles. The mother chicken sits on the eggs. After some time, baby chickens hatch from the eggs. She cares for the chicks. None of the baby chicks look like the mother. Some chicks have yellow feathers, while others are brown or black. All the chicks have the same mother. What does this make you wonder?	Crows like to eat grubs. Grubs can be hard to find because they live inside trees. Crows break twigs off trees and use their beaks to remove the bark from the twig. They bend the end of the twig into a hook. Crows use the hooked twig to scrape the grubs out of the tree. What does this make you wonder?
	■ Identify the ways parents care for their young. ■ Recognize that some but not all organisms require assistance from their parents during development. ■ Use text and media to determine patterns in the animal kingdom between parents and their offspring that provide offspring with a better chance of survival. ■ Use oral and written communication skills to explain that organisms develop at different rates and that some animal parents need to care for their offspring longer than others.	■ Compare similarities and differences between oneself and one's parents. ■ Use patterns to explain how traits are inherited, or passed, from parents to offspring. ■ Identify similarities and differences between animal offspring and their parents. ■ Observe a bean plant to collect evidence of the similarities and differences between plant parents and plant offspring. ■ Construct an evidence-based account that young plants and animals are similar but not identical to their parents.	■ Draw and label plant structures from a bean plant and describe their functions. ■ Identify specific adaptations of organisms and how they help the organism survive in its specific environment. ■ Design a solution to a human problem by mimicking how plants and/or animals use their external structures to help them survive. ■ Evaluate learning from throughout the unit about organisms, and compare that knowledge to initial ideas from the beginning of the unit.
	↓ Organisms develop at different rates. ↓ Some organisms develop inside their mother, others develop in eggs, and others develop from seeds. ↓ Though organisms have adaptations, they may not have the skills to survive on their own after they are born. ↓ Plants do not rely on their parents to help them get the resources they need to grow and develop. ↓ The relationship between a baby and its parent differs among animals. Animal parents can provide care by teaching, showing love, feeding, and protecting.	↓ Humans share traits with their family members, especially their parents and siblings. ↓ A baby gets its traits from both its mother and father. ↓ Most animal babies look similar to but not exactly like their parents. ↓ Some animals take a long time to develop before they look like their parents. ↓ Plants will look similar to but not exactly like the parent plant.	↓ Specialized structures that help an organism survive in its particular environment are often adaptations. ↓ Organisms living in the same environment often have similar structures. ↓ Plants begin as seeds and develop stems, roots, leaves, and other specialized structures. ↓ Plant structures vary based on the size, location, and type of plant. ↓ Some types of plants and animals have structures that act similarly to human structures.

Sky Watchers

Unit Overview

Every day, we go through a daily routine: we get up, go to school or work, come home, and go to bed. Then we repeat it the next day. But do we ever stop to think about the patterns in the sky? Sunrise, sunset, moonrise, moonset, stars, Moon phases—there's so much to observe! In the five lessons in *Sky Watchers*, students will have multiple opportunities to make observations of patterns in the sky and connect to concepts in Earth and space science. Students explore these concepts through investigation, discussion, and problem-solving. Students also practice making predictions, providing evidence and observations, and designing and testing plans.

Unit Anchoring Phenomenon

Every day, we go through a daily routine: we get up, go to school, come home, and go to bed. Then we repeat it the next day. But do we ever stop to think about the patterns in the sky? Sunrise, sunset, moonrise, moonset, stars, Moon phases—there's so much to observe! The anchoring phenomenon for *Sky Watchers* is looking for patterns in the daytime and nighttime skies.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	Birds, airplanes, the Sun, stars, the Moon—all of these objects can be seen in the sky. Some are close, and some are far away. Some objects can be seen during the day, and some objects can be seen at night. Some can be seen during both day and night. What does this make you wonder?	You notice that when you get up in the morning, the Sun appears in one place in the sky, but that by evening, the Sun appears to be in a different place. What does this make you wonder?
OBJECTIVES	■ Begin building an age-appropriate understanding of Earth's place in the universe. ■ Observe, measure, and record the change in position of a shadow over the course of a day. ■ Analyze shadow data to compare to patterns of the Sun's apparent movement across the sky.	■ Discuss and model how Earth rotates, or spins, causing the repeating pattern of day and night. ■ Explore the concept of rotation and how Earth makes a complete rotation once every 24 hours. ■ Describe how Earth's rotation causes it to be daytime on one side of Earth while it is nighttime on the other side of Earth. ■ Analyze patterns of Earth's rotation to predict future occurrences of day and night.
SCAFFOLDING Students should know:	↓ Daytime is the period between sunrise and sunset. ↓ Nighttime is the period between sunset and sunrise. ↓ The Sun can be seen only during the daytime. ↓ Shadows can be used to study patterns in the Sun's position in the sky.	↓ Earth rotates in a counterclockwise, or west to east, direction. ↓ Earth completes one full rotation on its axis every 24 hours. ↓ Earth's rotation and shape causes the pattern of daytime and nighttime. ↓ When it is light on one side of Earth, it is dark on the other side of Earth.

	LESSON 3	LESSON 4	LESSON 5
	You notice that at different times of year, your surroundings look different. Sometimes days are shorter, and sometimes they are longer. Leaves and flowers grow on trees and then the trees lose their leaves. Weather also changes during the year. What does this make you wonder?	You notice that the Moon looks different throughout the month. Sometimes it's completely lit up, and sometimes you can't see the Moon at all. You also notice that the Moon appears to move from one side of the sky to the other over the course of a night, just like the Sun appears to during the day. What does this make you wonder?	When you get up in the morning, the Sun is out. Sometimes you can see the Moon, too. When the Sun has set, it is dark. Sometimes you can see stars, planets, the Moon, and even satellites. You go to bed when it is dark out. When you get up the next morning, this pattern repeats. What does this make you wonder?
	■ Model and discuss how Earth revolves around the Sun in a predictable pattern. ■ Investigate patterns in seasons to conclude that these patterns repeat every year. ■ Make observations at different times of year to study patterns in daylight.	■ Use images and direct observations to learn about the patterns we see in the shapes of the Moon. ■ Investigate how the Moon revolves around Earth once a month. ■ Recognize and observe that the phases of the Moon repeat in a predictable monthly pattern.	■ Describe the position of an object by locating it relative to another object or its surroundings. ■ Construct models to demonstrate the general characteristics of the Sun-Earth-Moon system. ■ Evaluate learning from throughout the unit, and compare that knowledge to initial ideas from the beginning of the unit.
	↓ Earth revolves around the Sun. It takes Earth one year to revolve one time around the Sun. ↓ The tilt of Earth and where it is in its orbit around the Sun causes changes in seasons. ↓ Seasons occur in a predictable pattern and repeat every year as Earth orbits the Sun. ↓ The amount of daylight an area receives depends on where it is located and the time of year.	↓ The Moon rotates as it revolves around Earth. It takes about one month for the Moon to make one full revolution around Earth. ↓ The Moon does not make its own light, but rather we see the Moon because it reflects light from the Sun. ↓ The phases of the Moon occur in a predictable and repeating pattern. ↓ The Moon appears from our point of view to have only one part illuminated due to its position in its orbit around Earth.	↓ The Sun, Moon, and Earth work together as a system. ↓ Patterns can be observed in the rotation of Earth and in the revolution of Earth and the Moon. ↓ The Sun is our star in the solar system. ↓ Earth and other planets revolve around the Sun in a predictable pattern.

Matter

Unit Overview

Although matter makes up everything that surrounds us, the concept is abstract and often difficult to describe. To help students understand matter, the hands-on investigations in this Building Blocks of Science unit encourage students to manipulate materials, ask questions, and make connections between matter and phenomena. Throughout a series of five lessons, students build upon the concept that all objects are made of smaller parts and those smaller parts are composed of particles. Depending on the state of matter—solid, liquid, or gas—those particles behave differently. Students also explore the effect of mixing different kinds of matter and the effect of adding or taking away energy. This unit is an important introduction to chemistry that students can build upon.

Unit Anchoring Phenomenon

An engineer, builder, or inventor must consider many factors when choosing the materials to construct something. Whether it's a pencil, a skyscraper, or a sailboat, the materials used in the object are carefully chosen based on its function. The anchoring phenomenon for *Matter* is making connections between a material and how it is used.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	Three birds, Byron, Reggie, and Greta, need a home. They want to build a birdhouse out of wood. Greta collects many small pieces of wood. Reggie collects many large pieces of wood. Byron can find only one very large piece of wood. The three birds need instructions to build a birdhouse. What does this make you wonder?	The three birds begin building their birdhouse on a hot day. They work for a very long time. Byron decides to take a break and cool down in the birdbath. The water in the birdbath is very hot. It looks like there is steam rising from the water. Byron adds ice cubes to the water. He goes back to work and tells Greta about the ice. Greta wants to take a break, too. She flies to the birdbath and sees that the ice cubes have disappeared. What does this make you wonder?
OBJECTIVES	■ Use a model to provide evidence that large structures can be made by combining small pieces. ■ Collect evidence to prove that individual pieces can be rearranged to create structures with different shapes. ■ Identify the specifications to build a structure.	■ Define the three states of matter of water. ■ Provide evidence for the existence of particles and explain why they cannot be seen. ■ Draw distinctions between each state of matter by explaining how its particles move. ■ Use balloons to draw conclusions about gases and the behavior of their particles. ■ Construct an argument for how particle behavior changes as matter changes state.
SCAFFOLDING Students should know:	↓ Specifications are the directions to build something. ↓ Pieces, or building blocks, can be rearranged to create new structures. ↓ Some objects can be built using many materials, and some objects can be built using material. ↓ Smaller pieces are used to make larger structures.	↓ There are three states of matter: liquid, solid, and gas. ↓ All matter is made of small particles that cannot be seen. ↓ Solids, liquids, and gases have unique properties. ↓ The movement of particles changes as matter changes state. ↓ As matter changes from solid to liquid to gas, the particles become less attracted to one another and experience more and more movement.

	LESSON 3	LESSON 4	LESSON 5
	The three birds use glue to hold the walls of the birdhouse together. They notice that the glue moves very slowly when they tip the bottle upside down. The liquid glue slides slowly out of the bottle and is very thick and sticky. Suddenly, it begins raining. The rain makes the wood wet. The rain mixes with the glue. Later, the Sun comes out and the wood dries. It does not look different. The birds begin building again. They notice that the glue is not as thick or sticky. What does this make you wonder?	The wooden birdhouse is almost complete, but it is missing a roof. The birds have no more wood to make a roof. Reggie thinks they should build the roof out of metal because it is very strong. Greta disagrees. She thinks the roof should be made with cardboard because it is light and easy to bend. Byron thinks the roof should be made of a material that will float in case there is a flood. What does this make you wonder?	The birdhouse is finally finished! It has wood walls and a metal roof. They decide to have a party and celebrate. Greta bakes a cake, and the house smells like vanilla. They live very happily in the house. After many months, they notice the metal roof has changed colors. It began as silver, but now it is red. The wood did not change color. What does this make you wonder?
	■ Determine the properties related to solids by comparing different materials. ■ Determine the properties related to liquids by comparing different materials. ■ Make conclusions about the properties of a material by creating a mixture. ■ Identify physical changes that occur when matter is mixed.	■ Identify buoyancy as a property of matter. ■ Test the buoyancy of different materials and make connections between the results and how the materials are used. ■ Analyze the properties of materials and identify their uses.	■ Observe state changes to construct an argument about physical changes. ■ Observe a chemical reaction to construct an argument about chemical changes. ■ Distinguish physical reactions from chemical reactions by their reversibility. ■ Analyze data to determine if a material is suited for a particular use. ■ Evaluate learning by completing a summative assessment.
	↓ Solids and liquids can be described by their physical properties, or characteristics. ↓ Solids can be made of different materials, some of which are malleable, or able to be formed into different shapes. ↓ Liquids can be viscous or fluid, meaning they flow slower or faster. ↓ Matter can be combined into a mixture. ↓ When some matter is mixed, it results in physical changes.	↓ Other physical properties can be used to describe matter, such as buoyancy. ↓ Some materials sink, and other materials float. ↓ The physical properties of a material help to determine its function, or use.	↓ Matter can undergo physical changes, which can be observed when matter changes state, color, or shape. ↓ Matter can undergo chemical changes, which can be observed when matter changes state, color, or shape; or gives off heat or light; or forms a gas. ↓ Chemical reactions occur during chemical changes. ↓ Most physical changes are reversible, but chemical changes are never reversible. ↓ It is important to evaluate and test building plans to determine if the materials and specifications are appropriate.

Ecosystem Diversity

Unit Overview

An ecosystem is the living and nonliving things that interact with one another in a specific area. Within ecosystems are smaller habitats, which are the places where living things can meet their basic needs—water, air, a food source (or sunlight for plants), and a shelter. The availability of these resources varies from habitat to habitat. For example, there is less water in a desert than in a wetland. The water in an ocean is different from the water in the tundra. Because of these differences, different things live in each habitat on Earth. The characteristics that plants and animals have depend on the habitat in which they live. Some characteristics make an organism suited in survive in multiple habitats. For example, ectothermic animals with scales can survive in a desert or a grassland. In contrast, some characteristics are suited for only one kind of habitat; only certain types of plants and animals can survive in salty ocean water. *Ecosystem Diversity* provides hands-on, inquiry based investigations focused on phenomena that support concepts related to organisms interacting in their habitats. Through a series of five lessons, students identify different habitats, determine the growth patterns of plants, explore plants' dependence on animals, recognize the diversity of living things, and consider their own impact on the world around them.

Unit Anchoring Phenomenon

Many different habitats can be found on Earth, each with its own unique climate, access to light, and communities of organisms. Whether you go on a short trip within your state or on an intercontinental vacation, you can make comparisons between your local region and a new region. Perhaps the air is drier, there are fewer birds, or you find brightly colored plants that you've never seen before. The anchoring phenomenon for *Ecosystem Diversity* is the variety of habitats on Earth and observing the life within them.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	In many places, the temperature begins to drop and the weather becomes cool in the fall. There is also less sunlight. In time, the leaves may change color from green to red, orange, or yellow, and then fall off the trees. You might notice fewer birds and small mammals, like squirrels or rabbits. However, other places see an increase in birds and have warm weather during the fall. Plants in these places can even blossom. What does this make you wonder?	Raspberries grow best from July to September in a dry area. Many raspberry farms are located along the west coast of the United States. Cherries grow best in very moist soil during the month of June. Many cherries are produced in northern states, like Michigan and Wisconsin. Brussels sprout plants thrive in cool soil and can be harvested in October. Most farms that produce Brussels sprouts are in the northwestern United States. What does this make you wonder?
OBJECTIVES	■ Habitats are composed of living and nonliving things. ■ All living things have the same foundational needs: food, water, shelter, and air. ■ Living and nonliving things interact with one another. ■ There are different types of habitats, and each includes unique plants and animals. ■ Each habitat has different resources. ■ Seeds need sunlight and water to grow into plants.	■ Describe the life cycle of plants. ■ Examine the relationship between plants and animals. ■ Analyze different plants to identify their habitats.
SCAFFOLDING Students should know:	↓ Habitats are composed of living and nonliving things. ↓ All living things have the same foundational needs: food, water, shelter, and air. ↓ Living and nonliving things interact with one another. ↓ There are different types of habitats, and each includes unique plants and animals. ↓ Each habitat has different resources. ↓ Seeds need sunlight and water to grow into plants.	↓ Plants have a life cycle which begins when a seed germinates. The cycle continues as the seed grows into a mature plant, at which point it can be pollinated and develop seeds that can create more plants. ↓ Plants need to be pollinated to form seeds. ↓ The seeds of a plant need to be dispersed so new plants can grow. ↓ Each type of habitat has its own unique plants, which have characteristics that allow them to survive, grow, and reproduce.

	LESSON 3	LESSON 4	LESSON 5
	The weather gets warmer in spring. Many people suffer from allergies during the springtime. People who live in grassland habitats tend to have bad allergies. When people have allergies, it is best to stay inside. Doctors suggest frequently washing clothes or furry pets. What does this make you wonder?	Zoos have many buildings and exhibits that house different kinds of animals. Each building is set at a specific temperature and contains a variety of plants. Outdoor exhibits may also contain different plants, such as trees and shrubs, and may have a small pond or water source. Similarly, aquariums have very specific temperatures for each tank of fish. The salt in each tank is monitored by a scientist to make sure the animals stay healthy. What does this make you wonder?	The largest land bird in the United States is the California condor. These birds have a 3-meter (9.8-foot) wingspan! California condors can live up to 60 years. Their natural habitat is along the west coast of the United States, mostly in the coastal mountain areas. The California condor population is very small because its natural habitat doesn't have enough shelter, food, and water. In addition, many condors have died of poisoning. Recently, a few of the remaining condors have been captured by scientists. What does this make you wonder?
	■ Explain the interdependence between plants and animals. ■ Design and build a model to simulate pollination or seed dispersal. ■ Make connections between a habitat and challenges related to pollinating or dispersing seeds.	■ Identify the characteristics of different habitats to define the term "diversity." ■ Design two model habitats to determine the preferences of a pill bug. ■ Communicate results to draw conclusions about the preferred habitat of a pill bug.	■ Explain human impact on the distribution of resources in a habitat. ■ Evaluate the effect of human actions on ecosystems. ■ Revisit the interdependence of living and nonliving things to evaluate what students have learned.
	↓ Plants and animals depend on one another. ↓ Plants provide animals with food and shelter. ↓ Animals can pollinate flowers and disperse seeds. ↓ Some habitats are better suited for plant survival than others.	↓ There is diversity among plants and animals in each type of habitat. ↓ Animals have characteristics that help them to survive, grow, and reproduce in their habitat. ↓ Animals have preferences for certain foods and types of shelters.	↓ Humans are an important part of the habitat and can affect the habitat in positive and negative ways. ↓ Humans change their behaviors to find resources and survive in different habitats. ↓ The diverse living and nonliving things in a habitat depend on one another in a successful habitat

Earth Materials

Unit Overview

Earth's surface is constantly changing. In the six lessons of *Earth Materials*, students will investigate how natural materials such as water, minerals, rocks, and soil are key parts of Earth's surface and the materials that make landforms from canyons to mountains. Usually, changes to landforms happen over a long period of time; however, some agents of change, such as volcanoes and floods, can cause landforms to change more quickly. Students explore these concepts through investigation, discussion, and problem-solving. Students make observations and predictions, analyze and graph data, develop claims supported with evidence and reasoning, and use the engineering design process.

Unit Anchoring Phenomenon

The surface of Earth is constantly changing. The results of these changes usually take a long time to become noticeable, but some agents of change, such as volcanoes and floods, cause land to change more quickly. The anchoring phenomenon in *Earth Materials* is how natural materials such as water, minerals, rocks, and soil are important parts of Earth's surface.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	You turn on the faucet, and water comes out. In the summer, you like to play in sprinklers and swim in pools. You play in puddles when it rains. But where does the water come from? What does this make you wonder?	You have seen pictures of mountains, creeks, and streams. They all have one thing in common: rocks. Big rocks, small rocks, rocks of different shapes and colors. What does this make you wonder?
OBJECTIVES	■ Begin building an age-appropriate understanding about the materials that compose Earth. ■ Identify the uses of water and recognize its various forms. ■ Describe how water and ice can change the shape of land through erosion. ■ Use a map to identify different types of water sources. ■ Use a model to identify the stages of the water cycle. ■ Determine and graph the percentage of water compared to land.	■ Make close observations using a hand lens. ■ Use a student-designed plan to sort rocks by their characteristics. ■ Classify rocks based on their characteristics. ■ Recognize that some objects are made of more than one material. ■ Use evidence and reasoning to support a claim about changes in landforms.
SCAFFOLDING Students should know:	↓ Earth is composed of materials, or resources, that together help support life. ↓ Water is the natural material that makes up most of Earth's surface. ↓ Water is found on Earth in different forms. ↓ Water moves through a predictable cycle.	↓ Rocks are natural materials that typically have more than one component. ↓ Heat, pressure, and time are the factors that can form rocks. ↓ Rocks can be broken down by weathering and moved to new locations by erosion. ↓ Rocks make up many of the landforms on Earth.

	LESSON 3	LESSON 4	LESSON 5
	Guess which of Earth's materials I am describing. You may have seen this material on the playground, maybe in art class, or perhaps when you were on vacation. If you live near a desert or a beach, you might see this material often. It is made of small grains and can feel gritty. What does this make you wonder?	It's the weekend! No school! The weather is nice, and you are playing outside. You notice that your friend's mom is planting flowers in her garden. You see her using a shovel to dig holes in the ground, and then place a flower in each one. What does this make you wonder?	It has been raining nonstop for three days. It's not fun waiting for the bus in the rain. You notice that there is a lot of water on the ground and that the water is starting to change how the ground looks. Where the ground used to be flat, there are now small holes that are filled with water. There are tiny streams running between them. You are learning about bodies of water and landforms in school. What does this make you wonder?
	■ Observe the properties of sand, and recognize that some objects are made of more than one material. ■ Describe how sand is formed over time. ■ Investigate the connection between water, wind, and the erosion of the materials that make up Earth's surface. ■ Explore and design solutions to reduce wind erosion on sand dunes.	■ Observe the properties of soil. ■ Recognize that soil contains nutrients for plant growth and is composed of different materials. ■ Analyze the components of soil obtained from the local area. ■ Investigate the connection between water, wind, and the erosion of natural materials on Earth. ■ Identify and discuss solutions to the problem of soil erosion on farmland.	■ Investigate the connection between water, ice, and the erosion of the materials that Earth is made of. ■ Recognize the characteristics of several landforms and how they change over time. ■ Use a model to investigate how glaciers and rivers can change the shape of the land over time. ■ Discuss how other naturally occurring processes on Earth, such as volcanoes and the movement of Earth's plates, can create and change landforms.
	↓ Sand is a natural material formed primarily from the weathering and erosion of rocks over time. ↓ Wind and water can change and shape landforms composed of sand, such as sand dunes. ↓ Vegetation can help reduce the effects of wind erosion on sand dunes. ↓ Engineers design solutions to reduce the effects of erosion on sand dunes.	↓ Soil is a natural material composed of small, loose particles of Earth's crust. ↓ Soil contains nutrients that are important for plant growth. ↓ Wind and water can affect how soil forms. ↓ Runoff can wash away the top layers of soil, which affects the availability of nutrients that are needed for plant growth.	↓ Landforms can change over time due to weathering and erosion. ↓ Glaciers and rivers can contribute to the formation of new landforms or change the shape of existing landforms. ↓ Islands and mountains can be formed by volcanoes and other Earth processes.

Earth Materials

Unit Anchoring Phenomenon

The surface of Earth is constantly changing. The results of these changes usually take a long time to become noticeable, but some agents of change, such as volcanoes and floods, cause land to change more quickly. The anchoring phenomenon in *Earth Materials* is how natural materials such as water, minerals, rocks, and soil are important parts of Earth's surface.

LESSON 6

INVESTIGATIVE PHENOMENA

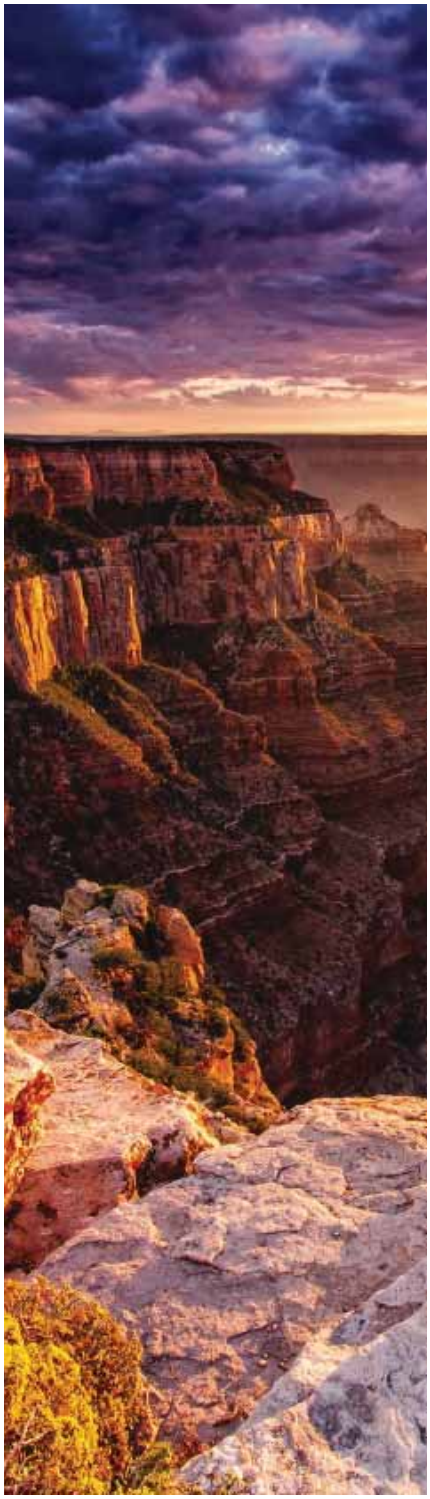
Off the south coast of Hawaii, a volcano is erupting underwater and forming new land. You have the ability to travel thousands of years into the future, and when you arrive, you see that there is a new island. What does this make you wonder?

OBJECTIVES

- Recognize the connection between wind, water, and ice and the erosion of the materials that make up Earth's surface.
- Identify that some changes to landforms occur slowly, over a long period of time, while others happen quickly.
- Create a model to explain the characteristics of landforms and the effect of erosion on those landforms.
- Present models and communicate information to classmates about the materials that make up Earth's surface.
- Evaluate learning throughout the unit, and compare that knowledge to initial ideas from the beginning of the unit.

SCAFFOLDING Students should know:

- Wind, water, and ice play a role in erosion of the materials that make up Earth's surface.
- Some landforms change slowly over a long time, while other changes happen more quickly.
- Even though islands are surrounded by water, the island itself can be composed of different types of landforms and other bodies of water.



NOTES

Forces and Interactions

Unit Overview

All objects experience forces. Students are likely to be familiar with forces that result in motion, like pushes or pulls, but may not know much about other forces, like magnetism or gravity, which are more abstract and require the observation of phenomena. *Forces and Interactions* focuses on Newton's three laws of motion, which form the central base of physical science concepts upon which students will develop understanding as they progress through science courses. This unit provides students opportunities to use inquiry-based, hands-on science to develop a deeper understanding of forces and the interactions that initiate, change, and stop movement. Throughout a series of five lessons, students will build upon the concepts of balanced and unbalanced forces by considering variables such as gravity, magnetism, friction, mass, and distance. Students will engage in a variety of investigations, practice engineering, and draw connections between science concepts and their real-life applications.

Unit Anchoring Phenomenon

All motion relies on the interactions of forces. Depending on the forces at work on an object, it may start, stop, change direction, or change speed. The mass of the object and the strength of the forces at work affect the resulting motion of the object. The anchoring phenomenon for *Forces and Interactions* is recognizing the interactions between forces at an amusement park.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	The Giant Drop is a roller coaster that takes the car far up a track in the air, where it pauses for a long time. Suddenly, the car is released, and it moves to the bottom of the track at a very high rate of speed. You decide to ride the Giant Drop with your friend. You choose seats next to each other, but before the operator starts the ride, he asks your friend to move over to the other side of the ride to create balance. He says that the ride is not safe if it is not balanced. What does this make you wonder?	A Fun Slide is three slides side by side that allows friends to race. One of the slides has been freshly oiled. On the count of three, three friends begin to slide. One friend sits on a mat and slides all the way down. One friend does not use a mat and gets stuck halfway down the slide. The third friend uses a mat, but she moves faster than the other two friends and wins the race! What does this make you wonder?
OBJECTIVES	■ Use a beam balance model to investigate balanced forces. ■ Determine the relative mass of an object using a beam balance. ■ Define "force," and draw connections to the forces acting upon an object in motion and an object at rest. ■ Explain how the pull of gravity can result in balanced forces.	■ Use models to explain the law of inertia. ■ Explain how forces are required to change the motion of objects. ■ Identify the cause-and-effect relationship between forces and movement. ■ Predict how different textures affect friction.
SCAFFOLDING Students should know:	↓ All objects experience forces, whether they are moving or still. ↓ Gravity is a pulling force that all objects experience. ↓ The forces acting on an object are balanced when the object is still. ↓ The relative mass of an object can be determined using a beam balance. ↓ Expressions can be used to describe the relative mass of an object.	↓ Forces are unbalanced when one force is greater than others. ↓ Unbalanced forces result in movement. ↓ Inertia is an object's resistance to a change in motion. ↓ Objects at rest will stay at rest and objects in motion will stay in motion unless another force acts on them. ↓ The amount of force applied to an object will affect its motion, specifically its speed and the distance it travels. ↓ Friction is a force that causes objects to slow down. ↓ Friction is related to the texture of a surface or an object.

	LESSON 3	LESSON 4	LESSON 5
	Four friends wait to ride a roller coaster. They notice a sign that has height and weight requirements for riders. Before the friends get on the ride, the conductor asks if they want an extra push at the top of the hill. During the ride, the car seems to slow down whenever the track makes a turn. What does this make you wonder?	Some types of roller coasters use an electromagnetic track. With a switch, the ride operator is able to use electricity to reverse the magnetic poles on the track. This can cause the roller coaster to begin moving or stop moving. What does this make you wonder?	Amusement parks have games for which you can win prizes. However, these games are designed to be very difficult to win. In one game, you must use a water shooter to knock over a target. Some people are suspicious that the target has been secured to its base with a magnet. What does this make you wonder?
	■ Use a model to determine how the strength of a force affects an object's motion. ■ Use a model to determine how an object's mass affects its ability to overcome inertia. ■ Observe a magnetic force and investigate how its strength can be changed.	■ Make connections between magnetism and the material an object is made from. ■ Identify attractive and repulsive charges. ■ Recognize attractive magnetic forces as pulls and repulsive magnetic forces as pushes. ■ Plan an investigation to prove that magnetic fields can differ based on the shape of the magnet. ■ Use a model to demonstrate how electric forces behave similarly to magnetic forces.	■ Reinforce previous learning and draw connections between forces, including gravity, magnetism, and electricity. ■ Design an efficient model of magnetism. ■ Evaluate a model to identify patterns related to forces and their interactions. ■ Evaluate learning from throughout the unit about forces and interactions, and compare that knowledge to initial ideas from the beginning of the unit.
	↓ The strength of a force will affect the resulting motion of an object. ↓ The speed at which an object travels and the distance that object moves are dependent on the strength of the force applied to the object. ↓ A strong force is needed to change the motion of an object with a great mass. ↓ An object's inertia is affected by its mass. ↓ Magnetic force is a pulling force. ↓ The strength of a magnetic force can be changed by adding more magnets to a system.	↓ Not all metals are magnetic. ↓ Iron is a type of metal that is magnetic. ↓ Magnets can have pulling and pushing forces, which relate to the terms "attract" and "repel." ↓ Magnets have poles. Like poles repel and different poles attract. ↓ All magnets have a magnetic field, which is the space in which magnetic objects can be attracted. ↓ Magnetic fields vary based on the shape of the magnet. ↓ Electric forces act similarly to magnetic forces and have poles, which are referred to as "charges." ↓ Some materials can build a strong electric charge when they are rubbed.	↓ A force can be a push or a pull. Gravity, friction, magnetism, and electric charges are different types of forces. ↓ Forces can be balanced or unbalanced and have different strengths. ↓ An object's inertia is dependent on its mass and on the strength of the applied force. ↓ Applied forces can make an object change speed or direction. Without an applied force, objects at rest stay at rest and objects in motion stay in motion.

Life in Ecosystems

Unit Overview

Earth is a very special place and still the only planet that has been found to support life. As students travel to school, play on the playground, or participate in a school fire drill, they are observing and sharing space with a diverse group of organisms that live in the local ecosystem. We depend on organisms in our ecosystems for food, shelter, and the oxygen we breathe. In the five lessons in *Life in Ecosystems*, students will be introduced to life cycles, inherited and acquired traits, adaptations, and the fossil record and how all of those things impact the diversity of life on Earth. Students explore these concepts through investigation, discussion, and problem-solving. Students make observations and predictions, analyze and graph data, develop claims supported with evidence and reasoning, and evaluate problems and solutions.

Unit Anchoring Phenomenon

Earth is a very special place and is the only planet that has been found to support life. Have you ever stopped to consider the sheer number of organisms that surround us in our daily interactions? As students travel to school, play on the playground, or participate in a school fire drill, they are observing and sharing space with many of the different organisms that live in the local ecosystem. The anchoring phenomenon for *Life in Ecosystems* is recognizing the amazing diversity of life in the ecosystems we live in.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	It is a nice day, so you head to a park after school with your friends. While there, you take note of your surroundings. You hear birds singing and a frog croaking. You see a squirrel grab some acorns from the ground and run up a nearby tree. You notice a line of ants moving toward a piece of bread someone has dropped. You think about all the different living things, including yourself, that are here in this small park. What does this make you wonder?	You are so excited to be able to finally meet your friend's German Shepherd puppies! You had to wait a month to play with them, until they had grown big enough to be handled. When you arrive at your friend's house, you notice that the mother had five puppies. Three puppies are the same brown color as the mother, one is all white, and one is black with a small white patch on its chest. What does this make you wonder?
OBJECTIVES	■ Distinguish between the different components that make up an ecosystem. ■ Recognize that different ecosystems are defined by their living and nonliving factors. ■ Provide examples of organisms and nonliving factors that can be found in ecosystems. ■ Analyze images to gather evidence to support a claim that some animals survive better in groups. ■ Compare plant and animal life cycles to identify patterns in birth, growth and development, reproduction, and death.	■ Distinguish between inherited traits and acquired traits in organisms. ■ Investigate various traits that an offspring can inherit from its parents. ■ Analyze variations of traits that occur among members of the same species. ■ Gather evidence to support a claim that humans are not the only organisms to pass traits on to offspring. ■ Develop models of the patterns in growth and development of an organism's life cycle by observing development of Wisconsin Fast Plants® and painted lady butterfly larvae. ■ Analyze data to describe the patterns of similarities in traits between organisms and their offspring to show evidence that traits are inherited.
SCAFFOLDING Students should know:	↓ Living things are called organisms. ↓ Many kinds of organisms live together as a community in an ecosystem. ↓ The main parts of an organism's life cycle are birth, growth and development, reproduction, and death. ↓ Living in a group can contribute to an animal's survival.	↓ Traits are characteristics that make organisms unique. Traits can be physical or behavioral. ↓ Inherited traits are passed on from parents to offspring. ↓ Acquired traits are developed over the course of an organism's lifetime and are not passed on to offspring. ↓ Variations can be found among members of the same species.

	LESSON 3	LESSON 4	LESSON 5
	Your neighbor has birdfeeders in her backyard. You notice that the birds that come to the feeders are all different colors and sizes. Some birds perch on the feeders to eat the seeds. Not all of these birds eat the same seeds. Other birds pull food from the ground—they are looking for bugs and worms! What does this make you wonder?	Another classroom in your school has a terrarium with pill bugs in it. One of the students from that class tells you that pill bugs have a unique adaptation to protect their soft insides: they roll up into a tight ball. This adaptation gives pill bugs the nickname "roly poly." The student also tells you that pill bugs are not actually insects, but isopods, which are more closely related to ocean animals like shrimp and crabs. What does this make you wonder?	You notice that there are drains in different locations along the curbs of the streets in your neighborhood. Some of the drains have a sign that says "No dumping. Drains to waterways." What does this make you wonder?
	■ Compare behavioral and physical adaptations. ■ Use models to investigate the relationships between an animal's adaptations and the food it eats. ■ Describe predator–prey relationships. ■ Use evidence to explain the benefits of camouflage. ■ Distinguish between variations in adaptations that affect how an organism survives in its environment.	■ Identify the ways in which an organism's habitat supports its basic needs. ■ Conduct an investigation to gather evidence to support the idea that the environment plays a role in the patterns of growth and development of an organism. ■ Argue and defend the idea that some organisms survive well, others less well, and some not at all in an environment. ■ Predict the results of a problem caused by environmental changes and how these changes may affect the populations of organisms that live there. ■ Analyze fossil structures and infer which present-day organisms could have descended from them. ■ Analyze and interpret data to draw the conclusion that organisms and the environments they live in change over time.	■ Identify how humans depend on and impact an ecosystem. ■ Use evidence to explain how changes to an environment affect the plants and animals that live in that environment. ■ Predict the results of a problem caused by environmental changes and how these changes may affect the populations of organisms that live there. ■ Evaluate a solution to a problem caused by environmental changes and determine whether the proposed solution reduces the impact of the problem.
	↓ Adaptations can help populations of organisms better survive in their environment. They can be physical or behavioral. ↓ Acclimation, the process of an individual organism making adjustments to survive in an environment, is not the same as adaptation. ↓ Camouflage is a physical adaptation of predators and prey that increases their chance of survival.	↓ Environmental factors can influence the development of inherited traits. ↓ When the environment changes, some organisms survive well, some less well, and others not at all. ↓ Fossil evidence is used to make connections between present-day organisms and their prehistoric ancestors. ↓ Fossils can provide clues about environmental changes over Earth's history. ↓ Fossils can be used to provide evidence of extinct organisms and the environments in which they lived.	↓ Humans depend on ecosystems and can impact them in positive and negative ways. ↓ An engineer is someone who uses science to solve problems or fulfill needs. ↓ When an environmental change occurs in an ecosystem, it affects the organisms that live there. ↓ The solutions proposed for problems facing an ecosystem have to be considered from many viewpoints, including social, economic, political, and environmental. ↓ Sometimes solutions to ecosystem problems can cause additional issues in the ecosystem.

Weather and Climate Patterns

Unit Overview

Step outside or look out the window, and you can observe weather. Perhaps it is cold and rainy today where you live, but in other parts of the world it may be hot and sunny, or perhaps a tropical storm is developing. "Climate" refers to an area's average weather pattern over many years, and climate influences the weather. Extreme weather events occur around the world every day, but how does climate variability influence the probability of extreme weather events? What do scientists need to know to inform people about dangerous weather and prevent damage and death from weather hazards? In the five lessons in *Weather and Climate Patterns*, students will explore and learn about patterns in weather, climate, seasons, and weather hazards. Students will be introduced to the components that make up weather, the tools used to measure weather, how changes in weather happen, and the connection between weather and climate. Students explore these concepts by investigating, discussing, and problem-solving. Students make observations and predictions, analyze and graph data, develop claims supported with evidence and reasoning, and evaluate problems and solutions.

Unit Anchoring Phenomenon

Step outside or look out the window, and you can observe weather. Perhaps it is cold and rainy today where you live, but in other parts of the world it may be hot and sunny, or perhaps a tropical storm is developing. "Climate" refers to an area's average weather pattern over many years, and climate influences the weather. This phenomenon has impacted Earth throughout its geologic history. In fact, dangerous weather events occur around the world every day as a result of climate variability. How does climate variability influence the probability of a weather event? What do scientists need to know to inform people about the weather and prevent damage and deaths from extreme weather events? The anchoring phenomenon for *Weather and Climate Patterns* is recognizing that weather and climate are connected.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	You are ready to leave for school when your older brother hands you a raincoat. You look outside and see that the Sun is shining. What does this make you wonder?	You are learning about different states. One of the states you are learning about is California. You look at pictures of different places in California that show people surfing in the fog, skiing in the snow, and hiking in the sunshine. What does this make you wonder?
OBJECTIVES	■ Recognize that weather is the conditions in the atmosphere at a specific time and place. ■ Identify words that can be used to describe weather. ■ Make observations about local weather conditions. ■ Investigate tools that measure weather. ■ Analyze patterns in weather data to make predictions about weather.	■ Analyze and graph the daily averages for temperature and precipitation in an area. ■ Estimate the weekly averages for temperature and precipitation in an area. ■ Analyze graphs of yearly temperature and precipitation data to look for weather patterns. ■ Investigate relationships between weather conditions in various cities to predict typical weather conditions during a particular season in the Northern Hemisphere.
SCAFFOLDING Students should know:	↓ Weather is the atmospheric conditions in a specific place at a specific time. ↓ There are many kinds of weather tools, such as windsocks, thermometers, and barometers, that measure specific attributes of the weather, such as wind speed, temperature, and air pressure. ↓ Patterns in weather data can be used to make predictions about future weather.	↓ Technology such as weather balloons, satellites, and radar can be used to collect weather data. ↓ Weather conditions can differ by time, place, and season. ↓ Temperature and precipitation data can be analyzed to look for patterns in specific areas. ↓ Long-range patterns in temperature and precipitation can be used to predict seasonal weather patterns.

	LESSON 3	LESSON 4	LESSON 5
	Your class has signed up to be online pen pals with a class in Santiago, Chile. Since you are learning about weather and climate, you ask your pen pals what the weather is like today in Santiago. It's the beginning of winter where you live in the Northern Hemisphere; it is starting to get cold at night, and there hasn't been much precipitation. Your pen pals report that today in Chile, it is sunny and a warm 82 degrees. What does this make you wonder?	You are in the car on the way to school, and your favorite song is playing on the radio. Suddenly, three loud screeches from the radio interrupt the song. A voice informs you that the National Weather Service has issued a severe thunderstorm warning for the county you live in. What does this make you wonder?	No matter which of Earth's climate zones you live in, there is a chance you will be impacted by a natural hazard. Earthquakes, volcanic eruptions, wildfires, and dangerous weather are all hazards that can occur at any moment on Earth. What does this make you wonder?
	■ Describe the relationship between weather and climate. ■ Identify the parts of Earth's climate system and the factors that can affect climate. ■ Recognize the different climate zones and where they are located on Earth. ■ Discuss patterns among Earth's climate system and climate zones.	■ Recognize that dangerous and severe weather is generally caused by warm and cold air masses meeting. ■ Identify types of weather hazards. ■ Describe patterns in climate and dangerous weather. ■ Describe the effects of a specific type of dangerous weather, tropical storms.	■ Describe the impacts of weather hazards on people and property. ■ Research weather hazards and proposed design solutions that lessen the weather-related impact on people and property. ■ Present findings of research on proposed solutions to reduce the impact of weather hazards. ■ Evaluate a proposed solution to a problem caused by weather hazards and make a claim to determine whether the solution reduces the impact of the hazard. ■ Evaluate learning from throughout the unit and compare that knowledge to initial ideas from the beginning of the unit.
	↓ Climate is the general weather patterns and long-term trends of an area. ↓ Many factors determine an area's climate, but two of the most important are air temperature and precipitation. ↓ Earth's surface can be broken into climate zones based on air temperature and air circulation.	↓ Air pressure and air circulation impact formation of weather and dangerous weather. ↓ Dangerous weather is a type of natural hazard that has the potential to cause damage or loss of life. ↓ A tropical storm is a dangerous weather event that causes weather hazards such as heavy rain, flooding, and high winds to affect an area. ↓ Meteorologists continue to study patterns in weather and climate to improve warning systems for storms.	↓ An engineer is someone who uses science to solve problems or fulfill needs. ↓ Design solutions have been used to reduce the impact of weather hazards in an area. ↓ Proposed solutions to weather hazards have many considerations, including social, economic, political, and environmental factors. ↓ Weather hazards can affect people or property at any time, so having a plan before a dangerous weather event is important.

Energy Works

Unit Overview

Energy is a central idea in science; however, it is a complex and somewhat abstract topic that students may struggle to grasp. *Energy Works* incorporates phenomena and provides opportunities for students to manipulate materials while exploring concepts related to energy. Throughout a series of six hands-on lessons, students study different kinds of energy, the transfers and transformations that occur between them, and how energy is used in the world around them. Inquiry-based investigations encourage students to make claims supported with evidence and reasoning, elaborate upon their observations, and design their own experiments.

Unit Anchoring Phenomenon

Before batteries, electricity, or even humans existed, many kinds of energy already existed on Earth. However, no type of energy, or life as we know it, would be possible without the Sun. The anchoring phenomenon for *Energy Works* is recognizing the Sun as Earth's ultimate source of energy.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	Before a race, coaches tell their runners to eat a healthy meal of pasta, fruits, or vegetables. In fact, coaches of all sports encourage their athletes to have a snack before a game. You might have had a teacher encourage you to eat a good breakfast the morning of a big test. What does this make you wonder?	Rockfalls occur when pieces of rock fall from the side of a steep cliff. They occur most commonly after rain, snowfall, or other types of precipitation. Sometimes high winds play a role in rockfalls. What does this make you wonder?
OBJECTIVES	■ Create a working definition of the term "energy." ■ Identify the Sun as the source of most energy on Earth. ■ Understand that energy can change type. ■ Recognize different types of energy in the classroom.	■ Recognize that energy has many types. ■ Participate in activities that demonstrate the difference between stored energy and motion energy. ■ Demonstrate an understanding of stored energy and motion energy. ■ Recognize that when objects collide, energy is transferred between them.
SCAFFOLDING Students should know:	↓ Energy flows through a system and can change type. ↓ There are different types of energy that can be found in different objects, both living and nonliving.	↓ Energy in a system can exist as stored (potential) energy. ↓ Energy can flow through a system as motion (kinetic) energy. ↓ There are different forms of energy, which can relate to either stored or motion energy. ↓ Speed and energy are related.

	LESSON 3	LESSON 4	LESSON 5	LESSON 6
	You are sitting outside on a very hot day. After some time, you begin sweating and notice that your skin has darkened. You move to a shady area beneath a tree, where it feels cooler. While you sit, you notice that some of the plants around you are smaller than the plants in the sunlight. What does this make you wonder?	Over the course of history, armies have used a device called a heliograph to communicate over long distances. Using a mirror, soldiers use the sunlight to flash patterns that represent letters and numbers. What does this make you wonder?	Some devices and machines are equipped with solar panels. During periods of sunshine, these solar panels absorb the light energy from the Sun and transform it into other types of energy. Newer types of solar panels have the ability to store energy for later use. What does this make you wonder?	In addition to using more renewable energy, we are constantly looking for new ways to develop energy-efficient machinery. Every day, engineers are designing new products that require less energy to function. A few examples include solar-powered charging stations, motion-sensing lights, and LED lights, which are found in many new TVs and car lights. What does this make you wonder?
	■ Describe some basic types of energy including light, radiant, thermal, sound, electrical, chemical, and mechanical. ■ Use scientific equipment to investigate energy and how it is transformed into other types and transferred within a system. ■ Model energy transformations using pie charts and provide evidence for energy changes.	■ Identify and define waves as regular patterns of motion. ■ Identify the parts of a wave. ■ Collect evidence to prove that waves have energy. ■ Use patterns to identify waves with different sizes and frequencies. ■ Use evidence to prove that waves can transfer energy.	■ Learn about alternatives to fossil fuels: solar energy, geothermal energy, wind energy, water energy, and biomass energy. ■ Construct models to demonstrate energy. ■ Work cooperatively and follow directions. Suggest innovations in design. Record questions for further exploration.	■ Design and plan an experiment or demonstration to answer a student generated question about energy. ■ Execute a plan to construct apparatus, collect data, and draw conclusions. ■ Present findings of investigations and share results with classmates. ■ Complete self-assessments to evaluate progress.
	↓ Energy in a system can be transferred to other objects or transformed into different types of energy. ↓ Circuits demonstrate energy transformations and transfers by creating a closed or open system.	↓ Energy can flow in waves, which follow a pattern. ↓ Light, sound, and water move in waves. ↓ Wave energy can be transferred to different objects. ↓ Changing the energy of a wave will change its shape.	↓ Most of our energy systems rely on fossil fuels, which are nonrenewable. ↓ Alternative, renewable sources of energy can be used to provide energy to systems. ↓ Each kind of alternative energy has pros and cons. ↓ Wind and water energy are affected by speed.	↓ Energy systems rely on energy transfers and transformations in a system to do work, create change, or cause motion. ↓ The total energy in a system can be changed with greater energy input. ↓ Energy is required for life to exist and can be observed everywhere.

Plant and Animal Structures

Unit Overview

All organisms have the same foundational needs: water, shelter, food, and air. However, a wide variety of plants and animals inhabit our world. Students may wonder how certain types of plants or animals can survive in places with extreme climates or why specific structures, like eyes, can vary so much in appearance. *Plant and Animal Structures* provides hands-on, inquiry-based investigations focused on phenomena and concepts related to adaptations. Through a series of six lessons, students examine plants, animals, and their own bodies to draw comparisons between organisms and explain how body parts and behavior allow for each organism's survival, growth, and reproduction. Students will perform several dissections and build models to gather evidence about adaptations and senses.

Unit Anchoring Phenomenon

Health is vitally important. Most students will be able to relate to visiting a doctor or may even have experience tending to the health of a pet or a garden. As students get older, they begin to draw connections between symptoms and a particular illness or condition. The anchoring phenomenon for *Plant and Animal Structures* is understanding the internal and external structures of organisms and the conditions in which they function effectively.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	In Alaska, temperatures can be extremely cold—as low as –60°C (–76°F). Few types of plants and animals can survive in such a climate, but the Alaskan wood frog is able to freeze its body, which stops its breathing and the beating of its heart. When the temperatures rise in spring, the frog thaws and returns to life. What does this make you wonder?	A fourth-grade class gets a lizard as a pet. The students set up a tank with the types of plants, rocks, and sand found in its natural environment. They feed it crickets and provide it with water. The lizard seems very happy at first. By the end of the day, it is not moving very much and has burrowed in the sand. The teacher picks up the lizard and finds that its skin feels cool. What does this make you wonder?
OBJECTIVES	■ Recognize that plants and animals have special structures and behaviors that enable them to survive in their environments. ■ Identify adaptations of plants and animals that are essential for survival, growth, and reproduction. ■ Design an environment for seeds to grow in and make predictions about their growth.	■ Describe structural adaptations and how they vary based on an animal's environment. ■ Use external and internal structures to explain how animals survive in their environments. ■ Argue how properly functioning external and internal structures are important for the survival of animals. ■ Investigate both internal and external adaptations using a preserved squid specimen.
SCAFFOLDING Students should know:	↓ Organisms have the same basic needs: water, shelter, food, and air. The amount of each resource required to survive differs among plants and animals. ↓ Organisms have adaptations that help them survive, grow, and reproduce in their environments. ↓ Adaptations can be structures, like gills, or behaviors, like migrating. ↓ Plants require sunlight to make their own food through the process of photosynthesis.	↓ Animals have structural and behavioral adaptations that assist in their survival, reproduction, and growth. ↓ Internal and external structures must work together in order for an animal to thrive. ↓ Certain structures are unique to animals in a certain environment. An animal may not be able to thrive in a nontypical area if it does not have the appropriate structures.

	LESSON 3	LESSON 4	LESSON 5
	Houseplants require less care than most other plants. Many common houseplants are relatives of rain forest plants. Sometimes you might notice the leaves of a plant beginning to brown. In such cases, it is recommended to prune, or cut, any leaf or stem that appears brown. Within a few days, new green leaves should begin to grow. What does this make you wonder?	During a checkup, the doctor might use a special tool to hit the bottom of your knee, which should cause you to kick. This test is used to make sure your nerves are working correctly. The doctor might also shine a light in your eye, feel your belly, and look at your tongue. These tests are used to check for internal health. What does this make you wonder?	Some people can go years without realizing they are color-blind. People who are color-blind have a difficult time distinguishing between certain colors. For example, a person can be red–green color-blind. There are many simple tests for color blindness, but there is no cure. What does this make you wonder?
	■ Identify and explain the purpose of internal and external structures in a plant and how these structures help the plant survive, grow, and reproduce. ■ Examine and compare seeds to draw conclusions about plant development. ■ Describe the different appearances as adaptations. ■ Dissect and identify the internal structures of a flower and explain how they relate to reproduction.	■ Investigate and analyze the five senses to determine their importance in survival. ■ Describe how information is processed, and predict the effects on information processing if the brain is damaged. ■ Explore the brain and use evidence to explain its role in sensing the world. ■ Identify the importance of memory when processing information in order to stay safe.	■ Identify the structures of the eye and their individual functions. ■ Explain how light waves and their frequencies affect our experience of vision. ■ Describe the role of the brain in processing information and its importance in recognizing color, shape, and motion. ■ Examine the cause-and-effect relationship between light and pupil size. ■ Use a cow eye to draw comparisons between human and animal eyes.
	↓ Plants begin as seeds, which have structures to protect the plant as it begins to grow. ↓ Plants have internal and external structures that must work together in order for the plant to survive, grow, and reproduce. ↓ Most plants have leaves, a stem, and roots, but some types have plants have specialized structures that are adapted to their environment. ↓ The reproductive success of plants is dependent on the transportation of pollen.	↓ The five main senses are touch, smell, taste, hearing, and sight. ↓ Senses help an animal survive by making sense of the world around them. ↓ All senses send messages to the brain; when a message is processed, the result is a thought or a reaction. ↓ The brain is able to store information as memories to make information processing faster. ↓ Different types of animals rely on different senses.	↓ Vision is a sense that many animals use to survive, but all animals have a different experience of vision. ↓ The eye contains special structures that transmit and interpret light waves. ↓ Different frequencies of light create colors. ↓ To prevent damage, the eye is able to change the amount of light that can enter the eye. This also helps to focus objects. ↓ Images are inverted in the eye, but the brain is able to flip the image when it processes information.

Plant and Animal Structures

Unit Anchoring Phenomenon

Health is vitally important. Most students will be able to relate to visiting a doctor or may even have experience tending to the health of a pet or a garden. As students get older, they begin to draw connections between symptoms and a particular illness or condition. The anchoring phenomenon for *Plant and Animal Structures* is understanding the internal and external structures of organisms and the conditions in which they function effectively.

LESSON 6

INVESTIGATIVE PHENOMENA

Animals like snakes and cats have pupils that look like slits. This shape allows greater control of the amount of light that enters their eye, which results in a clear image in both daytime and nighttime light conditions. These animals also tend to see more vibrant colors than other animals, which is ideal for animals like snakes, cats, and reptiles. What does this make you wonder?

OBJECTIVES

- Develop a model that demonstrates an understanding of the human eye and how it could be more powerful.
- Compare the eyes of other organisms to determine the weaknesses of the human eye.
- Present models to communicate knowledge about the eye's structures and functions.
- Evaluate models to argue which model is most successful.

SCAFFOLDING
Students should know:

- Animal eyes are adapted to respond to light differently based on the needs of the animal.
- Plants are able to respond to light; light is required for their growth, reproduction, and survival.
- Not all animals have precise vision, but many are able to tell the difference between light and dark.

NOTES

Changing Earth

Unit Overview

Earth is made up of mountain ranges, lakes, volcanoes, rivers, canyons, and many other landforms and waterways, all of which are continually changing. Most of these changes are not noticeable in a single lifetime; for example, it takes rivers thousands—even millions—of years to form canyons. Other changes are more drastic and immediate, such as those resulting from an earthquake or a volcanic eruption. *Changing Earth* provides hands-on, inquiry based investigations that focus on phenomena related to the history of Earth and its landforms. Through a series of six lesson, students learn about tectonic plates, make connections to the rock cycle, model erosion using stream tables, and consider how Earth's changes can impact on human activity.

Unit Anchoring Phenomenon

Our Earth is constantly changing; however, it occurs at a very slow rate. Changes to landforms or evidence of erosion may not be noticeable in a year or even a lifetime, but we can find evidence of past changes to predict future changes. The anchoring phenomenon for *Changing Earth* is identifying geological events and structures to explain the history of Earth.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	Throughout history, the west coast of the United States has experienced many earthquakes. In 1980, a strong earthquake occurred and led to the volcanic eruption of Mount St. Helens in Washington. The earthquake also caused a massive avalanche. What does this make you wonder?	Whether building a skyscraper, a home, or a sand castle, most structures require a deep hole for a foundation. As you dig this hole, you might notice that the color of the soil, sand, or clay changes as you dig deeper. When you're finished digging out your foundation, it has become evident that the land has a layered pattern. What does this make you wonder?
OBJECTIVES	■ Construct a model of three layers of Earth. ■ Assemble a map of Earth's tectonic plates and make predictions about the effects of their movement. ■ Recognize patterns within the Ring of Fire to draw conclusions about volcanic activity and earthquakes.	■ Compare the characteristics of different types of rocks. ■ Use a model to simulate the rock cycle. ■ Classify rocks by the way they are formed. ■ Research different types of rocks and make connections between their characteristics and where they are found.
SCAFFOLDING Students should know:	↓ Earth is composed of three layers: crust, mantle, and core. ↓ The mantle is made of liquid rock (magma), which convects and results in movement of the crust. ↓ Volcanic activity and earthquakes are common along the boundaries between tectonic plates. ↓ The movement of tectonic plates can cause magma to rise from Earth's mantle and flow from volcanoes as lava.	↓ Lava that flows from volcanoes can cool and form rock. ↓ There are three types of rocks: igneous, metamorphic, and sedimentary. ↓ Each type of rock is formed differently, and rocks can change into different types depending on the conditions to which they are exposed. ↓ We can examine patterns in rocks to learn about Earth's history and landforms. ↓ Humans use rocks in multiple applications.

	LESSON 3	LESSON 4	LESSON 5	LESSON 6
	If you drive through hills or mountain ranges, you might notice warning signs about rockslides, landslides or mudslides. It is particularly important to exercise caution around these regions during periods of high rainfall. In fact, some national parks might even close roads. What does this make you wonder?	When examining a map of the United States, you might notice shading in different regions. Thin blue lines are scattered throughout the map. Some of these lines are wavy; some are straight. Some maps, like globes, are three-dimensional. They might even have textures or appear raised in different areas. What does this make you wonder?	Paleontologists search all over the world for fossils. Most fossils are found in regions that used to be covered in water. As paleontologists dig, they tend to find fossils of water-dwelling organisms. What does this make you wonder?	One year in North Carolina, scientists found that many ponds and streams were very unhealthy, causing many of the plants and animals that lived in those areas to die. This was observed after a summer with a lot rainfall. The unhealthy ponds and streams were all near farms. What does this make you wonder?
	■ Differentiate between weathering and erosion. ■ Make a connection between water erosion and the rock cycle. ■ Use a water table to simulate how water erosion creates landforms. ■ Make predictions about the structures of Earth based on the locations of rivers and streams.	■ Use different maps to draw conclusions about the impact of water erosion on landforms. ■ Determine the importance of maps in exploring the history of Earth. ■ Develop maps of river systems to identify patterns of movement.	■ Model deposition using a stream table to explain how sedimentary rock forms. ■ Simulate fossil formation by creating layers of sediment in the stream table. ■ Estimate the relative ages of rock layers based on the fossils found within them.	■ Describe soil erosion and predict its impact on humans. ■ Develop a solution for soil erosion and use the stream table to test the model. ■ Analyze results to determine the effectiveness of models to prevent soil erosion and make connections to real-life solutions to scientific problems.
	↓ Sediment forms from rock as a result of weathering and erosion. ↓ Water, ice, wind, and gravity can cause rock to break down into smaller pieces. ↓ Landforms, such as valleys, canyons, and deltas, are formed by the process of erosion. ↓ The presence of vegetation and the speed of water impacts the rate of erosion and the formation of sediment.	↓ Maps can be used to observe patterns of erosion and weathering on Earth. ↓ Geologists use maps as tools to describe the history of Earth. ↓ River systems are responsible for shaping many of Earth's landforms. ↓ The flow of water, related to speed and elevation, affects erosion.	↓ Erosion moves sediment and eventually deposits it (deposition). ↓ Deposited sediment can form in layers and harden, forming sedimentary rock. ↓ Layers of rock form over time, and scientists use these layers to estimate the relative age of Earth. ↓ Fossils form in sedimentary rock and are exposed after erosion. ↓ We can learn about Earth's history using fossils and rock layers.	↓ Soil erosion changes the shape of the land and can have negative effects on human activities. ↓ To prevent soil erosion, scientists have developed solutions to limit the breakdown of sediment as water moves through an area. ↓ Soil erosion can be prevented by directing water through a specific path and preventing it from overflowing onto land.

Structure and Properties of Matter

Unit Overview

Matter makes up everything around us, but students may struggle to understand this given that they cannot see certain types of matter, like gases, and that they may not recognize when matter is a mixture or a solution. *Structure and Properties of Matter* provides hands-on, inquiry-based investigations focused on phenomena that support the concepts related to matter. Through a series of six lessons, students study the states of matter and make connections to physical and chemical properties, including volume, mass, freezing point, melting point, boiling point, and the ability to form mixtures and solutions. Students will learn to describe matter and predict its interactions with other types of matter.

Unit Anchoring Phenomenon

Understanding matter is vital to successful baking. Bakers rely on specific ratios of ingredients to create the desired consistency, size, and flavor of baked goods. Although we don't typically think about the interaction of particles while making cookies or whipping cream, we can observe the changes in the volume and mass before and after energy is added. The anchoring phenomenon for *Structure and Properties of Matter* is the physical and chemical changes that occur during baking.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	There are many different types of bread. Most are made using different combinations of flour, water, salt, and yeast. When you mix the ingredients, they form a soft, sticky dough. An important step in making bread is allowing the dough to rise for a long period of time. After about an hour of rising, you should notice that the dough takes up more space in its bowl. When you press on the dough, it seems to release a lot of air. What does this make you wonder?	Your friend wants cake and ice cream for his birthday party. To make the cake, you mix sugar, eggs, flour, oil, milk, and baking powder. The batter is a thick liquid. You pour the batter into a pan and notice that the batter fills the pan. You put the pan in a hot oven and wait. Meanwhile, you put the tub of ice cream on the counter so it can soften. The timer goes off. The cake is ready! You remove the pan from the oven and notice that the liquid batter is now a solid and that the cake doesn't reach the edges of the pan like before. You also notice the color of the cake is much darker than the batter was. While you finish preparing for the party, you notice the outside of the tub of ice cream is very wet, but there is no ice cream leaking out. What does this make you wonder?
OBJECTIVES	■ Develop a working definition of the term "matter." ■ Make observations to differentiate between solids, liquids, and gases. ■ Construct an argument about the properties of each state of matter. ■ Determine the best method for determining the mass and volume of objects. ■ Analyze data to prove that matter takes up space and has mass.	■ Make observations to gather evidence that the movement of and attraction between particles change as energy is added to matter. ■ Develop a model to explain the movement of particles in each state of matter. ■ Identify phase changes as physical properties of matter, specifically using evaporation and condensation. ■ Use data to graph quantities and provide support for concepts related to matter conservation. ■ Develop a scenario to describe matter conservation.
SCAFFOLDING Students should know:	↓ Matter is anything that takes up space and has mass. ↓ Mass and volume are properties of matter. ↓ Volume can be measured using displacement of water. ↓ There are three states of matter that each have unique properties. ↓ Matter can change states.	↓ Each state of matter is unique based on the behavior of its particles. ↓ Particles change in motion and attraction as energy is added or removed from matter. ↓ Physical properties of matter include the temperatures at which it can change state. ↓ Matter is conserved as it changes state.

	LESSON 3	LESSON 4	LESSON 5
	Flour, baking powder, baking soda, sugar, and salt are all white substances used as ingredients in chocolate chip cookies. Given their similar appearances, it is easy to mistake ingredients. Even expert bakers have mistaken salt for sugar, resulting in a less-than-tasty cookie. By changing the amount of each ingredient combined to make chocolate chip cookies, you can change the texture of the cookie. Too much flour will result in a dry cookie, while too little flour will result in a cookie as flat as a pancake. Choosing brown sugar instead of white sugar will change the flavor of the cookie. What does this make you wonder?	You are preparing a few dishes to share at a picnic. First, you make salad dressing. You mix together oil, vinegar, mustard, and seasoning. You notice that the seasoning floats in the dressing and the oil and vinegar are separated until you whisk everything together. For something sweet, you make pudding. You use a pudding mix that looks similar to the seasoning you used in the salad dressing. The instructions tell you to add milk to the pudding mix, and stir. As you stir, you notice that the mixture is starting to thicken. The pudding mix seems to have disappeared. What does this make you wonder?	A brownie recipe calls for 600 grams of sugar, 225 grams of butter, 200 grams of egg, 180 grams of flour, 70 grams of cocoa, and 4 grams of salt. You mix all the ingredients in a large bowl. The batter is very thick and clumpy. The brownie batter is placed in the oven for about 45 minutes. When you remove the brownies from the oven, you notice that they are solid and dense. Out of curiosity, you remove the cooked brownies from the pan and place them on the scale. You find that their mass to be 1,004 grams. What does this make you wonder?
	■ Identify additional physical properties of matter, including buoyancy, hardness, magnetism, and viscosity. ■ Plan an investigation for testing buoyancy, hardness, and magnetism, and use collected data to make connections between a material and its uses. ■ Determine the density of a liquid by testing the rate at which it flows. ■ Define "density" by making connections to the behavior of matter particles	■ Use measurements to provide evidence that matter is conserved when it is mixed. ■ Identify the connection between mixtures and solutions. ■ Compare the behaviors of solids and liquids when they are mixed. ■ Understand solubility as a property used to describe matter. ■ Plan an investigation to separate mixtures based on their properties.	■ Distinguish between physical and chemical changes using evidence. ■ Provide evidence that mixing substances results in physical or chemical changes. ■ Observe chemical reactions to draw conclusions about identity changes. ■ Demonstrate that the total mass of materials mixed together will not change regardless of chemical or physical changes.
	↓ Matter can be identified using physical properties like magnetism, buoyancy, hardness, and viscosity. ↓ The properties of matter can be used to determine a function for a specific material or substance. ↓ The density of a substance affects its ability to float or flow. ↓ Density relates to the attraction of particles.	↓ When matter is combined, it forms a mixture. ↓ Being mixed may change the properties of some types of matter. ↓ Different states of matter can be mixed. ↓ Solutions are mixtures that display solubility, or the dissolving of one substance in another. ↓ Solubility includes a solute and a solvent. ↓ Some mixtures can be easily separated, while others are more difficult to separate. ↓ The ability of a mixture to be separated depends on the physical properties of the components of the mixture.	↓ Mixing materials can cause chemical or physical changes. ↓ Chemical changes cause matter to change in identity, while physical changes may only change in shape, color, or state. ↓ Matter is conserved in physical or chemical changes. ↓ The behavior of particles of matter changes in both physical and chemical changes, but the organization of particles changes in chemical changes.

Matter and Energy in Ecosystems

Unit Overview

Ecosystems on Earth contain diverse forms of life and have unique needs to sustain these life-forms. An ecosystem is composed habitats, each made up of biotic and abiotic factors. Students should have an understanding that living things require the same basic resources: food, water, shelter, and air. However, they may not be aware of the interactions that occur when biotic factors compete to obtain these resources. Biotic factors depend on abiotic factors, such as the Sun, water, and air, and on other biotic factors, including plants and animals, to grow, reproduce, and survive. Through a series of six lessons in *Matter and Energy in Ecosystems*, students examine the movement of matter and cycling of energy within an ecosystem. They make connections to competition, interdependence, and Earth's spheres using models such as food webs, food pyramids, and ecocolumns. Students continuously build upon the idea that energy is constantly cycled on Earth.

Unit Anchoring Phenomenon

Energy is what drives activity, growth, repair, and reproduction for all living things. Students understand that they eat food to fuel their activities, like sports or studying, but they may not realize that their bodies are in constant need of energy. All living things require an energy source to survive. The anchoring phenomenon for *Matter and Energy in Ecosystems* is identifying the ways in which living things obtain energy and how they use that energy.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	Sometimes tree branches grow over houses, fences, or garages. To avoid potential danger, it is recommended to prune, or cut, tree branches before winter, usually early in November. Typically, a chainsaw is used to remove individual branches from a tree. This process is often repeated every three years. It is important to prune only the thinner branches at the sides of the tree and not the thick branches at the top of the tree. What does this make you wonder?	When flowering plants bloom in the spring, they can produce nectar. You might notice animals such as insects, birds, chipmunks, and rabbits around these flowering plants. If there are a lot of insects and birds, it is likely there will be a greater number of flowering plants by the end of summer. If there are more chipmunks and rabbits, there will likely be fewer flowering plants. What does this make you wonder?
OBJECTIVES	■ Differentiate between biotic and abiotic factors. ■ Identify different habitats as part of an ecosystem. ■ Develop a model of the plant life cycle. ■ Explain the importance of the Sun in photosynthesis. ■ Plan an investigation using a control and variables to determine what plants need to grow.	■ Define "interdependence" and provide examples of interdependence that are related to ecosystems. ■ Develop a food chain model to demonstrate the flow of energy in a specific habitat. ■ Use owl pellets to draw conclusions about an owl's diet. ■ Construct a food pyramid to illustrate energy transfers from the Sun to a tertiary consumer.
SCAFFOLDING Students should know:	↓ An ecosystem is composed of biotic (living) and abiotic (nonliving) factors. ↓ Ecosystems include different habitats, which are identified by their climate and the biotic factors within them. ↓ Plants use energy from the Sun to perform photosynthesis, the process by which they make their own food. ↓ Apart from sunlight, plants need water and air to perform photosynthesis.	↓ Within an ecosystem, biotic factors depend on abiotic factors and other biotic factors to meet their needs. ↓ Biotic factors need air, water, shelter, and food to survive, grow, and reproduce. ↓ Animals obtain their energy from eating plants or other animals. ↓ The Sun is the ultimate source of energy in an ecosystem. ↓ We can use models, like food chains or food pyramids, to demonstrate energy transfers among biotic factors in an ecosystem.

	LESSON 3	LESSON 4	LESSON 5
	Scientists have found connections between the populations of deer and wolves. When the population of deer begins to increase, the wolf population quickly follows. If the deer population decreases, the wolf population also begins to decrease. It is important that the deer population remains larger than the wolf population. What does this make you wonder?	Pigs produce a great deal of waste. During a heavy rainstorm, the waste can be carried by the rainwater into nearby lakes, ponds, and streams. This can cause an increase in plant growth; however, it may also lead to the death of fish, frogs, and other animals that live in the water. Populations of decomposers, including worms and bacteria, often increase as a result. What does this make you wonder?	Plastic bags are a threat to sea turtles. When they float in the ocean, they resemble jellyfish, which are a common food for sea turtles. Animals' stomachs cannot break down the plastic, and it remains in their stomachs. This has led to the death of many sea turtles. What does this make you wonder?
	■ Construct food webs to explain the cycling of energy in an ecosystem. ■ Identify how biotic factors use energy. ■ Describe the effects of competition on the transfer of energy in an ecosystem. ■ Make predictions about the effects of removing a biotic factor from a habitat.	■ Recognize the biotic and abiotic factors that make up the atmosphere, biosphere, geosphere, and hydrosphere. ■ Make a claim about the interactions between the four spheres of Earth. ■ Use the water cycle as a model to describe the interdependence of Earth's spheres. ■ Construct an ecocolumn to model an ecosystem that contains terrestrial and aquatic habitats. ■ Analyze and draw conclusions about the cycling of energy in an ecosystem that includes terrestrial and aquatic habitats.	■ Identify human needs and human actions used to meet these needs. ■ Use readings to investigate human impact, and draw conclusions about the effect of human behaviors on the cycling of energy in an ecosystem. ■ Analyze images for evidence of human impact. ■ Make connections between human impact and the water cycle. ■ Simulate water pollution by using ecocolumns to draw conclusions about the effects of pollution on an ecosystem.
	↓ Habitats include a diverse variety of biotic factors that depend on one another. ↓ Food webs are used to model the complex energy transfers that occur within an ecosystem. ↓ Biotic factors compete for access to resources. ↓ Removing an entire species from an ecosystem will affect other biotic factors. ↓ Energy, originating from the Sun, is cycled through an ecosystem.	↓ In order for an ecosystem to sustain life, it must have ample resources (food, water, shelter, air). ↓ Earth is composed of four spheres: atmosphere, biosphere, geosphere, and hydrosphere. ↓ An ecosystem relies on the interaction of Earth's spheres to obtain the resources it needs to exist. ↓ The water cycle employs all four of Earth's spheres to provide for biotic factors. ↓ Ecocolumns work as models to simulate the cycling of energy and resources in an ecosystem.	↓ Humans are biotic factors that rely on food, water, air, and shelter to grow, reproduce, and survive. ↓ Humans compete with other biotic factors for resources. ↓ Humans' use of technology, fossil fuels, and agriculture may have negative impacts on Earth's spheres and other biotic factors. ↓ Human activities can impact natural cycles, such as the water cycle. ↓ Water pollution can have immediate or long-term effects on the cycling of energy in an ecosystem.

Matter and Energy in Ecosystems

Unit Anchoring Phenomenon

Energy is what drives activity, growth, repair, and reproduction for all living things. Students understand that they eat food to fuel their activities, like sports or studying, but they may not realize that their bodies are in constant need of energy. All living things require an energy source to survive. The anchoring phenomenon for *Matter and Energy in Ecosystems* is identifying the ways in which living things obtain energy and how they use that energy.

LESSON 6

INVESTIGATIVE PHENOMENA

It's becoming more common to find composting bins in people's yards. You can compost items such as hair, eggs shells, coffee grounds, cotton fabric, fruit and vegetable peels, shredded paper, and the contents of your vacuum cleaner. Research has found that people who plant gardens using homemade compost have more success than those who use store-bought fertilizer. However, it is important to choose carefully the items that go in to a compost bin. Not all trash is good for composting. What does this make you wonder?

OBJECTIVES

- Analyze patterns of human behavior to identify negative effects on the ecosystem.
- Develop and organize potential solutions to decrease harmful human impact.
- Present ideas to classmates and evaluate the effectiveness of solutions.

SCAFFOLDING
Students should know:

- Human activity can have negative and positive effects on an ecosystem.
- Consistently negative impacts of human actions can have permanent effects on the health of the ecosystem.
- Developing solutions to limit negative human impact will have beneficial effects on Earths' spheres and on other biotic factors.

NOTES

Earth and Space Systems

Unit Overview

Systems of matter and energy are present around Earth and across space. Interactions within and between these systems produce observable and predictable patterns—night and day, seasons, tides, weather and climate. Earth is composed of interconnected systems and is also part of a larger system in space. In the five lessons in *Earth and Space Systems*, students explore the interaction between Earth's systems and its role as part of larger systems. Students explore these concepts through investigation, discussion, and problem-solving. Students practice making observations and predictions, providing claims, evidence and reasoning, and evaluating problems and solutions.

Unit Anchoring Phenomenon

Systems of matter and energy are present around Earth and across space. Interactions within and between these systems produce observable and predictable patterns—night and day, seasons, tides, weather and climate. Earth is composed of interconnected systems and is also part of a larger system in space. The anchoring phenomenon for *Earth and Space Systems* is recognizing patterns that can explain the interconnectedness of the systems on Earth and in space.

	LESSON 1	LESSON 2
INVESTIGATIVE PHENOMENA	The Sun shines through your window early in the morning, and it wakes you up. You step outside and see the Moon high in the sky. You go through your day, and then you watch the Sun set on the horizon. The night sky with the Moon and stars begins to emerge. The next morning, the pattern repeats. What does this make you wonder?	If you go outside on a clear night, you can see stars, the Moon, airplanes, and satellites moving across the sky. At different times during the night, star patterns and the Moon are observed in different positions. What does this make you wonder?
OBJECTIVES	■ Begin building an age-appropriate understanding about Earth's roles in space systems. ■ Compare the sizes of the planets in our solar system and the distances of those planets from the Sun and from each other. ■ Explain how the pull of gravity impacts Earth's shape and path around the Sun. ■ Construct an argument to support concepts related to gravity.	■ Use a model to investigate the apparent brightness of stars. ■ Construct an argument to compare the apparent brightness of stars. ■ Investigate patterns in the nighttime sky to describe patterns in the rotation and revolution of Earth. ■ Describe the rotation and revolution of Earth by investigating patterns in the daytime and nighttime skies. ■ Collect and analyze data to provide evidence for the Sun's apparent movement across the sky.
SCAFFOLDING Students should know:	↓ A system is a group of parts that work together. ↓ Earth is a part of large space systems. ↓ The shapes and orbits of planets and their satellites are caused by the constant pull of gravity.	↓ Our Sun is a star, and it is the only star in our solar system. ↓ The apparent brightness of a star viewed from Earth can be affected by distance in the sky. ↓ Earth's rotation causes the pattern of daytime and nighttime and the patterns of change in the positions of stars in the sky. ↓ Shadows can be used to investigate the relationship between the Earth's rotation and the position of the Sun in the sky.

	LESSON 3	LESSON 4	LESSON 5
	The sky changes. In winter, it can get dark very early, almost as soon as you get home from school. In spring, the Sun stays out longer into the evening. Even the Moon looks different every week. What does this make you wonder?	You are out for a hike. You come to a clearing and observe your surroundings. You notice there is a stream running through the clearing. Trees and other plants are growing near the stream. You see birds wading in the water at one end of the stream, and you notice small insects on the water's surface. Some children are playing on the rocky outcrops at the other end of the stream. What does this make you wonder?	You know that Earth is a unique planet. It has a diversity of life that exists in a delicate balance with other aspects of our world, including water, mountains, air, and the cities we live in. Litter, pollution, fossil fuels, droughts, wildfires, endangered species, and climate change all threaten this delicate balance. What does this make you wonder?
	■ Construct models to demonstrate the connections in the Sun-Earth-Moon system. ■ Model how Earth's revolution contributes to seasons. ■ Graph and analyze data to provide evidence for seasonal changes in daylight. ■ Construct a model of the phases of the Moon based on the movement of the Moon around Earth and the location of the Sun. ■ Identify patterns, such as Moon phases and tides, to provide evidence for the interaction of the Earth-Moon system.	■ Identify Earth's major systems and the characteristics of each. ■ Create a model to describe how Earth's systems interact. ■ Use a model and create a graph to illustrate the distribution of water on Earth.	■ Describe how people affect Earth's systems and how people work to protect them. ■ Discuss ways that communities use science ideas and knowledge to help protect Earth's resources and environments. ■ Review unit content by developing questions to assess peers.
	↓ The Sun, Earth, and Moon are an interconnected system. ↓ Earth's tilt on its axis and its position in its orbit around the Sun influence seasonal patterns. ↓ Earth and the Moon are also an interconnected system. ↓ Patterns in the Moon's phases can be observed as the Moon orbits Earth. Repeating patterns can be predicted. ↓ Tides are the periodic rise and fall of the ocean. Tidal patterns are influenced primarily by the gravitational pull of the Moon.	↓ Earth itself has interconnected systems, the atmosphere, biosphere, geosphere, hydrosphere. ↓ The majority of water on Earth is salt water and is found in the oceans. ↓ Most of the water available as freshwater is stored in glaciers and ice caps.	↓ Local communities can use scientific ideas to protect natural resources. ↓ Local communities can use scientific understanding of interactions between systems to help protect their environment. ↓ Humans depend on and can influence Earth's systems.

NOTES

Building Blocks of Science 3D—The Total Package

Hands-on + Digital + Print
One All-Inclusive Price

Hands-on materials are always included—not an extra purchase

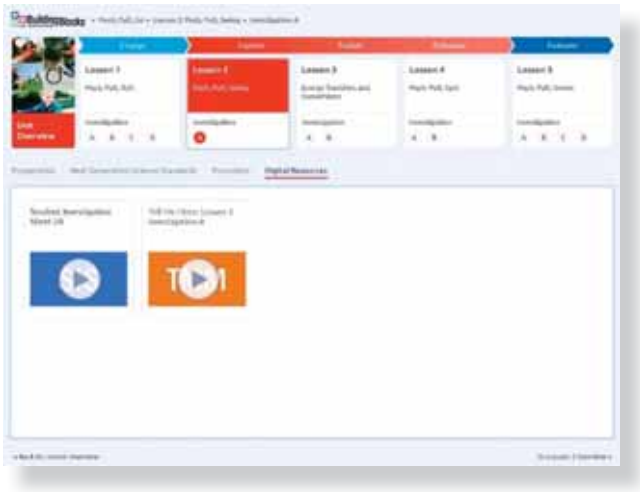
The Right Blend of Hands-On Investigation and Technology

Along with hands-on learning, Building Blocks of Science 3D provides digital resources to enhance the classroom experience, offering an additional method of delivering content and support for teachers.

Support for Teachers

Everything you need to teach the lesson

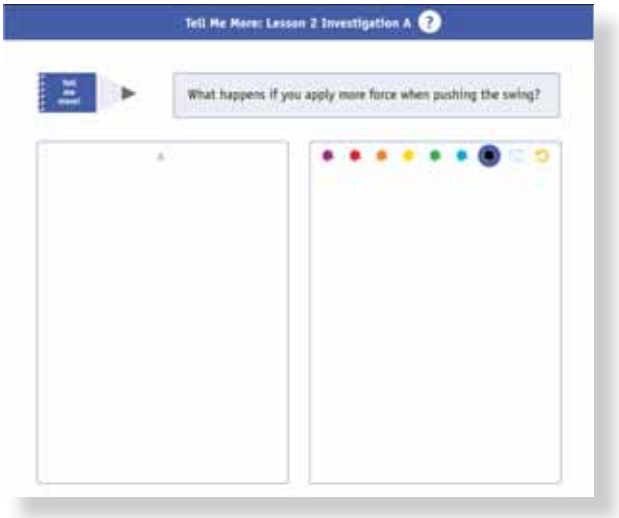
- Identification of where a lesson falls within the **5E Learning Cycle**
- Preparation—Includes investigation overview, materials list, and step-by-step teacher preparation instructions
- **NGSS Standards**—Includes the PEs, DCIs, SEPs, and CCCs that will be addressed within the investigation
- **Lesson Procedure**—Step-by-step instruction for each investigation within a lesson
- **Digital Resources**—All the digital resources available in one place, by lesson and by individual investigations within each lesson



Digital resources by lesson

Everything you need to teach ALL your students

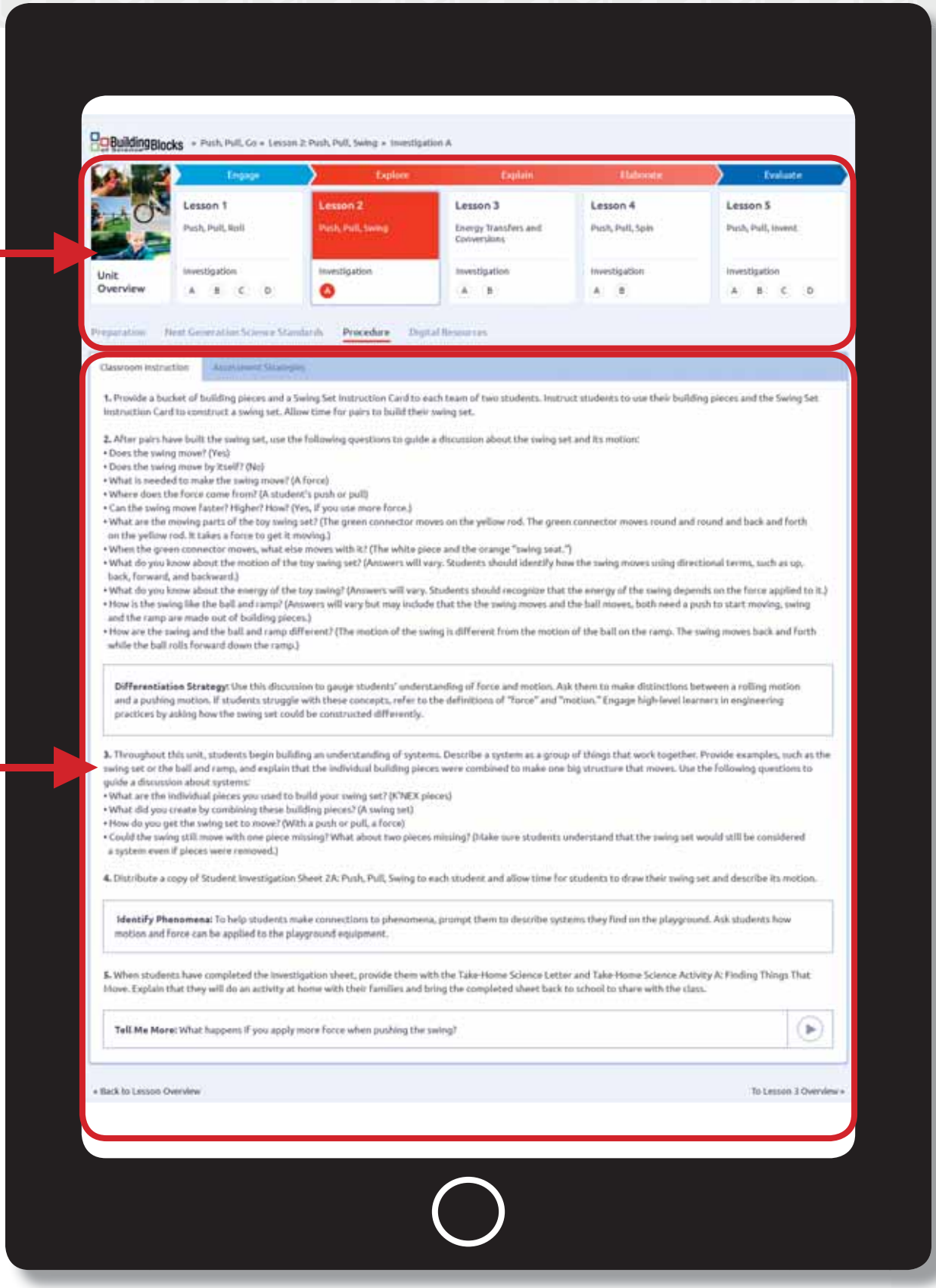
- Step-by-step instruction including guiding questions and anticipated responses
- Differentiation strategies at point of use within each investigation
- **Identify Phenomena** provides teachers with prompts to help students make connections to phenomena addressed within an investigation
- Assessment Strategies including **Tell Me More** formative assessment to help gauge student understanding



Tell Me More, a formative assessment strategy

For a closer look, visit:

www.carolina.com/bbs3dreview


BuildingBlocks
» Push, Pull, Go » Lesson 2: Push, Pull, Swing » Investigation A
Engage
Explore
Explain
Elaborate
Evaluate
Lesson 1
Push, Pull, Roll
Lesson 2
Push, Pull, Swing
Lesson 3
Energy Transfers and Conversions
Lesson 4
Push, Pull, Spin
Lesson 5
Push, Pull, Invent
Unit Overview
Investigation
A B C D
Preparation
Next Generation Science Standards
Procedure
Digital Resources
Classroom Instruction
1. Provide a bucket of building pieces and a Swing Set Instruction Card to each team of two students. Instruct students to use their building pieces and the Swing Set Instruction Card to construct a swing set. Allow time for pairs to build their swing set.
2. After pairs have built the swing set, use the following questions to guide a discussion about the swing set and its motion:
• Does the swing move? (Yes)
• Does the swing move by itself? (No)
• What is needed to make the swing move? (A force)
• Where does the force come from? (A student's push or pull)
• Can the swing move faster? Higher? How? (Yes, if you use more force.)
• What are the moving parts of the toy swing set? (The green connector moves on the yellow rod. The green connector moves round and round and back and forth on the yellow rod. It takes a force to get it moving.)
• When the green connector moves, what else moves with it? (The white piece and the orange "swing seat.")
• What do you know about the motion of the toy swing set? (Answers will vary. Students should identify how the swing moves using directional terms, such as up, back, forward, and backward.)
• What do you know about the energy of the toy swing? (Answers will vary. Students should recognize that the energy of the swing depends on the force applied to it.)
• How is the swing like the ball and ramp? (Answers will vary but may include that the the swing moves and the ball moves, both need a push to start moving, swing and the ramp are made out of building pieces.)
• How are the swing and the ball and ramp different? (The motion of the swing is different from the motion of the ball on the ramp. The swing moves back and forth while the ball rolls forward down the ramp.)
Differentiation Strategy: Use this discussion to gauge students' understanding of force and motion. Ask them to make distinctions between a rolling motion and a pushing motion. If students struggle with these concepts, refer to the definitions of "force" and "motion." Engage high-level learners in engineering practices by asking how the swing set could be constructed differently.
3. Throughout this unit, students begin building an understanding of systems. Describe a system as a group of things that work together. Provide examples, such as the swing set or the ball and ramp, and explain that the individual building pieces were combined to make one big structure that moves. Use the following questions to guide a discussion about systems:
• What are the individual pieces you used to build your swing set? (K'NEX pieces)
• What did you create by combining these building pieces? (A swing set)
• How do you get the swing set to move? (With a push or pull, a force)
• Could the swing still move with one piece missing? What about two pieces missing? (Make sure students understand that the swing set would still be considered a system even if pieces were removed.)
4. Distribute a copy of Student Investigation Sheet 2A: Push, Pull, Swing to each student and allow time for students to draw their swing set and describe its motion.
Identify Phenomena: To help students make connections to phenomena, prompt them to describe systems they find on the playground. Ask students how motion and force can be applied to the playground equipment.
5. When students have completed the investigation sheet, provide them with the Take-Home Science Letter and Take-Home Science Activity A: Finding Things That Move. Explain that they will do an activity at home with their families and bring the completed sheet back to school to share with the class.
Tell Me More: What happens if you apply more force when pushing the swing?
« Back to Lesson Overview
To Lesson 3 Overview »

Digital Components to Support Instruction and Assessment

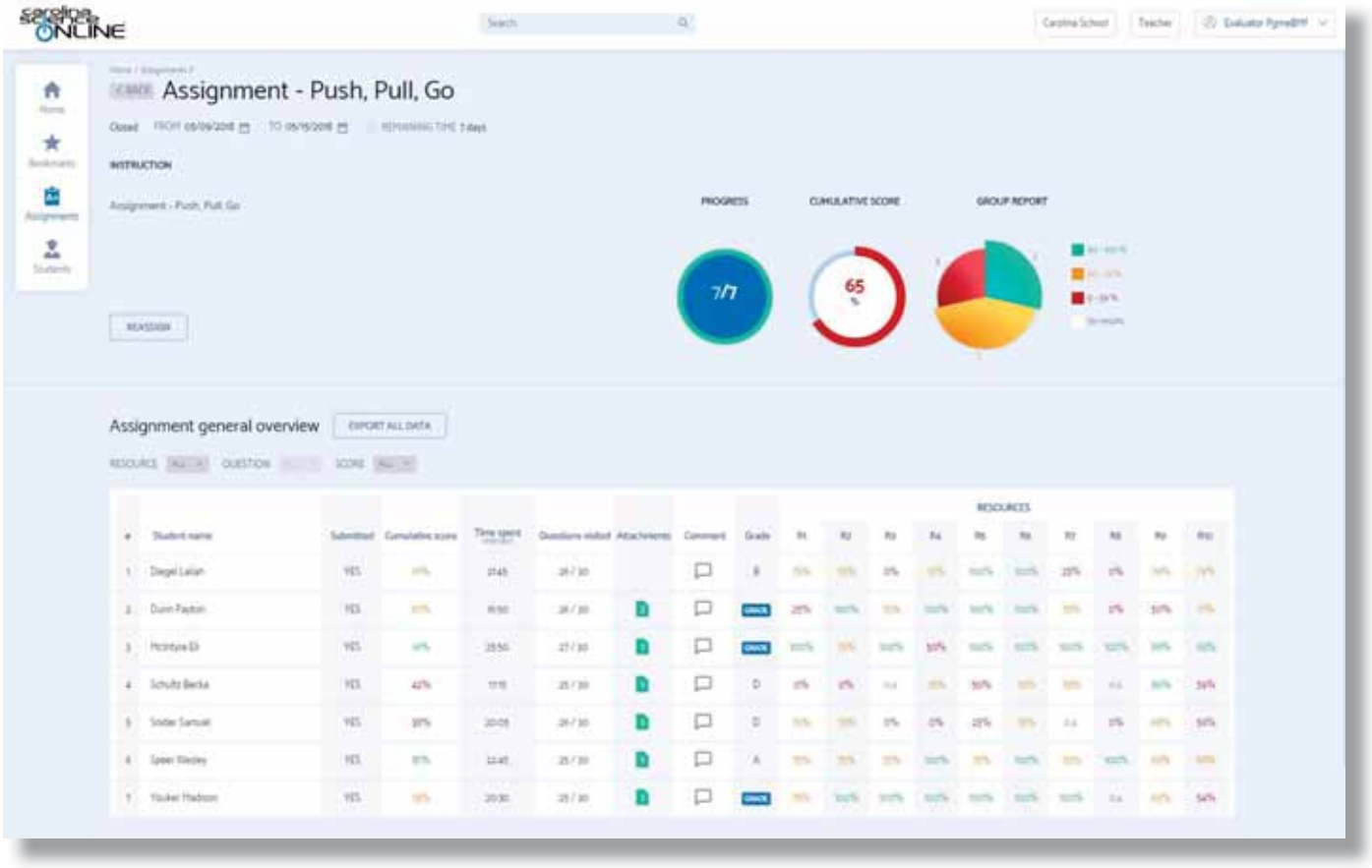
For the Teacher—Customizable Digital Planning at Your Fingertips

Blocks of Science 3D goes beyond just providing you access to your content. You can also:

- Use the assignment management system to create and grade custom assignments for classes and individual students to help differentiate instruction
- Create customizable bookmarks that include your student and instruction resources as well as URL links, PDF files, PowerPoint® presentations, and video files

The assignment management system dashboard allows you to:

- Track the progress of your classes and individual students
- See student assignment results for the class at a glance and by individual student in detail
- Automatically grade close-ended questions (e.g., multiple choice, matching, fill-in-the-blank)
- Adjust student grades based on individual student performance and open-ended responses
- Assign remediation to student groups that need additional support or enrichment to groups that need a challenge

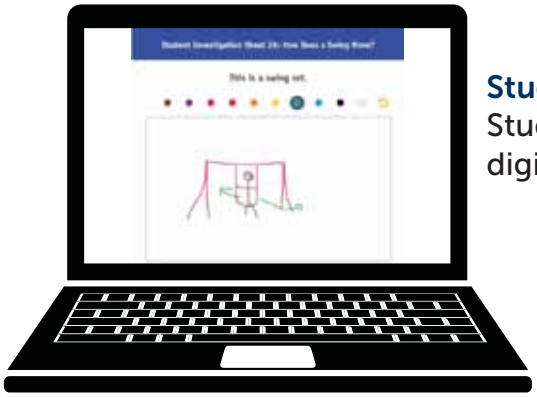


Digital components for students enhance and deepen student understanding, differentiate learning, and provide multiple modalities for delivering information.

"Digital Tips" take the guesswork out of integrating simulations and interactive whiteboard activities.

Simulations: Flexible enough to be used to introduce, support, or review a topic or concepts. Simulations are manipulative and provide a visual for differentiation.

Interactive Whiteboard Activities: With typing and drawing capabilities, IWB activities bring investigation-aligned classroom charts to life and are perfect for individual student review.



Student Investigation Sheets:
Students record their observations and data digitally when completing investigations.

Interactive Literacy Readers:
These enhanced versions of the printed student readers include check-for-understanding questions and animations to support the concepts covered in the text, enforce literacy skills, and provide additional practice.

NOTES

NOTES

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Learning Framework

Kindergarten	**Push, Pull, Go** *K-PS2-1; K-PS2-2; K-2-ETS1-1; K-2-ETS1-2*	**Living Things and Their Needs** *K-LS1-1; K-ESS2-2; K-ESS3-1; K-ESS3-3; K-2-ETS1-2*	**Weather and Sky** *K-PS3-1; K-PS3-2; K-ESS2-1; K-ESS3-2; K-2-ETS1-1; K-2-ETS1-2*
1st Grade	**Light and Sound Waves** *1-PS4-1; 1-PS4-2; 1-PS4-3; 1-PS4-4; K-2-ETS1-1; K-2-ETS1-2*	**Exploring Organisms** *1-LS1-1; 1-LS1-2; 1-LS3-1; K-2-ETS1-2*	**Sky Watchers** *1-ESS1-1; 1-ESS1-2*
2nd Grade	**Matter** *2-PS1-1; 2-PS1-2; 2-PS1-3; 2-PS1-4; K-2-ETS1-1; K-2-ETS1-2*	**Ecosystem Diversity** *2-LS2-1; 2-LS2-2; 2-LS4-1; K-2-ETS1-2; K-2-ETS1-3*	**Earth Materials** *2-PS1-1; 2-ESS1-1; 2-ESS2-1; 2-ESS2-2; 2-ESS2-3; K-2-ETS1-1; K-2-ETS1-2*
3rd Grade	**Forces and Interactions** *3-PS2-1; 3-PS2-2; 3-PS2-3; 3-PS2-4; 3-5-ETS1-1; 3-5 ETS1-2*	**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; 3-5-ETS1-2*	**Weather and Climate Patterns** *3-ESS2-1; 3-ESS2-2; 3-ESS3-1; 3-5-ETS1-2*
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; 3-5 ETS1-2; 3-5-ETS1-3*	**Plant and Animal Structures** *4-LS1-1; 4-LS1-2; 4-PS4-2; 3-5-ETS1-2*	**Changing Earth** *4-ESS1-1; 4-ESS2-1; 4-ESS2-2; 4-ESS3-2; 3-5-ETS1-2*
5th Grade	**Structure and Properties of Matter** *5-PS1-1; 5-PS1-2; 5-PS1-3; 5-PS1-4; 3-5-ETS1-2*	**Matter and Energy in Ecosystems** *5-PS3-1; 5-LS1-1; 5-LS2-1; 5-ESS2-1; 5-ESS3-1; 3-5-ETS1-3*	**Earth and Space Systems** *5-PS2-1; 5-ESS1-1; 5-ESS1-2; 5-ESS2-1; 5-ESS2-2; 5-ESS3-1; 3-5-ETS1-2*

Phenomenon-based investigations with digital support in 30-minute lessons!

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