GRADE 1

Building Blocks OF SCIENCE™ | 3D

Sky Watchers

Program Highlights and Lesson Sampler

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

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Inside this sampler, you will find:

Sky Watchers

Teacher's Guide

3rd Edition

Building Blocks OF SCIENCE™ | 3D

Kit Materials

Material	Quantity Needed from Kit	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Basalt rock sample	10				■	
Clip connector	7	■	■			
Flashlight	6		■		■	■
Large sphere	7		■	■	■	■
Literacy Reader: *Sky Watchers* (below grade level)	1	■	■	■	■	■
Literacy Reader: *Sky Watchers* (on grade level)	1	■	■	■	■	■
Piece of chalk	6	■				
Rod	7	■	■	■		
Ruler, 30 cm	6	■				
Small sphere	1				■	■
Sunrise and Sunset Card Set	1			■		
Wheel	7	■	■	■		

* The below-grade literacy reader is distinguished from the on-grade literacy reader by a yellow dot near the bottom left corner of the back cover.

Needed But Not Supplied Materials

Material	Quantity Needed	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Art supplies (such as markers, construction paper, star stickers, tissue paper, pipe cleaners, sticky notes, and foil)						■
Black permanent marker	1		■			
Book or clipboard	24	■				
Chart paper or whiteboard		■	■	■	■	■
Colored pencils or crayons		■	■	■	■	■
Globe or world map	1			■		
Glue			■			■
Index card (optional)	3				■	
Large, sunlit concrete area outdoors	1	■				
Marker		■	■	■	■	■
Pair of scissors	25		■	■	■	■
Paper clip	12				■	
Paper fastener	25		■	■		
Paper plate or piece of cardstock	1		■			
Projection system		■				
Roll of tape					■	■
Rubber band	1		■			
Science notebook	24	■	■	■	■	■
Sheet of white paper	1			■	■	

NOTES

Unit Overview: *Sky Watchers*

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.

Students begin by drawing upon previous knowledge to discuss what they know about objects in the sky. They predict and then observe objects they can see in the daytime sky. To investigate objects in the nighttime sky, students complete a Take-Home Science Activity in which they record observations for one week. These nighttime observations are compared with students' daytime observations. To further investigate patterns, students use a shadow stick to observe how shadows change over the course of the day and explain how changing shadows are related to Earth's rotation. Students compare the number of daylight hours over the course of a year to look for seasonal patterns and connect this to Earth's revolution. Students use models to further discuss seasonal patterns and the Sun-Earth-Moon system. In the last lesson, students work in groups to design a model to explain a specific concept from the unit. Each group shares its model with the class to explain what they learned and as a way of reviewing the unit content in preparation for the summative assessments. As a culminating activity, students revisit the class chart from the first lesson and evaluate what they have learned about objects in the sky throughout the unit and complete a written assessment.

Credit: David M. Schrader/Shutterstock.com

Next Generation Science Standards

The Building Blocks of Science unit *Sky Watchers* integrates process skills as defined by the Next Generation Science Standards (NGSS).

Performance Expectations

- **1-ESS1-1:** Use observations of the sun, moon, and stars to describe patterns that can be predicted.
- **1-ESS1-2:** Make observations at different times of year to relate the amount of daylight to the time of year.

Disciplinary Core Ideas

- **ESS1.A:** The Universe and Its Stars
- **ESS1.B:** Earth and the Solar System

Science and Engineering Practices

- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Obtaining, Evaluating, and Communicating Information

Crosscutting Concepts

- Patterns
- Scale, Proportion, and Quantity

Important Terms Related to Science Instruction

Science and science instruction rely on specific terminology. Many scientific terms are likely to be new or unfamiliar to students. Below is a list of terms that are used throughout Building Blocks of Science units. Each is followed by a student-friendly definition to help students understand the meaning of the term in a scientific context. A brief description of how Building Blocks employs each of these scientific skills and tools is intended to help you help students model the behavior of scientists.

- **Analyze:** To examine. *Students are asked to examine (analyze) data they collect to help develop their understanding of core ideas and crosscutting concepts.*
- **Claim:** A statement. *To help students develop their understanding of concepts, they will make statements (claims) concerning various scenarios based on observations and data they have collected*.
- **Classify:** To arrange things in groups or categories. *As students investigate and collect data, they will arrange (classify) their data to look for patterns that may help to support claims that they make.*
- **Communicate:** To share information. *Students are continually asked to share experiences, questions, observations, data, and evidence (communicate) within their groups and with the class as a whole. Communication takes many forms, including discussions, the creation of models, designing solutions to problems, and formal presentations.*
- **Compare:** To note similarities and differences among things. *Like classifying, noting how things are alike and different (comparing) is another skill that students will use to analyze their data and look for patterns, cause and effect relationships, and other crosscutting concepts.*
- **Conclude:** To arrive at an opinion by reasoning. *The scientific practices of conducting investigations, collecting and analyzing evidence, and sharing and discussing information lead students to form opinions based on reasoning (to conclude). The conclusions that students develop during the unit will help you assess their understanding of the unit's core ideas.*
- **Evaluate:** To form an idea based on evidence. *Throughout each unit, students will look at (evaluate) the observations and data they collect and discuss their conclusions with classmates in order to form ideas about concepts based on evidence.*
- **Evidence:** Information to show whether something is true or valid. *Students will use the observations and data (evidence) they collect to support claims they make as being valid or true.*
- **Explain:** To describe in detail. *Throughout investigations, students will analyze the data they collect, make claims supported by evidence, and share their information with one another to make sense of (explain) core ideas and phenomena.*
- **Investigate:** To use a standard process to discover facts or information. *Students will carry out standard processes (investigate), sometimes developing those processes themselves, to discover facts or information related to scientific ideas.*
- **Model:** A representation of an object or idea. *Using a representation of an object or idea (a model) helps student scientists communicate and evaluate ideas regarding phenomena. Students will develop many types of models during a unit, including drawings, physical models, diagrams, graphs, and mathematical representations.*

- **Phenomena:** Occurrences or events that can be observed and cause one to wonder and ask questions. *Presenting occurrences or events (phenomena) related to the science concepts being studied engages students through real-world events and ensures common experiences for all students. Presenting phenomena also allows students to develop their own questions and take ownership of their learning.*

- **Predict:** To develop anticipated results of an event based on prior experience or knowledge. *Students are asked to anticipate (predict) the results of events based on experience and data from prior events.*

- **Reasoning:** Thinking about something in a logical way. *Students are asked to make claims, support them with evidence, and explain their claims in a logical fashion (with reasoning). Making claims supported with evidence and reasoning is scientific, or evidence-based, argumentation.*

- **Record:** To write down. *During investigations, students will keep track of their observations (record) by drawing or writing in their science notebooks or on student investigation sheets.*

- **Variable:** A factor that is able to be changed. *As students conduct investigations, they will consider which factors can be changed or manipulated (variables) to test something during the investigation.*

The 5E Instructional Model

Building Blocks of Science uses a constructivist approach to learning by encouraging students to build upon existing ideas using the 5Es. This instructional model cycles through five phases:

- **Engage:** Students draw upon prior knowledge to make connections to a new concept or topic.
- **Explore:** Students are provided with an activity related to a concept or topic and are encouraged to make claims and observations, collect evidence, and ask questions.
- **Explain:** Students use observations and discussion to construct an explanation for a concept or topic they are studying.
- **Elaborate:** Students must draw upon their experiences and apply their knowledge to a new situation in order to demonstrate understanding.
- **Evaluate:** Students assess their knowledge and review what they have learned.

In each Building Blocks of Science unit, students begin with an engaging pre-assessment activity, which allows the teacher to gauge levels of previous knowledge. The following lessons cycle through the explore, explain, and elaborate phases, and then in the final lesson, students are evaluated using project-based and summative assessments.

Incorporating Phenomena

Building Blocks of Science uses phenomena, or observable occurrences, to encourage students to develop questions that will lead to deeper understanding of the core ideas investigated in each unit and to support inquiry-based learning. Each unit includes both an anchoring phenomenon and lesson-specific investigative phenomena.

The unit's anchoring phenomenon, introduced to students in the first lesson, serves as the main focus of the unit. The anchoring phenomenon is introduced through a descriptive narrative in the Teacher's Guide and supported visually by a short online video. This visual teaser of the anchoring phenomenon piques students' interest and helps them to think more deeply and to develop questions. Viewing the video again at the end of the unit prompts students to make connections between the anchoring phenomenon and its applications beyond the scope of the unit's investigations.

An investigative phenomenon is 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 its questions and addresses them based on the evidence they collected during the lesson investigations, making connections to the lesson's investigative phenomenon.

As students begin to develop a deeper understanding of the unit's core ideas, they begin to make sense of the phenomena introduced throughout the unit. Students draw connections between what they have learned and how it applies to the world around them. In the last lesson, students engage in a performance task in which they are challenged to synthesize their knowledge to make connections to the unit's anchoring phenomenon. Students may be asked to build a model or design a solution to a problem. When communicating their designs and findings to their classmates, students explain their reasoning using evidence-based claims and answer questions during their presentation.

Each unit's literacy and digital components provide examples of connections between a concept and a phenomenon and ask students to make their own. Teachers are encouraged to support these connections by selecting related articles and videos or by engaging the class in discussion. Teacher Tips within the Teacher's Guide suggest other opportunities to identify related phenomena.

Anchoring phenomenon videos kick off each unit

The Engineering Cycle

Building Blocks of Science incorporates an engineering design process to support the engineering, technology, and application of science (ETS) core idea outlined in the National Research Council's "A Framework for K–12 Science Education" (NRC, 2012, pp. 201–202). This ETS core idea has been brought into action through the NGSS ETS performance expectations, which allow students to practice systematic problem solving as they apply scientific knowledge they have acquired.

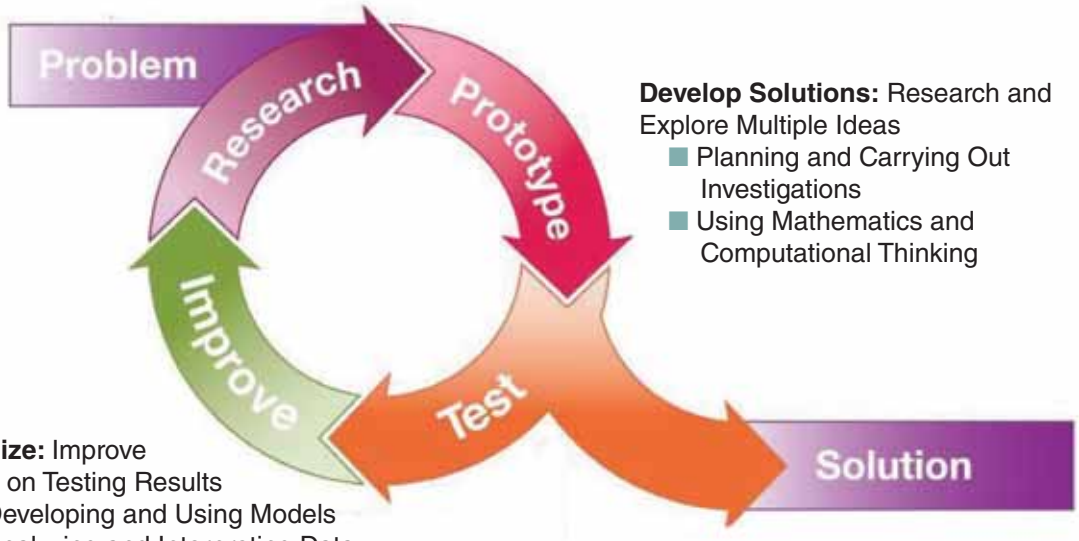
Through scientific engineering and design, students apply what they have learned to creatively solve real-world problems. This 21st-century skill encourages students to collaborate and exposes them to the idea that one problem can have multiple solutions.

An engineering design process can be thought of in three phases: defining a problem, developing solutions, and optimizing the design. Each phase can be correlated with NGSS Science and Engineering Practices as depicted in the graphic below.

Engineering Design Process

Define Problem: Identify Constraints and Criteria for Success

- Asking Questions and Defining Problems
- Obtaining and Evaluating Information



Develop Solutions: Research and Explore Multiple Ideas

- Planning and Carrying Out Investigations
- Using Mathematics and Computational Thinking

Optimize: Improve Based on Testing Results

- Developing and Using Models
- Analyzing and Interpreting Data

In each Building Blocks of Science unit, students employ this engineering cycle to assess their knowledge and build problem-solving skills. Depending on the activity, students may create a model, develop an experiment, or redesign an existing product. To increase student engagement, relate the engineering process to a task, a phenomenon, or a career.

Sensemaking: Developing Claims Supported with Evidence and Reasoning

Scientific argumentation, or evidence-based argumentation, is defined as making scientific explanations (claims) using empirical data (evidence) to justify an argument (reasoning). Scientists use this type of argumentation to make sense of phenomena and refine their ideas, explanations, and experimental designs. In the classroom, students should be introduced to scientific argumentation to guide them in sensemaking, or building an understanding of phenomena based on evidence gained through observations, investigations, and data analysis. Through sensemaking, students refine and revise their understanding as new evidence is acquired and information is shared through class discussions.

Building Blocks of Science units offer multiple opportunities for students to make sense of scientific concepts by developing claims and supporting their claims with evidence and reasoning. At the start of an investigation, students are presented with a question related to a scientific concept. To make sense of a phenomenon or concept, students must draw upon their previous knowledge and experiences to develop a statement or conclusion that answers the question. To support that claim, students must provide relevant and specific data as evidence. This data may come from previous investigations, inference clues, texts, or class discussions. Students may even reference personal experience. Reasoning provides justification for why the selected evidence supports the claim. Relevant scientific principles should be incorporated into this reasoning. After the investigation, students should revisit their initial claims and determine if they are supported by newly gathered evidence. If the available evidence does not support students' initial claims, students should identify misunderstandings and present a claim that is supported.

To support students who struggle with scientific argumentation, ask them to use sentence frames such as "I think _____ because _____" to help with sensemaking. Explain that the first blank is the claim and the second blank is the evidence and reasoning.

Science Notebooks

Science notebooks are an integral part of the process of learning science because they provide a location for students to record their ideas, questions, predictions, observations, and data throughout the unit. The science notebook is used for notes, Tell Me More responses, diagrams, and outlines. Student investigation sheets can be glued, taped, or stapled into the science notebook as well.

Spiral notebooks are recommended and can be purchased inexpensively. If you choose to pre-assemble notebooks, consider including blank sheets of centimeter graph paper and plain paper for writing and drawing. It is recommended to create tabs for each lesson and to have students date each entry.

NOTE: Student investigation sheets use a specific numbering sequence to make it easier for students and teachers to identify them. The first number calls out the lesson, and the letter references the investigation. For example, Student Investigation Sheet 1A supports Investigation A of Lesson 1. If there are multiple student investigation sheets in one investigation, a second number will indicate the order of use (Student Investigation Sheet 2A.1, 2A.2, etc.).

Take-Home Science Activities

Take-Home Science activities are included in each unit and are called out within the related lesson. These activities reflect the science concepts and vocabulary that students are learning about and extend that learning to the home.

A reproducible letter explains how Take-Home Science activities work. Topic-specific activity sheets include directions for the parent, simple background information, and a space for the student to record observations or data. It is recommended that students share their findings and compare experiences as a class after completing the activity. Take-Home Science resources are found with the student investigation sheets at the end of the lesson in which they are assigned.

Assessment

Building Blocks of Science units provide assessment opportunities that correspond to specific lesson objectives, general science process skills, communication skills, and a student's ability to apply the concepts and ideas presented in the unit to new situations. The Teacher's Guide includes strategies for both formative and summative assessment. Each unit includes:

- **Pre-Unit Assessment and Post-Unit Assessment Opportunities:** The pre-unit assessment asks students to draw upon previous knowledge, allowing you to gauge their levels of understanding. The post-unit assessment touches upon the topics and concepts from the entire unit and evaluates students' learning. It is a beneficial practice to ask students to compare the pre-unit assessment and post-unit assessment activities to evaluate growth.

- **Formative Assessment Strategies:** At the end of each lesson, specific strategies are listed for each investigation. These include ways to utilize Student Investigation Sheets and Tell Me More questions as assessment tools. In lower grades, an Assessment Observation Sheet lists things to look for as you work with small groups of students.

- **Literacy and Digital Components:** These resources can be assigned to differentiate assignments and to assess student progress as needed.

- **General Rubric:** Appendix A includes a rubric that provides an expected progression of skills and understanding of science content. You can use these guidelines to assess students throughout the course of the unit.

- **Summative Assessment:** This unit-specific, cumulative assessment allows students to demonstrate their understanding of content presented by responding to questions in a variety of formats. Each question is aligned to performance expectations and provides insight on students' understanding of the concepts addressed. An answer key is provided, as well as a chart that indicates the performance expectation addressed by each question and lessons to revisit if remediation is required.

Additionally, there is a second end-of-unit assessment accessible only online. This digital summative assessment is **scenario-based** and touches upon all the standards from the unit. It includes both close-ended and open-ended questions.

Building Blocks of Science 3D—The Total Package

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

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

Navigating the Teacher's Guide

Phenomenon

NGSS Standard and 5E Alignment

Investigation Overview with Time Considerations

Vocabulary

Tell Me More Formative Assessment Questions

Teacher Tips and Differentiation Strategies


LESSON 3

Push, Pull, Tumble

LESSON ESSENTIALS

Performance Expectations
- K-PS2-1: Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.
- K-2-ETS1-2: Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Disciplinary Core Ideas
- PS2.A: Forces and Motion
- PS2.B: Types of Interactions
- ETS1.B: Developing Possible Solutions

Science and Engineering Practice
- Planning and Carrying Out Investigations

Crosscutting Concept
- Cause and Effect

Literacy Components
- *Push, Pull, Go* Big Book pgs. 6, 11–14
- Literacy Article 3A: Falling Tree

Digital Component[1]
- Simulation: Dominoes

[1]Accessible at Carolina Science Online

PHENOMENON

Read the investigative phenomenon aloud to the class. Encourage students to generate questions about what they hear. Keep track of students' questions on a class chart, or have students record the questions in their science notebooks. Refer to these questions at the end of the lesson and throughout the unit to support the unit's anchoring phenomenon.

Investigative Phenomenon for Lesson 3: 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. It is important to look before you slide! What does this make you wonder?

Anticipated Questions:
- Why can't you stop sliding?
- Why does your friend fall over?
- Why does your friend knock another person over

LESSON OVERVIEW

In the previous lessons, students built their knowledge of fo
by rolling balls and observing swinging. They learned that c
applied to a system will change how the system moves. In t
begin to understand that the motion of an object is also affe
Students learn about systems and use what they learn to e
of falling dominoes. In the next lesson, students will extend
systems to explore the spinning motion of a toy top. They w
pulling force of gravity and its effect on motion.

INVESTIGATION OVERVIEW

Investigation A: How Can I Make Dominoes Tumble?
Using dominoes, students explore the motion of tumbling and further investigate forces.
- Teacher Preparation: 10 minutes
- Lesson: 30 minutes

Investigation
System?
Students further
manipulating the
dominoes.
- Teacher Prep
- Lesson: 30 m

Cred

64 PUSH, PULL, GO


LESSON 3

MATERIALS
- Student
1 Science notebook*
1 Student Investigation Sheet 3B: *How Do Dominoes Move After a Push?*
- Team of two students
8 Dominoes
- Teacher
1 Student Investigation Sheet 3B: *How Do Dominoes Move After a Push?* (Teacher's Version)
Assessment Observation Sheet: Lesson 3

NOTE: A materials list for each investigation precedes the procedure within the lesson.

*These materials are needed but not supplied.

OBJECTIVES
- 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).

VOCABULARY
- Force
- Gravity
- Motion

TEACHER PREPARATION

Investigation A

1. Make a copy of Assessment Observation Sheet: Lesson 3 for yourself. During the investigations in this lesson, use the questions and prompts on this sheet to formatively assess students as they work.

2. Find an online video that shows large, complex domino setups. It will be helpful if the video uses dominoes similar to the ones students will use in the investigation.

3. Have eight dominoes from the kit available for each team of two students.

Investigation B

1. Have one copy of Student Investigation Sheet 3B: *How Do Dominoes Move After a Push?* for each student.

2. Have eight dominoes from the kit available for each team of two students.

3. Have your Assessment Observation Sheet handy to continue formatively assessing students.

Figure 3.1:

LESSON 3

Investigation B

WHAT IS A SYSTEM?

MATERIALS
- Student
1 Science notebook*
1 Student Investigation Sheet 3B: *How Do Dominoes Move After a Push?*
- Team of two students
8 Dominoes
- Teacher
1 Student Investigation Sheet 3B: *How Do Dominoes Move After a Push?* (Teacher's Version)
Assessment Observation Sheet: Lesson 3

*These materials are needed but not supplied.

1. Review the term "system" with students by referencing the swing or the ramp and ball. Ask students to make connections to the dominoes. Ask:
- What are the parts of this system? *(Eight dominoes)*
- What force causes changes in this system? *(A push)*
- What changes occur? *(A force causes the dominoes to tumble over.)*
- Do you think the system still work if you take away one part of it? Make a prediction.

2. Instruct students to use their dominoes to test their predictions. Allow time for pairs to set up their dominoes and then test what will happen if one domino is removed from the middle of the system. Assist students who appear to be struggling. When all students have tested their predictions, ask:
- What happens to the motion in the system when pieces are removed? How do you know?
- What do you think would happen if you removed two dominoes? Make a prediction and try it.
- How does changing a system affect the way it moves?

3. Provide each student with a copy of Student Investigation Sheet 3B: *How Do Dominoes Move After a Push?* Allow time for students to draw what happens to the line of dominoes and to complete the sentence prompts. Answer any questions students have as they work.

How can you change how fast something tumbles?

Tell Me More!

Disciplinary Core Ideas
- PS2.A: Forces and Motion
- PS2.B: Types of Interactions
- ETS1.B: Developing Possible Solutions

Science and Engineering Practice
- Planning and Carrying Out Investigations

Crosscutting Concept
- Cause and Effect

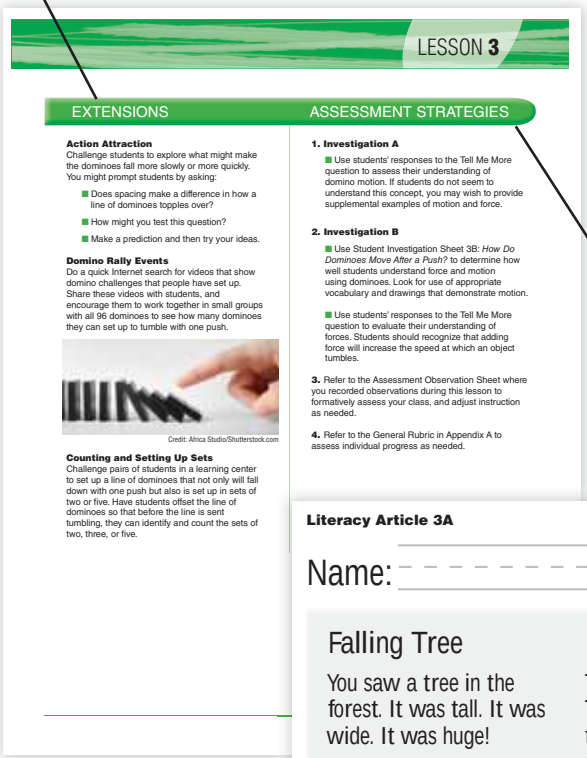
5Es
- Elaborate

Teaching Tip

Depending on the setup, some students' dominoes may continue to fall if they are very close together. If students appear to struggle with this concept, you may wish to lead a demonstration. Show what happens when you remove one of the middle dominoes, when you remove two dominoes that are side by side, and when you remove two dominoes from different locations.

LESSON 3 ■ PUSH, PULL, TUMBLE 69

Extensions



LESSON 3

EXTENSIONS

Action Attraction
Challenge students to explore what might make the dominoes fall more slowly or more quickly. You might prompt students by asking:

- Does spacing make a difference in how a line of dominoes topples over?
- How might you test this question?
- Make a prediction and then try your ideas.

Domino Rally Events
Do a quick Internet search for videos that show domino challenges that people have set up. Share these videos with students, and encourage them to work together in small groups with all 96 dominoes to see how many dominoes they can set up to tumble with one push.

Credit: Africa Studio/Shutterstock.com

Counting and Setting Up Sets
Challenge pairs of students in a learning center to set up a line of dominoes that not only will fall down with one push but also is set up in sets of two or five. Have students offset the line of dominoes so that before the line is sent tumbling, they can identify and count the sets of two, three, or five.

ASSESSMENT STRATEGIES

1. Investigation A

- Use students' responses to the Tell Me More question to assess their understanding of domino motion. If students do not seem to understand this concept, you may wish to provide supplemental examples of motion and force.

2. Investigation B

- Use Student Investigation Sheet 3B: *How Do Dominoes Move After a Push?* to determine how well students understand force and motion using dominoes. Look for use of appropriate vocabulary and drawings that demonstrate motion.
- Use students' responses to the Tell Me More question to evaluate their understanding of forces. Students should recognize that adding force will increase the speed at which an object tumbles.

3. Refer to the Assessment Observation Sheet where you recorded observations during this lesson to formatively assess your class, and adjust instruction as needed.

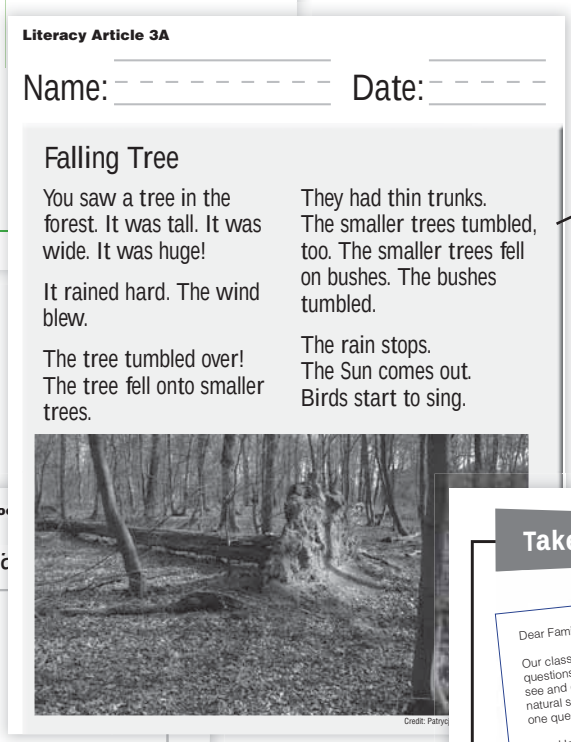
4. Refer to the General Rubric in Appendix A to assess individual progress as needed.

Additional Features

- Lesson Overview Charts
- Guide to Instructional Scaffolding
- Teacher Preparation
- Background Information
- NGSS Standards by Lesson
- Literacy and Digital Components
- Summative Assessment

Assessment Strategies

Literacy Articles



Literacy Article 3A

Name: _____ Date: _____

Falling Tree

You saw a tree in the forest. It was tall. It was wide. It was huge!

It rained hard. The wind blew.

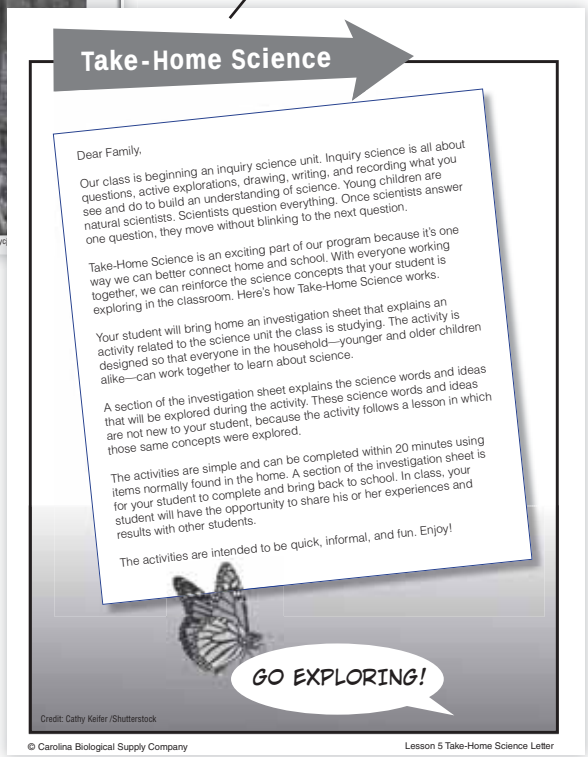
The tree tumbled over! The tree fell onto smaller trees.

They had thin trunks. The smaller trees tumbled, too. The smaller trees fell on bushes. The bushes tumbled.

The rain stops. The Sun comes out. Birds start to sing.

Credit: Patryc

Take-Home Science Activities



Take-Home Science

Dear Family,

Our class is beginning an inquiry science unit. Inquiry science is all about questions, active explorations, drawing, writing, and recording what you see and do to build an understanding of science. Young children are natural scientists. Scientists question everything. Once scientists answer one question, they move without blinking to the next question.

Take-Home Science is an exciting part of our program because it's one way we can better connect home and school. With everyone working together, we can reinforce the science concepts that your student is exploring in the classroom. Here's how Take-Home Science works.

Your student will bring home an investigation sheet that explains an activity related to the science unit the class is studying. The activity is designed so that everyone in the household—younger and older children alike—can work together to learn about science.

A section of the investigation sheet explains the science words and ideas that will be explored during the activity. These science words and ideas are not new to your student, because the activity follows a lesson in which those same concepts were explored.

The activities are simple and can be completed within 20 minutes using items normally found in the home. A section of the investigation sheet is for your student to complete and bring back to school. In class, your student will have the opportunity to share his or her experiences and results with other students.

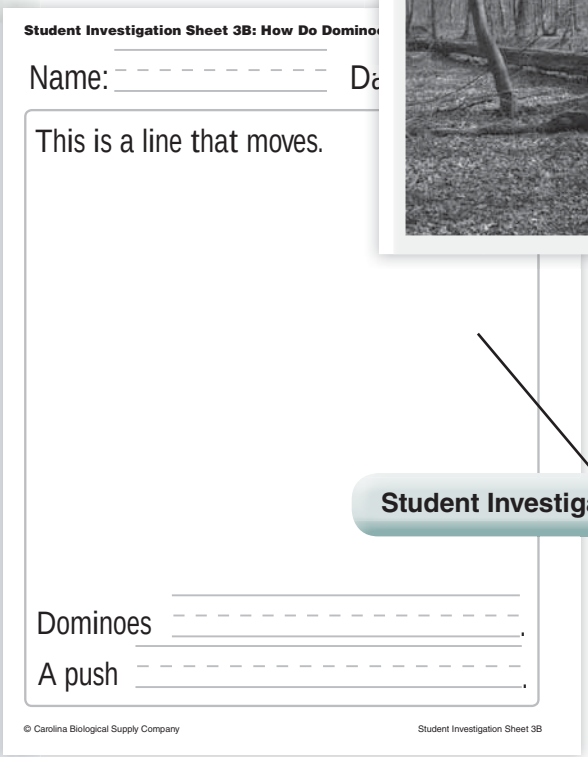
The activities are intended to be quick, informal, and fun. Enjoy!

GO EXPLORING!

Credit: Cathy Keifer /Shutterstock

© Carolina Biological Supply Company Lesson 5 Take-Home Science Letter

Student Investigation Sheets



Student Investigation Sheet 3B: How Do Domino

Name: _____ Da

This is a line that moves.

Dominoes _____.

A push _____.

© Carolina Biological Supply Company Student Investigation Sheet 3B

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.

Concepts build from one lesson to the next

	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.

NGSS correlations by lesson

Lesson 3: Sunrise, Sunset, and Seasons

Investigation Overview

Investigation A: What Are Seasons and What Causes Them?
5Es: Explain
As a class, students model and discuss the predictable pattern of Earths' revolution around the Sun and how it relates to seasonal patterns.
- **Teacher Preparation:** 15 minutes
- **Lesson:** 30 minutes

Tell Me More! The equator is an imaginary line that divides Earth in half. If it is winter north of the equator, what season is it south of the equator?

Investigation B: How Does Daylight Change During the Year?
5Es: Explore, Explain
Students plan and carry out an investigation to study patterns in sunrise and sunset at different times of the year and relate the amount of daylight to the time of year.
- **Teacher Preparation:** 15 minutes
- **Lesson:** 30 minutes

Tell Me More! Draw an outdoor activity you like to do when the days are longer. Label your picture with a month that has more daylight.

30-minute investigations fit into your busy day

Standards

Next Generation Science Standards Performance Expectation
- **1-ESS1-2:** Make observations at different times of year to relate the amount of daylight to the time of year.

Disciplinary Core Ideas
- **ESS1.A:** The Universe and Its Stars
- **ESS1.B:** Earth and the Solar System

Science and Engineering Practice
- Planning and Carrying Out Investigations

Crosscutting Concept
- Patterns

Language and Math Standards
Language Arts
- **L.1.1:** Conventions of Standard English
- **L.1.2.B:** Conventions of Standard English
- **L.1.2.E:** Conventions of Standard English
- **RF.1.1:** Print Concepts
- **RF.1.2:** Phonological Awareness
- **RF.1.3:** Phonics and Word Recognition
- **RF.1.4:** Fluency
- **SL.1.1:** Comprehension and Collaboration
- **SL.1.3:** Comprehension and Collaboration
- **SL.1.4:** Presentation of Knowledge and Ideas
- **SL.1.5:** Presentation of Knowledge and Ideas
- **SL.1.6:** Presentation of Knowledge and Ideas
- **W.1.2:** Text Type and Purposes
- **W.1.5:** Production and Distribution of Writing

Math
- **1.G.A.3:** Reason with shapes and their attributes.
- **1.MD.C.4:** Represent and interpret data.
- **1.NBT.B.2:** Understand place value.

Resources

Student Investigation Sheets
- Student Investigation Sheet 3A: *What Are Seasons and What Causes Them?*
- Student Investigation Sheet 3B: *How Does Daylight Change During the Year?*

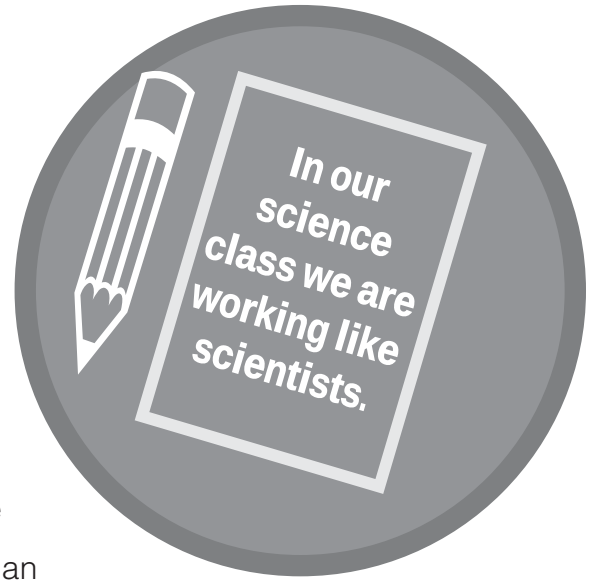
Literacy Components
- *Sky Watchers* Literacy Reader, pgs. 10–13
- Literacy Article 3B: Days of Change

Digital Component
- Interactive Whiteboard: Seasons
- Interactive Whiteboard: Our Plan to Investigate Daylight Patterns
- Interactive Whiteboard: Sunrise and Sunset Data
- Simulation: Earth's Revolution

Vocabulary
- Orbit
- Revolve
- Season
- Sunrise
- Sunset
- Tilt

Integrated ELA and math

Safety Contract



In science class, I will:

- ■ Listen to directions
- ■ Complete each step of the experiment
- ■ Look, feel, smell, and listen but never taste
- ■ Wait to begin until my teacher tells me
- ■ Wear safety goggles when my teacher tells me
- ■ Ask my teacher to approve any experiment I plan on my own or with classmates
- ■ Keep my hands away from my mouth and eyes as I work
- ■ Tie back long hair
- ■ Tuck in loose clothing
- ■ Keep my workstation neat
- ■ Put away materials after use
- ■ Follow all safety rules

I have read this contract and will follow these safety rules in science class.

Student's signature _____

Date _____

I have read this safety contract and understand what is expected of my child during science class.

Parent/Guardian's signature _____

Date _____

Note to Parent/Guardian:
Science materials and activities are chosen for safety and age appropriateness.

All lesson are anchored in phenomena

Sunrise, Sunset, and Seasons

LESSON ESSENTIALS

Performance Expectation
- **1-ESS1-2:** Make observations at different times of year to relate the amount of daylight to the time of year.

Disciplinary Core Ideas
- **ESS1.A:** The Universe and Its Stars
- **ESS1.B:** Earth and the Solar System

Science and Engineering Practice
- Planning and Carrying Out Investigations

Crosscutting Concept
- Patterns

Literacy Components
- *Sky Watchers* Literacy Reader, pgs. 10–13
- **Literacy Article 3B:** Days of Change

Digital Components‡
- **Interactive Whiteboard:** Seasons
- **Interactive Whiteboard:** Our Plan to Investigate Daylight Patterns
- **Interactive Whiteboard:** Sunrise and Sunset Data
- **Simulation:** Earth's Revolution

‡ Accessible at Carolina Science Online

VOCABULARY
- Orbit
- Revolve
- Season
- Sunrise
- Sunset
- Tilt

PHENOMENON
Read the investigative phenomenon aloud to the class. Encourage students to generate questions about what they hear. Keep track of students' questions on a class chart, or have students record the questions in their science notebooks. Refer to these questions at the end of the lesson and throughout the unit to support the unit's anchoring phenomenon.

Investigative Phenomenon for Lesson 3: 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?

Anticipated Questions:
- Do you notice the same things happening at certain times every year?
- Why are some days shorter and some days longer?
- What causes a tree to lose its leaves?

LESSON OVERVIEW
In the previous lesson, students used models to investigate Earth's rotation and how it relates to the predictable pattern of daytime and nighttime. In this lesson, students model Earth's revolution around the Sun and discuss seasons. Students plan and carry out an investigation to compare the patterns in the amount of daylight at various times of year. In the next lesson, students will investigate the patterns of the Moon and the Moon's phases.

INVESTIGATION OVERVIEW

Investigation A: What Are Seasons and What Causes Them?
As a class, students model and discuss the predictable pattern of Earths' revolution around the Sun and how it relates to seasonal patterns.
- **Teacher Preparation:** 15 minutes
- **Lesson:** 30 minutes

Investigation B: How Does Daylight Change During the Year?
Students plan and carry out an investigation to study patterns in sunrise and sunset at different times of the year and relate the amount of daylight to the time of year.
- **Teacher Preparation:** 15 minutes
- **Lesson:** 30 minutes

OBJECTIVES
- 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.

MATERIALS

Student
1 Science notebook*
1 Student Investigation Sheet 3A: *What Are Seasons and What Causes Them?*
1 Student Investigation Sheet 3B: *How Does Daylight Change During the Year?*
1 Pair of scissors*
1 Paper fastener*

Team of two students
4 Sunrise and Sunset Cards

Class
Colored pencils or crayons*

Teacher
1 Student Investigation Sheet 3B: *How Does Daylight Change During the Year?* (Teacher's Version)
1 Assembled Earth model* (from Lesson 2)
1 Sheet of white paper*
1 Sunrise and Sunset Card Set
Assessment Observation Sheet: Lesson 3
Chart paper or whiteboard*
Globe or world map*
Markers*

NOTE: A materials list for each investigation precedes the procedure within the lesson.

*These materials are needed but not supplied.

Credit: macastro67/Shutterstock.com

TEACHER PREPARATION

Investigation A

1. Make one single-sided copy of Student Investigation Sheet 3A: *What Are Seasons and What Causes Them?* for each student. Students will cut out Part A, so do not make double-sided copies of this investigation sheet.

2. Make a copy of Assessment Observation Sheet: Lesson 3 for yourself. During the investigations in this lesson, use the questions and prompts provided on this sheet to formatively assess students as they work.

3. Title a sheet of chart paper "Seasons." Have a marker available to write on the chart during the investigation. Alternatively, use Interactive Whiteboard: Seasons.

4. On a sheet of white paper, draw a circle and label it "Sun." Have available your assembled Earth model with the rubber band from Lesson 2.

5. Identify an area in the classroom where students can spread out in a circle. Alternatively, you may wish to use an open outside area or the gym.

6. Each student will need a paper fastener and a pair of scissors.

7. Students will need crayons or colored pencils. If they do not have these, make some available for the class to share.

Investigation B

1. Make one copy of Student Investigation Sheet 3B: *How Does Daylight Change During the Year?*

2. Have the Sunrise and Sunset Card Set from the kit available. This card set includes 48 cards: three sets of four cards for each of four different cities (Auckland, New Zealand; Barrow, Alaska; Lisbon, Portugal; and Quito, Ecuador). Prepare to distribute one four-card set to each pair of students. Because each pair's card set includes data from a different location, pairs will share data and record it on a class chart during the investigation so they can analyze data from all locations.

NOTE: If you have more than 12 pairs of students in your class, form larger groups so that students can still analyze all four data cards for their assigned city.

3. Title a sheet of chart paper "Our Plan to Investigate Daylight Patterns." Have a marker available to write on the chart during the investigation. Alternatively, use Interactive Whiteboard: Our Plan to Investigate Daylight Patterns.

4. On a sheet of chart paper or a whiteboard, create a five-column chart. Title the chart "Sunrise and Sunset Data." Title each column with the name of one of the four cities from the Sunrise/Sunset Card Set (Barrow, Quito, Auckland, and Lisbon) and the name of your city. Alternatively, use Interactive Whiteboard: Sunrise and Sunset Data.

5. Use a weather website to find the sunrise and sunset times for your location for the following dates: September 22, March 20, December 21, June 21, and then calculate the approximate total hours of daylight for your area.

6. Have a world map or globe available to point out locations of the cities to students.

7. Have your Assessment Observation Sheet handy to continue formatively assessing students.

8. Students will need crayons or colored pencils. If they do not have these, make some available for the class to share.

Just-in-time background information

BACKGROUND INFORMATION

As Earth rotates, it also moves in a path, or **orbit**, as it **revolves** around the Sun. One revolution around the Sun takes Earth one year. Earth is tilted; As Earth revolves around the Sun, the angle at which Earth is tilted toward the Sun changes. When the northern half of Earth is leaning toward the Sun, the southern half is leaning away. As Earth revolves, this changes, and the southern half leans toward the Sun while the northern half leans away. This determines seasonal change and explains why in June, it is summer in the Northern Hemisphere and winter in the Southern Hemisphere. Six months later, in December, it is winter in the Northern Hemisphere and summer in the Southern Hemisphere. This cycle repeats every year.

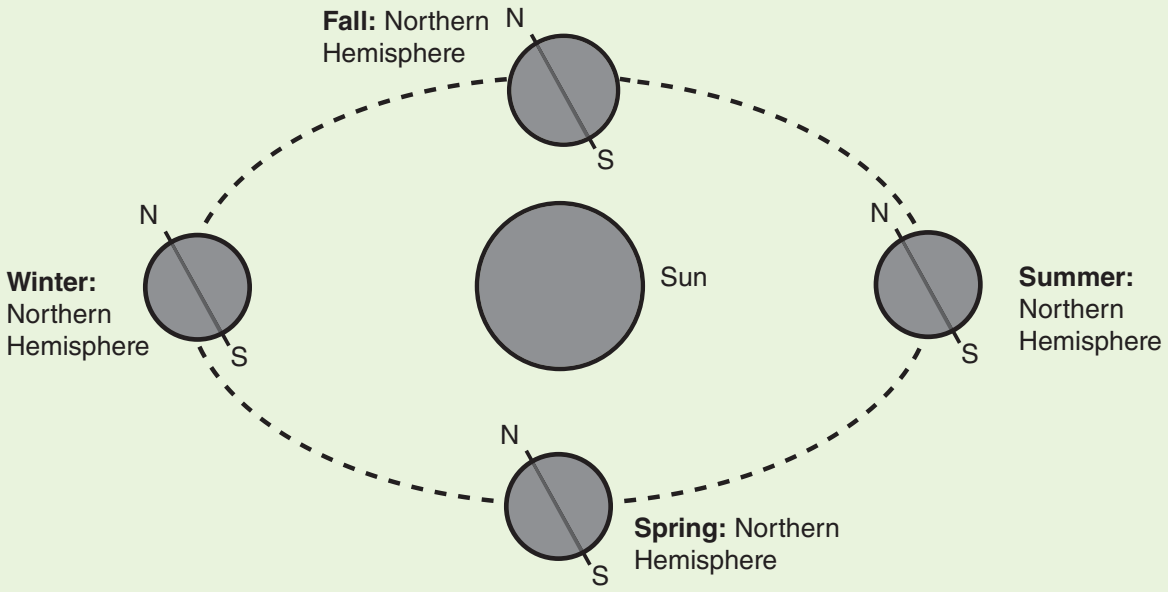


Figure 3.1: Earth revolving around the Sun

Students may have several misconceptions about the concepts explored in this lesson, including:

- Earth is closer to the Sun during summer and farther away during winter.
- **Seasons** happen at the same time everywhere on Earth.
- Seasonal characteristics and change are the same everywhere on Earth.

Rotation, revolution, and tilt are complex concepts. Younger students may have difficulty visualizing these phenomena, so this lesson approaches the concept of seasons by looking at how the amount of daylight is related to the time of year in different locations around the world.

Investigation A

WHAT ARE SEASONS AND WHAT CAUSES THEM?

MATERIALS

- **Student**

1 Science notebook*
1 Student Investigation Sheet 3A: *What Are Seasons and What Causes Them?*
1 Pair of scissors*
1 Paper fastener*

- **Class**

Colored pencils or crayons*

- **Teacher**

1 Assembled Earth model* (from Lesson 2)
1 Sheet of white paper*
Assessment Observation Sheet: Lesson 3
Chart paper or whiteboard*
Markers*

*These materials are needed but not supplied.

Disciplinary Core Ideas
- **ESS1.A:** The Universe and Its Stars
- **ESS1.B:** Earth and the Solar System

Crosscutting Concept
- Patterns

5Es
- Explain

Literacy Components
- *Sky Watchers* Literacy Reader, pgs. 10–13

Digital Component
- **Interactive Whiteboard:** Seasons
- **Simulation**: Earth's Revolution

1. Post the "Seasons" class chart, and ask students to share what they know about seasons. Accept all ideas, and record students' responses on the chart. Prompt students with the following questions:

- How many seasons does Earth experience in one year? What are they called?
- Do the seasons happen in the same order every year?
- What makes each season different from the others?
- Why do you think Earth has seasons?
- How many seasons do you experience? About how long do they last? Why do you think so?

Connect to phenomena

2. Direct students to come to the center of the room and form a circle. Have the Earth model and Sun that you drew available for the demonstration. Place the paper Sun on the ground in the center of the circle. Instruct students to take three steps backward.

Identify Phenomena

Earth's orbit is elliptical, or slightly oval-shaped, which causes Earth to be closer to the Sun during part of its orbit and farther away during other parts.

3. Display your Earth model, and review with students how Earth's rotation contributes to the pattern of daytime and nighttime.

Differentiation

Differentiation Strategy

Ask high-level learners how many times they think Earth rotates on its axis during a day (one) and a year (365). Encourage them to explain their reasoning.

4. Ask students if they have heard the term "orbit." Explain that Earth follows a path, or orbit, as it moves around the Sun. Introduce the term "revolve," and tell students that "to revolve" means "to move around a central object." Explain that the Sun is the central object around which Earth revolves. Holding the Earth model, walk in a steady pace around the inside of the circle that students have made, rotating the sphere of the model as you walk around the circle. Use some or all of the questions to facilitate a class discussion about what students observed:

- How did the Earth model move around the Sun? *(Students should notice that the Earth model continued to rotate as it traveled in a path around the Sun.)*
- How long do you think it takes Earth to revolve around the Sun one time? What is your reasoning for your answer? *(Answers will vary.)*
- After Earth completes one orbit around the Sun, what happens next? *(Accept all reasonable responses. Students should realize that Earth will continue on the same path.)*
- What is Earth's main source of light and heat? *(The Sun)*
- Do you think the position of Earth on its path around the Sun has anything to do with the seasons? Explain your thoughts. *(Answers will vary. Students are likely to suggest that the distance from Earth to the Sun plays a role in seasonal change. Accept all responses. This is a great opportunity to find out what misconceptions students have about seasons.)*

5. Tell students to pretend that there is a campfire in the middle of the circle, and ask students to lean in toward the center of the circle. Ask:

- Think about the parts of your body that are facing the "campfire." Which parts are warmer? Which parts are cooler? *(Students should determine that their upper half would be warmer and bottom half would be cooler.)*
- What determines whether you are warmer or cooler? *(Students should recognize that the parts of their bodies that are closer to heat will be warmer and the parts of their bodies that are farther from the heat will be cooler.)*

Digital simulations to enrich concepts

Digital Tip

Show the Earth's Revolution simulation to help students visualize how the position of Earth in its orbit around the Sun changes which part of Earth is tilted toward the Sun. Pause the simulation to emphasize the angle of the Earth in different positions around the Sun.

6. Explain that just as students leaned into the middle of the circle, Earth also leans, or **tilts**, on its axis. As Earth revolves around the Sun during the year, different parts of the Earth receive more sunlight than others. This is what accounts for the seasons.

7. Show students the Earth model, and explain that at the times of the year when the northern half of Earth is leaning toward the Sun, the southern half is leaning away. As Earth revolves, this changes, and the southern half leans toward the Sun while the northern half leans away.

8. Distribute a pair of scissors, a fastener, and a copy of Student Investigation 3A: *What Are Seasons and What Causes Them?* to each student. Instruct students to draw and color pictures in the wheel in Part A of the investigation sheet that represents each season and what they would wear during each season. When they are done drawing, guide students to cut out the wheels on both pages of the investigation sheet. They should place the wheel with their season drawings underneath the wheel with the cut-out quadrant and attach the wheels together using a paper fastener.

9. After ample time for students to finish their season wheels, invite some students to share their pictures with the class. Ask:

- How do you think the shape of the season wheel relates to what we have discussed about seasons? *(Students should recognize that seasons repeat in a predictable pattern over a period of a year just as their wheel can turn around and around.)*

Tell Me More!

? The equator is an imaginary line that divides Earth in half. If it is winter north of the equator, what season is it south of the equator?

3-dimensional learning

Investigation B

HOW DOES DAYLIGHT CHANGE DURING THE YEAR?

MATERIALS

Student
1 Science notebook*
1 Student Investigation Sheet 3B: *How Does Daylight Change During the Year?*

Team of two students
4 Sunrise and Sunset Cards

Class
Colored pencils or crayons*

Teacher
1 Student Investigation Sheet 3B: *How Does Daylight Change During the Year?* (Teacher's Version)
1 Assembled Earth model* (from Lesson 2)
1 Sunrise and Sunset Card Set
Assessment Observation Sheet: Lesson 3
Chart paper or whiteboard*
Globe or world map*
Markers*

*These materials are needed but not supplied.

1. Review seasons with students. Ask:

- What month is it? What season are we experiencing?
- What do you wear during this season?
- What activities do you like to do during this season?
- What do you notice about the amount of daylight during this season? How is the amount of daylight different during other seasons?

Literacy Tip

To review seasons and introduce daylight patterns during the year, read Literacy Article 3B: Days of Change aloud as a class, or ask student to read it in small groups.

Disciplinary Core Ideas
- **ESS1.A:** The Universe and Its Stars
- **ESS1.B:** Earth and the Solar System

Science and Engineering Practice
- Planning and Carrying Out Investigations

Crosscutting Concept
- Patterns

5Es
- Explore
- Explain

Literacy Components
- *Sky Watchers* Literacy Reader, pgs. 10–13
- **Literacy Article 3B:** Days of Change

Digital Component
- **Interactive Whiteboard:** Our Plan to Investigate Daylight Patterns
- **Interactive Whiteboard:** Sunrise and Sunset Data

2. Post the "Our Plan to Investigate Daylight Patterns" class chart. Ask students to discuss with a partner how they could study the amount of daylight at different times throughout the year. After allowing time for pairs to brainstorm, invite students to share their ideas, and record students' responses on the chart. Use the following questions to help guide the discussion:

- How can the amount of daylight help us determine what time of year it is? *(Answers will vary. Students may suggest shorter days are in winter and longer days are in summer.)*
- How can we determine the amount of daylight we have? (*Answers will vary. Students may suggest using a clock, reading a weather report, or using the shadow stick.)*
- What patterns would you expect to find in the amount of daylight during the year? *(Answers will vary.)*
- Do you think everywhere on Earth has the same exact daylight patterns that we have? *(Answers will vary.)*

3. Post the "Sunrise and Sunset Data" class chart. Introduce each city listed on the chart, and use a globe or a world map to show students where each city is located. Explain that to study patterns in daylight, students will work in pairs to look at data from different places around the world, including their own city.

4. Distribute a subset of four cards from the Sunrise and Sunset Card Set to each pair of students. Direct students to study the data on the cards to look for patterns and to decide on a way to organize the cards.

5. After allowing ample time for pairs to organize the cards, gather students together and invite each pair to share what patterns they noticed and how they organized the cards. Then invite students to share the **sunrise** and **sunset** data from their cards. As they read aloud the data from the cards, record it on the class chart under the appropriate city.

ELA connection
L.1.1, SL.1.1

6. When all the columns for the four cities from the card set have been filled in on the chart, write the local sunrise and sunset data you obtained in the last column of the chart. Ask students to analyze the data. Use the following questions to help guide the discussion:

- For what months do we have data for each city? *(June, September, December, and March)*
- What did you notice about the amount of daylight in December? *(Students should recognize that while Barrow has no daylight, Quito has 12 hours of daylight, Lisbon has 9 hours of daylight, and Auckland has 15 hours of daylight. Guide students to understand that the amount of daylight each city has in December depends on the city's location on Earth.)*

- What season do we experience here in December? *(The season you experience in December will depend on your geographic location.)*
- What did you notice about the amount of daylight in March? *(Students should recognize that patterns of daylight on this day are fairly similar [about 12 hours] across the planet.)*
- What season do we experience in March? *(The season you experience in March will depend on your geographic location.)*
- What did you notice about the amount of daylight in June? *(Students should recognize that Barrow has 24 hours of daylight, Quito has 12 hours, Lisbon 15 hours, and Auckland has 9 hours.)*
- What season do we experience in June? *(The season you experience in June will depend on your geographic location.)*
- What did you notice about the amount of daylight in September? *(Students should recognize that patterns of daylight on this day are fairly similar [about 12 hours] across the planet.)*
- What season do we experience in September? *(The season you experience in September will depend on your geographic location.)*
- How does our area compare to these other areas in terms of amount of daylight during the year? *(Answers will vary.)*

Teaching Tip

Tell students that Barrow, Alaska, has the nickname "Land of the Midnight Sun" because the Sun shines there for 24 straight hours in June.

Differentiation

Differentiation Strategy

Depending on your class, challenge them with this question: Given what we know about patterns in daylight, what pattern would you expect to see for McMurdo Station, Antarctica?

7. Distribute a copy of Student Investigation Sheet 3B: *How Does Daylight Change During the Year?* to each student. Make colored pencils or crayons available for the class to share. Read aloud the instructions for the class, and ask students to describe or draw the pattern in amount of daylight during each season for your area.

8. Direct students to complete Part B by completing the sentences, drawing a picture, and filling in the blanks.

9. Allow ample time for students to complete the investigation sheet. As time allows, invite students to share their drawings and sentences with the class.

Tell Me More!

Draw an outdoor activity you like to do when the days are longer. Label your picture with a month that has more daylight.

Formative assessment

Phenomenon

Review students' questions about the investigative phenomenon from the beginning of this lesson. Guide students in applying the concepts explored in this lesson and connecting them to the anchoring phenomenon: looking for patterns in the daytime and nighttime skies. By the end of the lesson, students should be able to explain that:

- As Earth rotates, it also revolves around the Sun.
- Seasons are repeated every year and are connected to Earth's orbit around the Sun.
- Patterns in the amount of daylight depend on location on Earth and the season.

Connecting ideas about phenomena to evidence

NOTES

ELA connection
SL.1.3, SL.1.5

EXTENSIONS

Seasons Through Song
Teach the following song and movements to the class. The song is sung to the tune of "The Hokey Pokey":

In summer, Earth tilts in *(students lean in toward you, the "Sun")*

In winter, Earth tilts out *(students lean out away from you, the "Sun")*

Seasons repeat when you orbit all about *(students rotate counterclockwise with their arms spread wide)*

Do the revolution while you orbit all around *(students hold hands in a circle and walk counterclockwise to the beat of the song)*

Tilt's what it's all about! *(students clap their hands to the syllabic pattern)*

Use this opportunity to reinforce that Earth does not travel closer to the Sun in the summer. Instead, Earth's axis has a permanent tilt, and the hemisphere that is closer to the Sun will experience summer.

Observing Daylight Throughout the Year
Collect sunrise and sunlight data throughout the year by tracking the patterns on a classroom calendar. Invite students to be Sun reporters, and assign a different student to get the sunrise and sunset data each week during a month. At the end of the month, discuss patterns and predictions for the next month.

Reading About Seasons
Read *Goodbye Summer, Hello Autumn* and *Goodbye Autumn, Hello Winter* by Kenard Pak. Discuss patterns that students notice in the books, and then invite students to come up with a story to continue the timeline from winter to spring and spring to summer.

ELA connection
W.1.2, W.1.5

Cause and Effect with Seasons and Animals and Plants
Ask students to list ways that plants and animals behave differently during the changing seasons. Take time to focus on the cause-and-effect relationships and how all things depend on the amount of sunlight and heat that Earth receives during each season. Ask questions such as:

- What happens to trees in the fall? In the spring?
- What do bears do during winter?
- What do birds and insects do when the weather begins to cool?
- During what season(s) do you see plants sprouting and flowers blooming?

Provide examples of local plants and animals and examples of plants and animals from a different area of the world.

NOTES

ASSESSMENT STRATEGIES

Formative assessment

1. Investigation A

- Review students' responses to Student Investigation 3A: *What Are Seasons and What Causes Them?* to gauge what they know about seasonal patterns throughout the course of a year. Provide additional support as needed.

- Use students' responses to the Tell Me More question to determine how well they can identify that when it is winter in the Northern Hemisphere, it will be summer in the Southern Hemisphere.

2. Investigation B

- Use students' responses on Student Investigation Sheet 3B: *How Does Daylight Change During the Year?* to determine how well they understand the patterns in the amount of daylight in the different seasons of the year. If students do not seem to understand this concept, provide additional review.

- Use students' responses to the Tell Me More question to assess their knowledge of the types of activities that can be done outside during longer daylight hours.

3. Refer to the Assessment Observation Sheet where you recorded observations during this lesson to formatively assess your class, and adjust instruction as needed.

4. Refer to the General Rubric in Appendix A to assess individual progress as needed.

NOTES

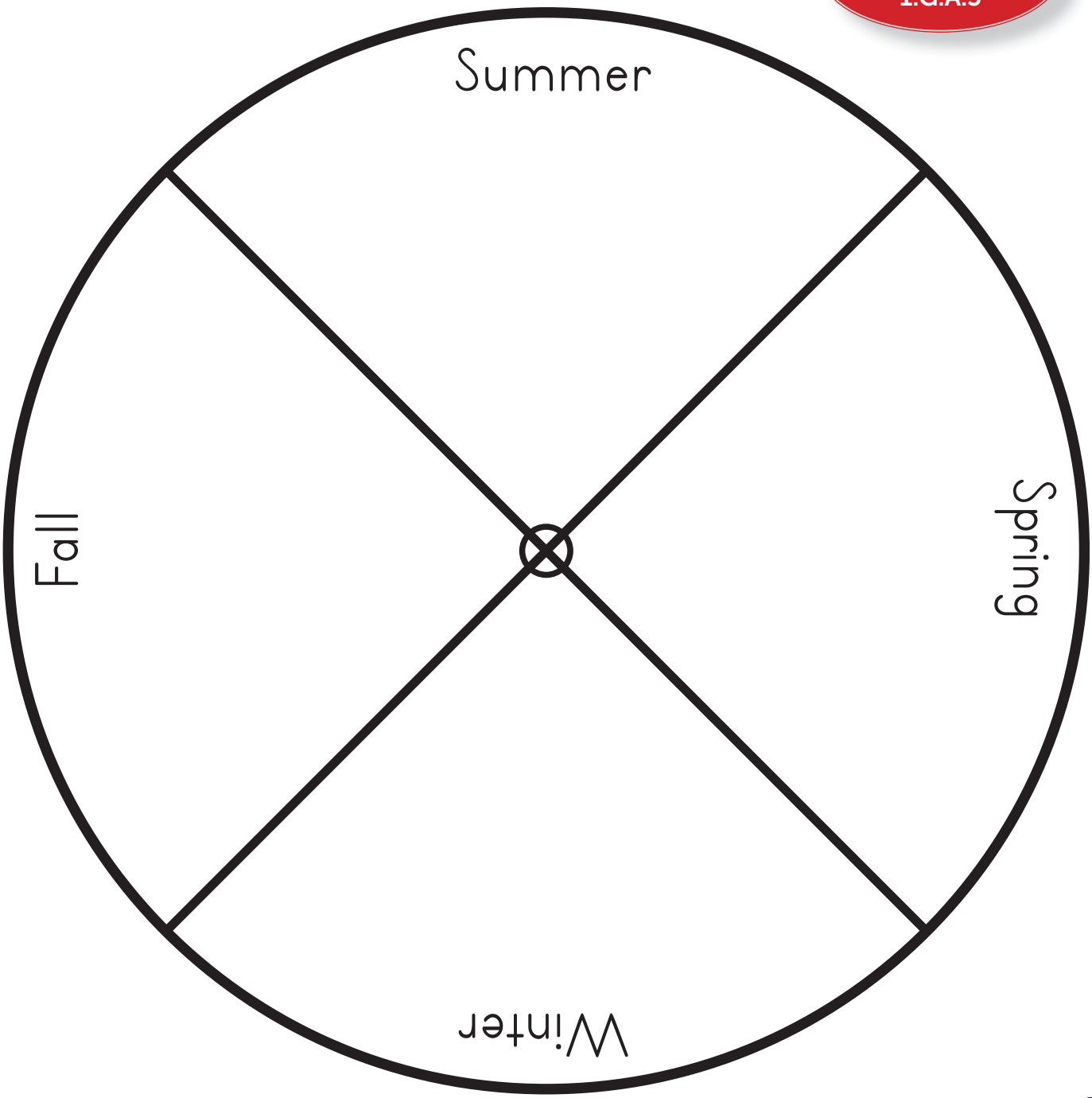
Student Investigation Sheet 3A: What Are Seasons and What Causes Them?

Name: _____ Date: _____

A. Draw and Cut

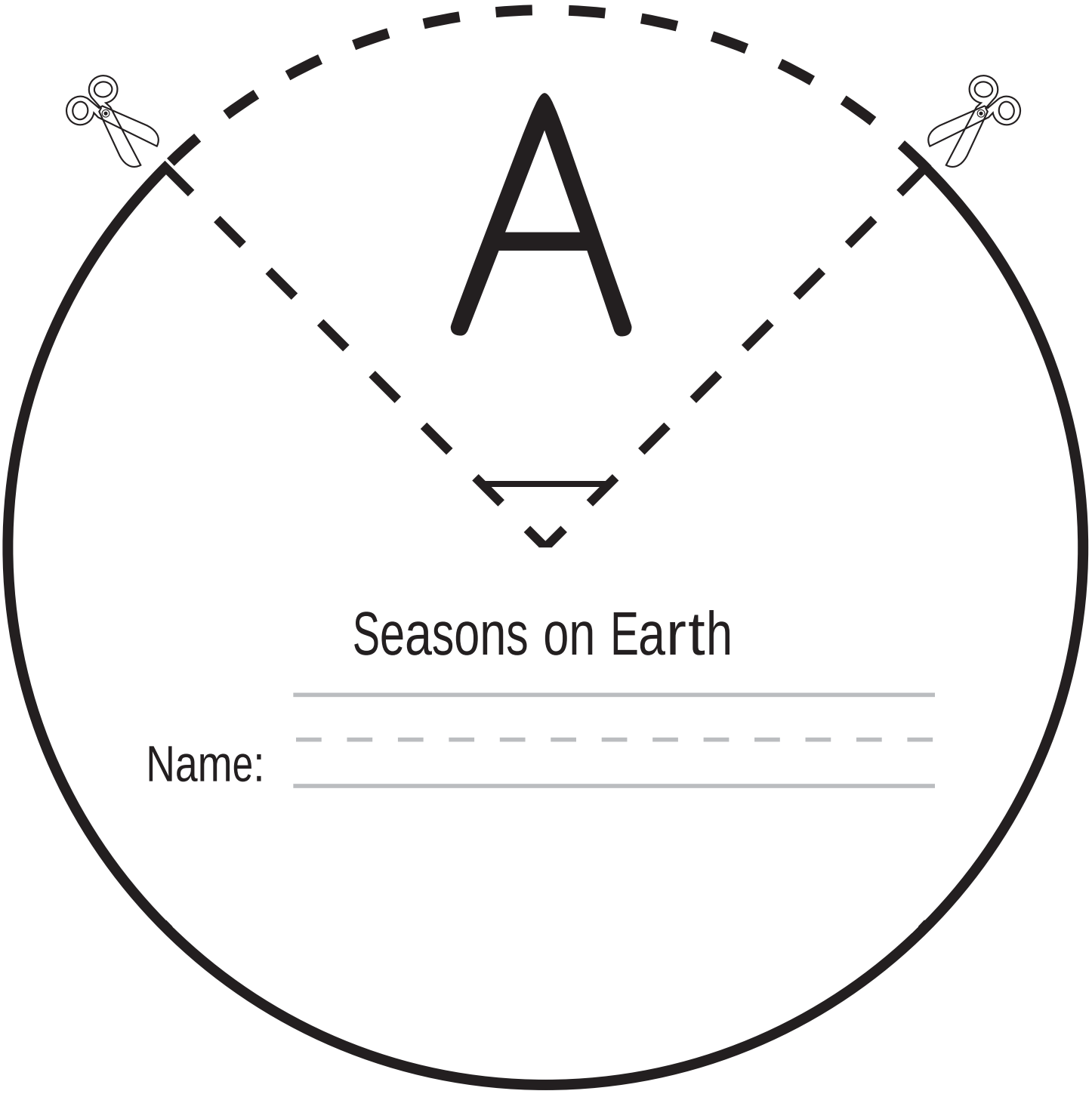
Draw a picture to represent each season. Then cut out the circle.

Math connection 1.G.A.3



B. Cut and Attach

Cut out the circle below, then cut out the section marked A. Place this circle on top of the one from Part A. Attach the two circles together using a paper fastener.



Name: _____ Date: _____

ELA connection
RF.1.1, RF.1.2, RF.1.3, RF.1.4

Days of Change

In winter, it is dark when I get up in the morning. It is cold. The Sun is not up yet. In the afternoon, the Sun starts to set. It is dark before I go to bed.

In summer, I feel sunlight on my eyelids. I wake up. The Sun is shining. It is warm. I jump out of bed. I play outside all morning. I play outside all afternoon. After dinner it is still light! I can play some more. Sometimes the Sun is setting just as I go to bed. I like summer best of all.

Why do the seasons change? Earth revolves around the Sun. Earth is not straight up and down. It is tilted.

In winter, the part of Earth where I live tilts away from the Sun. There is less daylight. It is colder. In summer, where I live tilts toward the Sun. There is a lot of daylight. It is warm.

Credit: almanino/Shutterstock.com

Credit: Mario Trottier/Shutterstock.com

Student Investigation Sheet 3B: How Does Daylight Change During the Year?

Name: _____ Date: _____

A. Describe

1. Draw or describe how daylight changes where you live during the four seasons.

ELA connection
L.1.1, L.1.2.B, L.1.2.E, SL.1.5, W.1.2

Winter	Spring
Summer	Fall

B. Explain

Fill in the blanks:

1. Seasons are a _____.

2. My favorite season is _____ because _____.

3. Draw a picture of what you like to do in your favorite season.

4. Earth _____ around the Sun once a year.

When the part of Earth we live on is tilted toward the Sun, we have the season called _____, and we have _____ daylight than in other seasons.

Assessment Observation Sheet

Lesson 3—Sunrise, Sunset, and Seasons

Consider the following observations and talking points during student exploration activities, quiet conversations, and class discussions.

A. Can students describe the differences between rotate and revolve?

B. What repeated patterns do students describe as caused by rotation and revolution (e.g., time intervals, weather, day/night, seasons, etc.)?

C. Talk informally about seasons. Listen for an intuitive understanding of how the amount of sunlight hitting Earth at a certain time of year contributes to seasons.

D. Do students demonstrate an understanding that when it is summer north of the equator, it is winter south of the equator, and vice versa?

E. Note students who seem to be having difficulty understanding how patterns in the amount of daylight can differ with the time of year and location on Earth. Provide enrichment and remediation as needed.

F. Additional considerations:

NOTES

Formative assessment—How are they progressing?

Student Investigation Sheet 3B: Teacher's Version

How Does Daylight Change During the Year?

A. Describe

1. Draw or describe how daylight changes where you live during the four seasons. *(Students' drawings will vary, but look for depictions that represent the pattern of change in daylight throughout the year where you live.)*

B. Explain

Fill in the blanks:

1. Seasons are a *pattern*.

2. My favorite season is _____ because _____. *(Answers will vary.)*

3. Draw a picture of what you like to do in your favorite season. *(Students' drawings will vary.)*

4. Earth *revolves* around the Sun once a year. When the part of Earth we live on is tilted toward the Sun, we have the season called *summer*, and we have *more* daylight than in other seasons.

Summative Assessment

Name: _____ Date: _____

1. Which object(s) below can be seen during the day?

   a. Sun

   b. Other stars

   c. Moon

   d. Neptune

2. If it is winter in Canada, in which region will it be summer?

   a. Central America

   b. The North Pole

   c. South America

   d. Europe

Building Blocks of Science Student Literacy

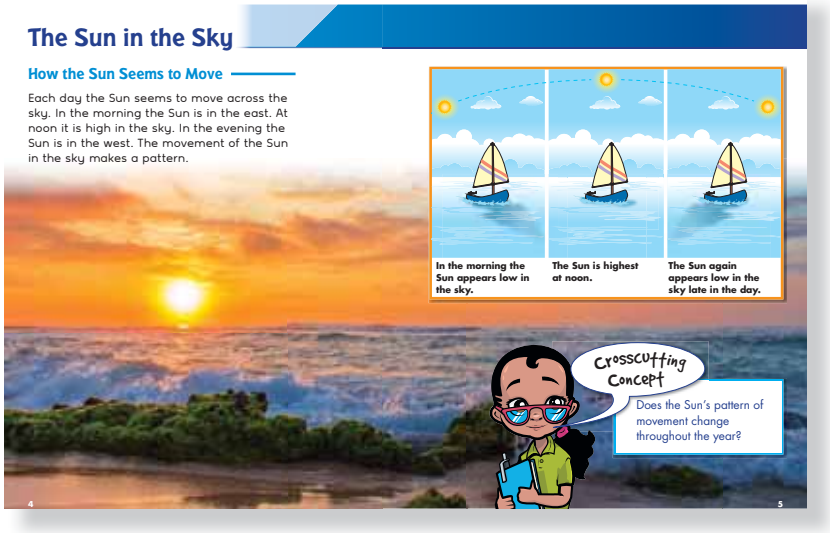
Build students' literacy skills with literacy components found within lessons and Literacy Readers.

Building Blocks of Science Literacy Components can be used to:

- Introduce a new lesson
- Support an investigation
- Incorporate science connections into your language arts sessions
- Differentiate instruction
- Review previously learned concepts

Literacy Readers—**on-level and below-level** readers in **English and Spanish** and available in **print or digital format**—provide informational text that:

- Incorporates English language arts and literacy standards
- Uses supporting text with graphs, vocabulary, charts, data, illustrations, and photographs to address **science concepts** related to lessons
- Provides opportunities to practice skills such as analysis and reasoning, and communication of ideas through **crosscutting concept** questions
- Challenges students to exercise and apply knowledge to a **science and engineering practice** activity
- Features a career that provides real-world insight into related science content



What else to look for?

Literacy Articles—These encourage students to elaborate upon unit topics, discuss real-world applications and phenomena, and ask student to connect this to concepts in the unit. Corresponding questions ask student to access high-level thinking and draw upon previous knowledge. (See page 26 of this sampler for an example.)

Science in the News Article Report—Students analyze a content-relevant reading or current event article, developing literacy skills as students identify important information, apply vocabulary, and draw connections to science content.

Building Blocks OF SCIENCE™ | 3D

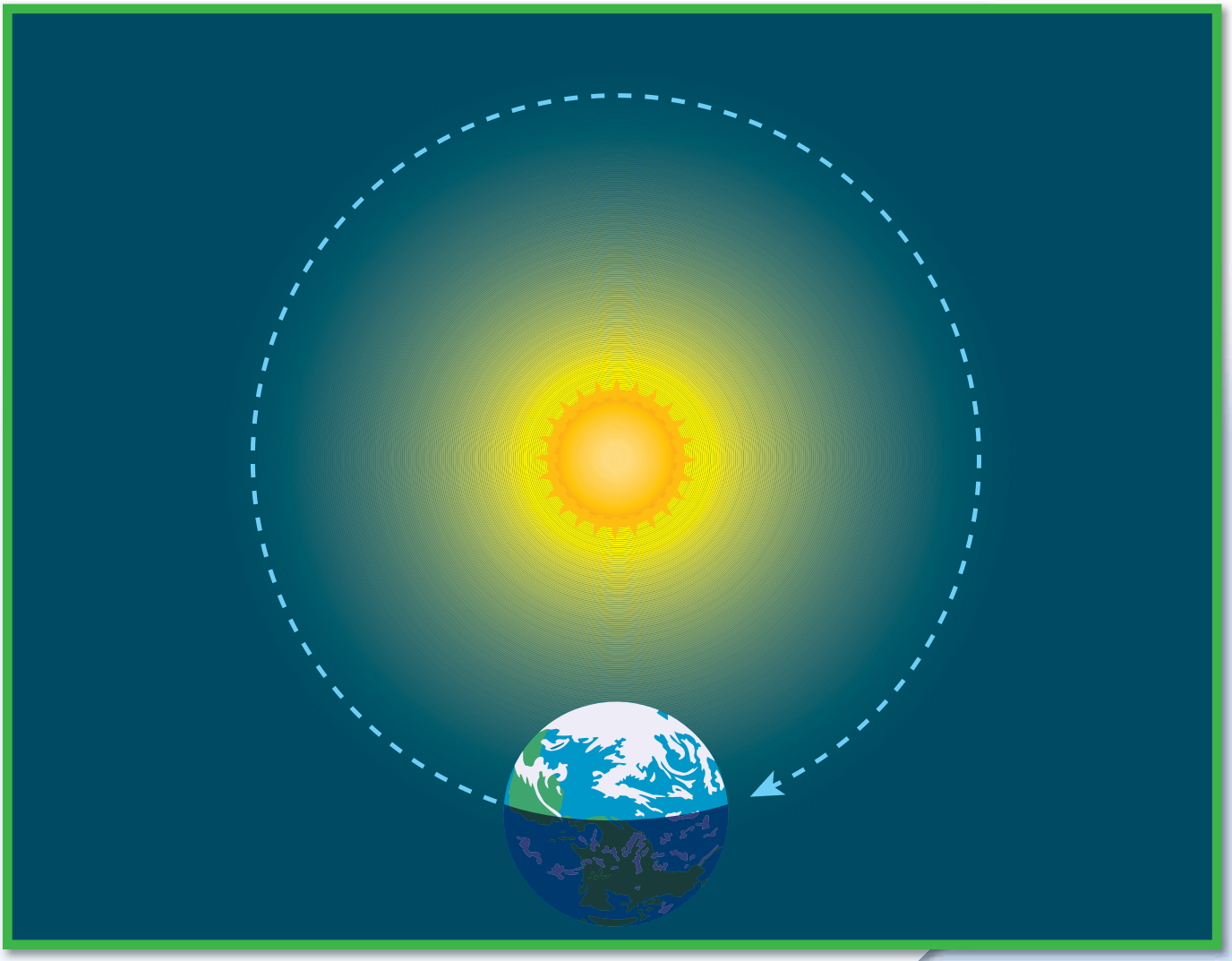
Sky Watchers

Student literacy–available in digital and print

Seasons

Earth moves in another way. Earth moves around the Sun. One trip around the Sun takes about 365 days, or 1 year. One trip around the Sun is one **revolution**.

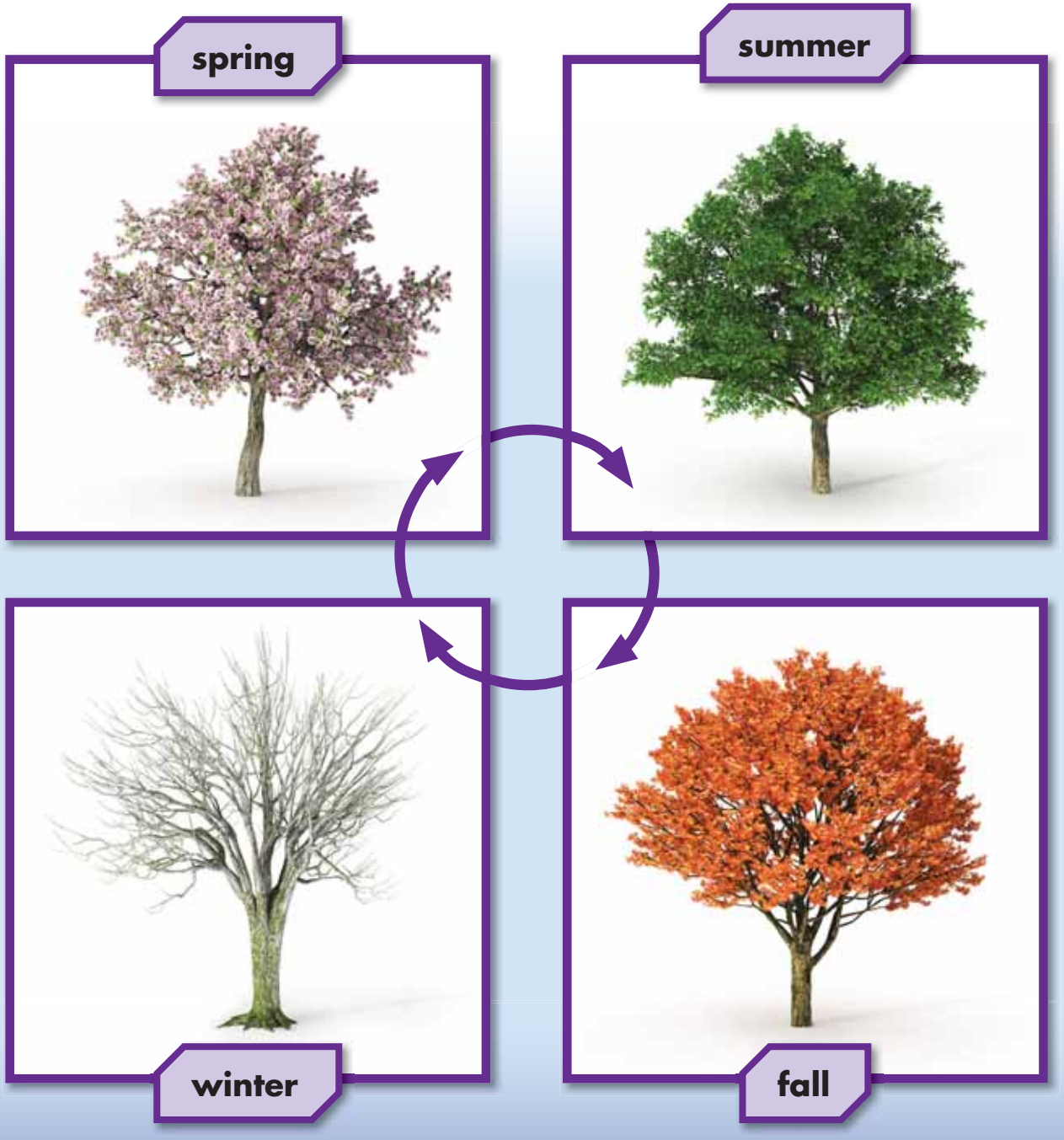
ELA connection
RF.1.3, RF.1.4



Earth's path around the Sun is called its orbit.

During the year, Earth has four **seasons**. They are winter, spring, summer, and fall. Earth's moving around the Sun causes seasons.

Weather changes with the seasons. Winter is the coolest season. Spring is warmer. Summer is the warmest season. It becomes cooler in the fall. The pattern of seasons is always the same.



Careers

Science in the world

Astronomer

An astronomer studies the Sun, the Moon, planets, and stars. Astronomers may make maps of the sky. They write science reports. Some astronomers teach science classes.

Would I like this career?	You might like this career if • you are good at math and science. • you like studying with a team.
What would I do?	• You would study the day and night sky. • You would share what you learn with other scientists.
How can I prepare for this career?	• Study computers, math, and science. • Join an astronomy club.

Astronomers use tools to study objects in the sky.

Profesiones

Spanish literacy—available in digital and print

Astrónomo

Un astrónomo estudia el Sol, la Luna, los planetas y las estrellas. Los astrónomos dibujan mapas del cielo. Escriben informes científicos. Algunos astrónomos enseñan ciencias.

¿Me gustaría esta profesión?	Te gustaría esta profesión si • eres bueno para las matemáticas y las ciencias. • si te gusta estudiar en equipo.
¿Qué tendría que hacer?	• Estudiarías el cielo diurno y nocturno. • Compartirías lo que aprendes con otros científicos.
¿Cómo puedo prepararme para esta profesión?	• Estudia computación, matemáticas y ciencias. • Hazte miembro de un club de astronomía.

Los astrónomos usan instrumentos que los ayudan a estudiar los objetos en el cielo.

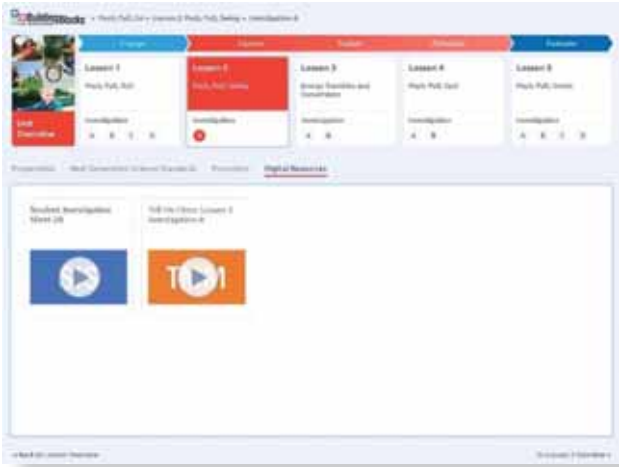
The Right Blend of Hands-On Investigation and Technology

Along with hands-on learning, Building Blocks of Science 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

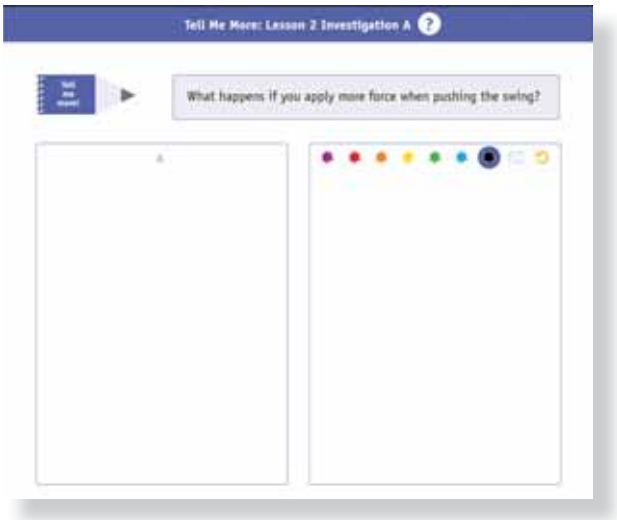
- Identification of where a lesson falls within the **5E Learning Cycle**
- **Preparation**—Includes investigation overview, materials list, and step-by-step teacher preparation instructions
- **NGSS Standards**—Includes the PEs, DCIs, SEPs, and CCCs that will be addressed within the investigation
- **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

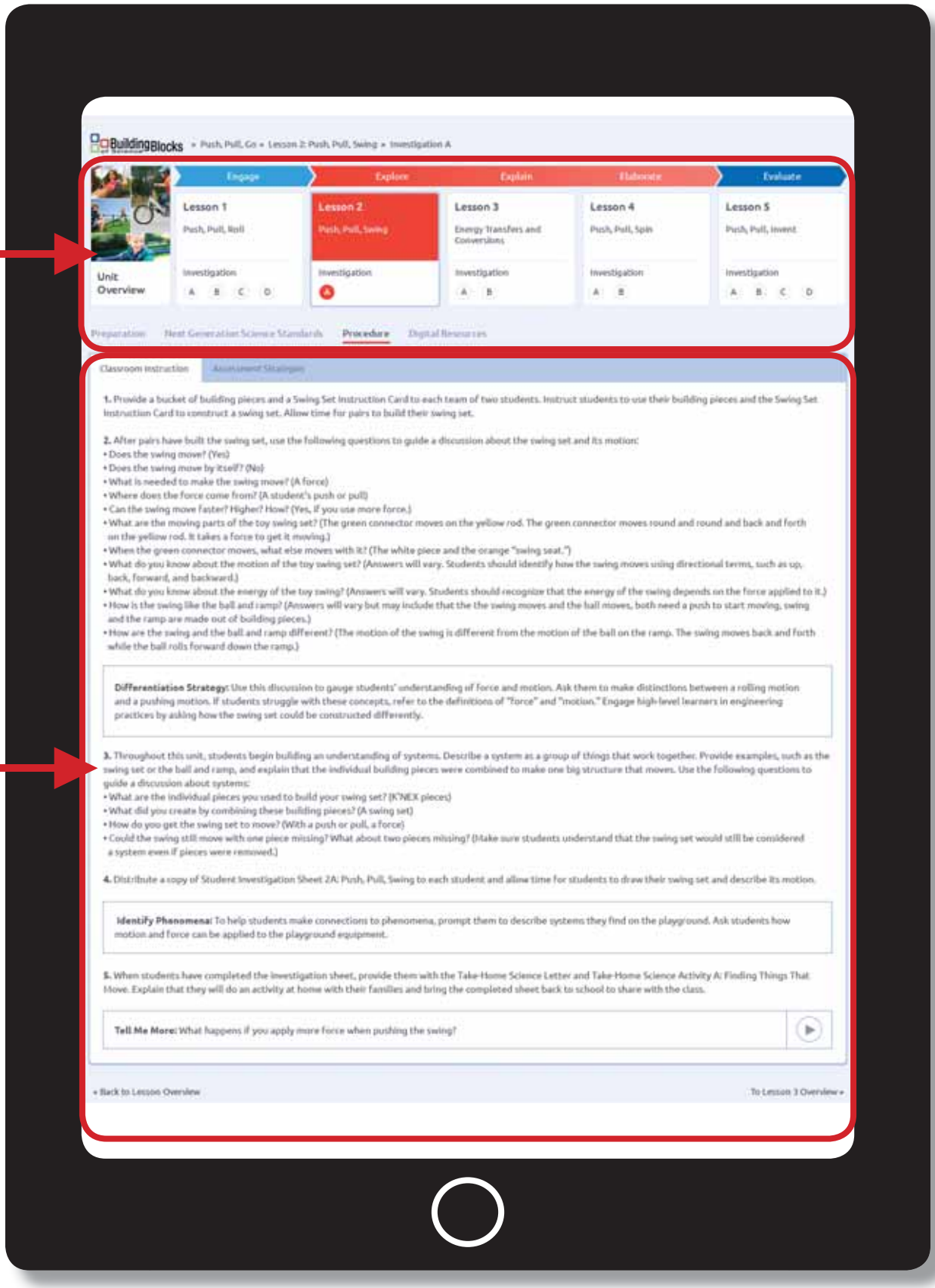
- Step-by-step instruction including guiding questions and anticipated responses
- Differentiation strategies at point of use within each investigation
- **Identify Phenomena** provides teachers with prompts to help students make connections to phenomena addressed within an investigation
- Assessment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

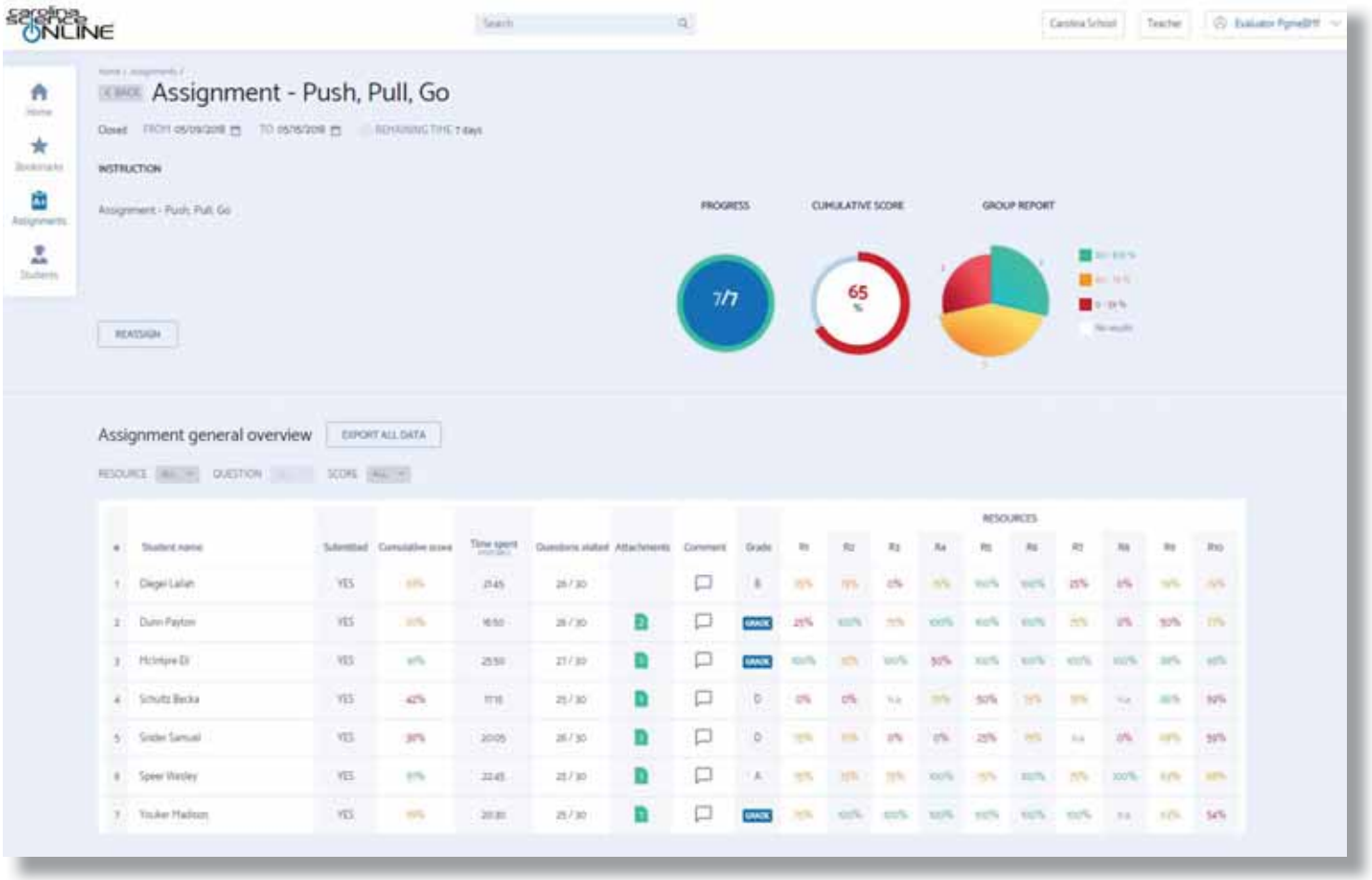
For the Teacher–Customizable Digital Planning at Your Fingertips

Building 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



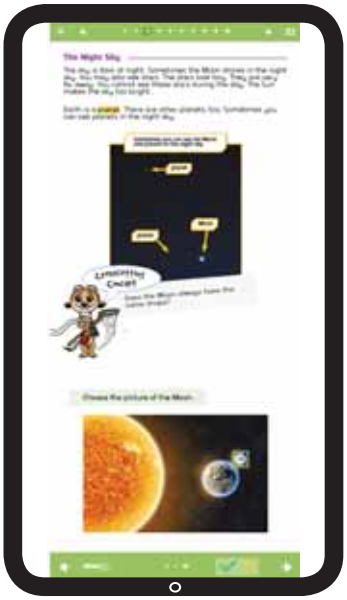
Digital components for students enhance and deepen student understanding, differentiate learning, and provide multiple modalities for delivering information.

"Digital Tips" take the guesswork out of integrating the following digital resources with hands-on investigations:

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.

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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!
For more information, visit www.carolina.com/bbs