Core Knowledge® Science


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Science in Action: Kyle and Jamie

Teacher Guide

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Core Knowledge®

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Core Knowledge Science™ Kindergarten

GRADE K

Introduction

About Science in Action

The goal of teaching students science from Kindergarten through high school graduation is not to turn every student into a scientist by profession. However, scientific advances occur at a faster rate year after year and this leads to a job market and society that needs people comfortable with science as part of their daily work lives. And while students traditionally receive an education in science, they may not be familiar how a path from learning about science leads to a career in the science. Students may have an imperfect understanding of how science will impact their future and future career. Students may be undecided about their futures and have no background or understanding about how science could inform their career as adults.

While STEM is now taught as a portion of classes in many grades, there are very few schools with dedicated engineering classes. Many industries have a focus on engineering which can change rapidly as a result of the faster evolution of technology. As a result, many students receive little exposure to this vital aspect of their future careers. Students are asked to learn about engineering and adapt to new engineering skills in a short time frame without developing the depth and breadth of how to put science in action.

With this in mind, Core Knowledge has developed the Science in Action readers. Each reader features two or more chapters. Students learn first about the early childhood of the subject and how their interest in the sciences and engineering was piqued. The second part features the subject in the present day and explores their academic and engineering experiences in college, their work experiences as they relate to their scientific and engineering experiences, and in some cases their careers post-college. Each account ends with an "Inspired by…" section which features one or more scientists or engineers who provided inspiration in their path. The goal is to help young students connect their own experiences at a younger age to their future endeavors and careers as part of the larger society outside the classroom.

Core Knowledge Foundation is committed to educating students in many disciplines. *Science in Action* is intended to show that a person, no matter what age, encounters science and engineering in their everyday experiences. Further, the program intends to help students connect their personal lives with the broader needs and interests of society so when they get to high school and beyond in their academic careers, they will more familiar with the paths they follow.

Standards

Core Knowledge Science offers units that comprehensively address all of the Next Generation Science Standards (NGSS) in a three-dimensional approach that integrates Disciplinary Core Ideas (DCIs), Science and Engineering Practices (SEPs), and Crosscutting Concepts (CCCs). The program clusters the NGSS Performance Expectations into physical science, life science, and earth and space science units.

Stemming from the commitment that background knowledge is essential, the units build around Student Books, which largely center on all of the NGSS DCI concepts. However, the pure NGSS approach de-emphasizes reading, and the standards do not treat the Science and Engineering Practices or the Crosscutting Concepts as *content*, or discrete ideas to be taught and learned. This omission makes the SEPs and CCCs logical concepts for focus of direct student attention. Core Knowledge maintains that it is favorable and valuable for students to read or hear stories that are specifically about practices and overarching concepts.

The lessons in Kindergarten Core Knowledge Science in Action are constructed to cultivate student exposure to and understanding of the ideas present in the following NGSS dimensions. Lessons also cite relevant support of Common Core State Standards for English and Language Arts. Additional cross-curriculum standards relevant to specific lesson will be listed at the lesson level.

Nature of Science

NOS1. Scientific Investigations Use a Variety of Methods

- Science investigations begin with a question.
- Scientists use different ways to study the world.

NOS2. Scientific Knowledge Is Based on Empirical Evidence

- Scientists look for patterns and order when making observations about the world.

NOS3: Scientific Knowledge Is Open to Revision in Light of New Evidence

- Science knowledge can change when new information is found.

NOS4. Scientific Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Scientists use drawings, sketches, and models as a way to communicate ideas.
- Scientists search for cause-and-effect relationships to explain natural events.

NOS5. Science Is a Way of Knowing

- Science knowledge helps us know about the world.

NOS6. Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes natural events happen today as they happened in the past.
- Many events are repeated.

Sources:

NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press.

National Research Council. 2012. *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Committee on a Conceptual Framework for New K–12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

National Governors Association Center for Best Practices, Council of Chief State School Officers. 2010. *Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects*. National Governors Association Center for Best Practices, Council of Chief State School Officers, Washington DC.

NOS7. Science Is a Human Endeavor

- People have practiced science for a long time.
- Men and women of diverse backgrounds are scientists and engineers.

NOS8. Science Addresses Questions About the Natural and Material World

- Scientists study the natural and material world.

Science and Engineering Practices

SEP1. Asking Questions (for science) and Defining Problems (for engineering)

A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world(s) works and which can be empirically tested. Engineering questions clarify problems to determine criteria for successful solutions and identify constraints to solve problems about the designed world. Both scientists and engineers also ask questions to clarify ideas. Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.

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

SEP2. Developing and Using Models

A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations. Modeling tools are used to develop questions, predictions, and explanations; analyze and identify flaws in systems; and communicate ideas. Models are used to build and revise scientific explanations and proposed engineered systems. Measurements and observations are used to revise models and designs. Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Distinguish between a model and the actual object, process, and/or events the model represents.
- Compare models to identify common features and differences. Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).
- Develop a simple model based on evidence to represent a proposed object or tool.

SEP3. Planning and Carrying Out Investigations

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

- With guidance, plan and conduct an investigation in collaboration with peers (for K).
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence

to answer a question. Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question.

- Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons.
- Make observations (firsthand or from media) and/or measurements of a proposed object or tool or solution to determine if it solves a problem or meets a goal.
- Make predictions based on prior experiences.

SEP4. Analyzing and Interpreting Data

Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis. Engineering investigations include analysis of data collected in the tests of designs. This allows comparison of different solutions and determines how well each meets specific design criteria—that is, which design best solves the problem within given constraints. Like scientists, engineers require a range of tools to identify patterns within data and interpret the results. Advances in science make analysis of proposed solutions more efficient and effective. Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Record information (observations, thoughts, and ideas).
- Use and share pictures, drawings, and/or writings of observations.
- Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.
- Compare predictions (based on prior experiences) to what occurred (observable events).
- Analyze data from tests of an object or tool to determine if it works as intended.

SEP5. Using Mathematics and Computational Thinking

In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks, such as constructing simulations; solving equations exactly or approximately; and recognizing, expressing, and applying quantitative relationships. Mathematical and computational approaches enable scientists and engineers to predict the behavior of systems and test the validity of such predictions. Mathematical and computational thinking in K–2 builds on prior experience and progresses to recognizing that mathematics can be used to describe the natural and designed world(s).

- Decide when to use qualitative vs. quantitative data.
- Use counting and numbers to identify and describe patterns in the natural and designed world(s).
- Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs.
- Use quantitative data to compare two alternative solutions to a problem.

SEP6. Constructing Explanations (for science) and Designing Solutions (for engineering)

The end products of science are explanations and the end products of engineering are solutions. The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power of phenomena than previous theories. The goal of engineering design is to find a systematic solution to problems that is based on scientific knowledge and models of the material world. Each proposed solution results from a process of balancing competing criteria of desired functions, technical feasibility, cost, safety, aesthetics, and compliance with legal requirements. The optimal choice depends on how well the proposed solutions meet criteria and constraints. Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.
- Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem.
- Generate and/or compare multiple solutions to a problem.

SEP7. Engaging in Argument from Evidence

Argumentation is the process by which evidence-based conclusions and solutions are reached. In science and engineering, reasoning and argument based on evidence are essential to identifying the best explanation for a natural phenomenon or the best solution to a design problem. Scientists and engineers use argumentation to listen to, compare, and evaluate competing ideas and methods based on merits. Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution, resolving questions about measurements, building data models, and using evidence to evaluate claims. Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).

- Identify arguments that are supported by evidence.
- Distinguish between explanations that account for all gathered evidence and those that do not.
- Analyze why some evidence is relevant to a scientific question and some is not.
- Distinguish between opinions and evidence in one's own explanations.
- Listen actively to arguments to indicate agreement or disagreement based on evidence, and/or to retell the main points of the argument.
- Construct an argument with evidence to support a claim.
- Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence.

SEP8. Obtaining, Evaluating, and Communicating Information

Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity. Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations as well as orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and

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

- Read grade-appropriate texts and/or use media to obtain scientific and/or technical information to determine patterns in and/or evidence about the natural and designed world(s).
- Describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea.
- Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question and/or supporting a scientific claim.
- Communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, and/or design ideas.

Crosscutting Concepts

CCC1. Patterns

In grades K–2, children recognize that patterns in the natural and human-designed world can be observed, used to describe phenomena, and used as evidence.

Patterns . . . are a pervasive aspect of all fields of science and engineering. When first exploring a new phenomenon, children will notice similarities and differences, leading to ideas for how they might be classified. The existence of patterns naturally suggests an underlying cause for the pattern. For example, observing snowflakes are all versions of six-side symmetrical shapes suggests something about how molecules pack together when water freezes; or, when repairing a device, a technician would look for a certain pattern of failures suggesting an underlying cause. Patterns are also helpful when interpreting data, which may supply valuable evidence in support of an explanation or a particular solution to a problem.

CCC2. Cause and Effect

In grades K–2, students learn that events have causes that generate observable patterns. They design simple tests to gather evidence to support or refute their own ideas about causes.

Cause and effect lies at the heart of science. Often, the objective of a scientific investigation is to find the cause that underlies a phenomenon, first identified by noticing a pattern. Later, the development of theories allows for predictions of new patterns, which then provides evidence in support of the theory. For example, Galileo's observation that a ball rolling down an incline gathers speed at a constant rate eventually led to Newton's Second Law of Motion, which in turn provided predictions about regular patterns of planetary motion, and a means to guide space probes to their destinations.

CCC3. Scale, Proportion, and Quantity

In grades K–2, students use relative scales (e.g., bigger and smaller; hotter and colder; faster and slower) to describe objects. They use standard units to measure length.

Scale, proportion, and quantity are essential considerations when deciding how to model a phenomenon. For example, when testing a scale model of a new airplane wing in a wind tunnel, it is essential to get the proportions right and measure accurately or the results will not be valid.

When using a computer simulation of an ecosystem, it is important to use informed estimates of population sizes to make reasonably accurate predictions. Mathematics is essential in both science and engineering.

CCC4. Systems and System Models

In grades K–2, students understand objects and organisms can be described in terms of their parts; and systems in the natural and designed world(s) have parts that work together.

Systems and system models are used by scientists and engineers to investigate natural and designed systems. The purpose of an investigation might be to explore how the system functions or what may be going wrong. Sometimes investigations are too dangerous or expensive to try out without first experimenting with a model.

CCC5. Energy and Matter (flow in systems)

In grades K–2, students observe objects may break into smaller pieces, be put together into larger pieces, or change shapes.

Energy and matter are basic to any systems model, whether of a natural or a designed system. Systems are described in terms of matter and energy. Often, the focus of an investigation is to determine how energy or matter flows through the system, or in the case of engineering to modify the system, so a given energy input results in a more useful energy output.

CCC6. Structure and Function

In grades K–2, students observe the shape and stability of structures of natural and designed objects are related to their function(s).

Structure and function can be thought of as a special case of cause and effect. Whether the structures in question are living tissue or molecules in the atmosphere, understanding their structure is essential to making causal inferences. Engineers make such inferences when examining structures in nature as inspirations for designs to meet people's needs.

CCC7. Stability and Change (factors to always consider)

In grades K–2, students observe some things stay the same while other things change, and things may change slowly or rapidly.

Stability and change are ways of describing how a system functions. Whether studying ecosystems or engineered systems, the question is often to determine how the system is changing over time, and which factors are causing the system to become unstable.

Engineering and Design

ED.A. Defining and Delimiting Engineering Problems

Defining and delimiting engineering problems involves stating the problem to be solved as clearly as possible in terms of criteria for success, and constraints or limits.

- Define - Identify situations that people want to change as problems that can be solved through engineering

ED.B. Developing Possible Solutions

Designing solutions to engineering problems begins with generating a number of different possible solutions, then evaluating potential solutions to see which ones best meet the criteria and constraints of the problem.

- Develop solutions - Convey possible solutions through visual or physical representations

ED.C. Optimizing Design Solutions

Optimizing the design solution involves a process in which solutions are systematically tested and refined and the final design is improved by trading off less important features for those that are more important.

- Optimize - Compare solutions, test them, and evaluate each

Science, Technology, Society, and the Environment

STSE1. Interdependence of Science, Engineering, and Technology

- Science and engineering involve the use of tools to observe and measure things.

STSE2. The Influence of Engineering, Technology, and Science on Society and the Natural World

- Every human-made product is designed by applying some knowledge of the natural world and is built by using natural materials. Taking natural materials to make things impacts the environment.

Common Core State Standards for English and Language Arts

Reading Standards for Informational Text

Key Ideas and Details:

- **CCSS.ELA-LITERACY.RI.K.1:** With prompting and support, ask and answer questions about key details in a text.
- **CCSS.ELA-LITERACY.RI.K.2:** With prompting and support, identify the main topic and retell key details of a text.
- **CCSS.ELA-LITERACY.RI.K.3:** With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.

Craft and Structure:

- **CCSS.ELA-LITERACY.RI.K.4:** With prompting and support, ask and answer questions about unknown words in a text.
- **CCSS.ELA-LITERACY.RI.K.5:** Identify the front cover, back cover, and title page of a book.
- **CCSS.ELA-LITERACY.RI.K.6:** Name the author and illustrator of a text and define the role of each in presenting the ideas or information in a text.

Integration of Knowledge and Ideas:

- **CCSS.ELA-LITERACY.RI.K.7:** With prompting and support, describe the relationship between illustrations and the text in which they appear (e.g., what person, place, thing, or idea in the text an illustration depicts).
- **CCSS.ELA-LITERACY.RI.K.8:** With prompting and support, identify the reasons an author gives to support points in a text.
- **CCSS.ELA-LITERACY.RI.K.9:** With prompting and support, identify basic similarities in and differences between two texts on the same topic (e.g., in illustrations, descriptions, or procedures).

Range of Reading and Level of Text Complexity:

- **CCSS.ELA-LITERACY.RI.K.10:** Actively engage in group reading activities with purpose and understanding.

What Teachers Need to Know

Supportive information on the content standards and the science they address is provided throughout the lessons at points of relevance:

Know the Standards: These sections, found later in this Teacher Guide, explain what to teach and why, with reference to NGSS and Core Knowledge expectations.

Know the Science: These sections provide supporting, adult-level, background information or explanations related to specific examples or Disciplinary Core Ideas.

Students come to elementary classrooms across the country with a wide range of prior experiences. Some have grown up in cities away from nature. Others have grown up in the country, intimately involved in nature.

Some have had teachers and/or family members who have been reading aloud and sharing the wonderful world of animals and plants with them for several years, while others have not. Some have traveled to other cities, states, and countries, while others may know only their own family and neighborhood.

Draw out students. Give them the opportunity to express what they know about the natural world, about rocks, the stars, motion, giraffes, or matter. You can assess the prior knowledge students have about science, and since science deals with everything around a child, the wealth of their background in science should not be underestimated.

Features

Using the Student Book

The *Science in Action* Student Book includes four, intended to be read aloud by the teacher as the students look at images on each page. The Student Book opens with stories of the source of inspiration for a scientist when they were young. The parts that follow the chapters introduce the scientist as an adult, the work they do as an adult in a science-based field. The final part discusses how they were inspired by scientists of the past.

Online Resources

The Student Book is spiral bound to allow students to lay it flat when reading or following along.

Because students in Kindergarten–Grade 2 are just learning to read and are learning how to decode written words, so the complexity and amount of text that these young students can actually read is quite limited.

While some advanced students may be able to read words on a given page of the Student Book, as a general rule, students should not be expected or asked to read aloud the text on the Student Book pages. The text in the Student Book is there so that teachers and parents can read it when sharing the Student Book with students.

The intent of the Grades K–2 CK Science in Action lessons is to build students' understanding and knowledge of science concepts, as well as of associated practices and skills, using a teacher Read Aloud, accompanied by example images and diagrams. Cognitive science research has clearly documented the fact that students' listening comprehension far surpasses their reading comprehension well into the late elementary and early middle school grades. Said another way, students are able to understand and grasp far more complex ideas and texts that they hear read aloud than they would ever be able to read or comprehend when they read to themselves. For a more thorough discussion of listening and reading comprehension and the underlying cognitive science research, teachers may want to refer to Appendix A of the Common Core State Standards for English Language Arts, noting in particular the Speaking and Listening section of the appendix.

Using the Teacher Guide

The *Science in Action* Teacher Guide is set up with lessons that parallel the chapters of the Student Book. Additionally, there are Experiences which follow some of the Lessons. Experiences are class-length labs which support the science content in the Student Book. Within the Teacher Guide are a list of the Nature of Science, SEPs, CCCs, and Literacy standards which students may encounter within the lessons and experiences.

Online Resources

Use this link to download the CKSci Online Resources for this unit, where the specific link to this appendix can be found:

www.coreknowledge.org/cksci-online-resources

Activity Pages

Activity Pages

AP 1–20

Black line reproducible masters for activity pages, as well as an answer key, are included in Teacher Resources on pages 66–70. The icon shown to the left appears throughout the Teacher Guide wherever activity pages (AP) are referenced.

Make sufficient copies for your students in advance of each lesson segment.

Lesson 1—Working Together 66

Lesson 2—Putting into Groups 67

Lesson 3—Finding Patterns in Nature 68

Lesson 4—Using Maps 69

Online Resources

Online Resources

For each CKSci unit, the Teacher Guide includes references to online resources (including external websites and downloadable documents) to enhance classroom instruction. Look for the icon on the left.

Use this link to download the CKSci Online Resources for this unit:

www.coreknowledge.org/cksci-online-resources

Materials and Equipment

These lessons suggest a moderate variety of materials to support activities that enhance the Science in Action chapter readings. Prepare in advance by collecting the materials and equipment needed for all the demonstrations and hands-on investigations.

Internet access and the means to project images/videos for whole-class viewing are also required in many lessons but not repeated below.

Lesson 1

- reference books and other research materials
- colored pencils or crayons

Lesson 2

- reference books and other research materials
- colored pencils or crayons
- a variety of classroom items of two different colors

Lesson 3

- reference books and other research materials
- colored pencils or crayons

Lesson 4

- reference books and other research materials
- colored pencils or crayons

Pacing

The Core Knowledge Science in Action Student Book consists of four chapters, each ten pages long. This accompanying Teacher Guide contains one lesson of instructional support per chapter. Each lesson offers prompts for the teacher to use in facilitation of class discussion. Many lessons offer brief hands-on activities, teacher demonstrations, or online enhancements in addition to the reading support. All lessons include an Activity Page reproducible master.

The Science in Action lessons, requiring 30–45 minutes each, can be implemented in sequence, as a stand-alone unit across twenty consecutive class sessions. The unit can also serve as the basis of an enrichment program. Or, teachers may elect to use one lesson per week across the school year, layered in tandem with other physical, life, and earth/space science content units. To assist with the latter approach, the following table provides a key suggesting the science domain most prominently emphasized in each Science in Action chapter to help pair the chapters meaningfully with other units.

Science in Action Chapter/Experience	Has content that ties to …	Core Knowledge Kindergarten Units
1. Kyle's Nature Adventures	Life science, STEM	• Needs of Plants and Animals, • Changing Environments, • Science All Around Us
2. Kyle Bradford: Studying Ants	Life science, STEM	• Needs of Plants and Animals, • Changing Environments, • Science All Around Us
3. Jamieson's Explorations	Life science, STEM	• Needs of Plants and Animals, • Changing Environments, • Science All Around Us
4. Jamieson Chaitman: Mapping Trees	Life science, STEM	• Needs of Plants and Animals, • Changing Environments, • Science All Around Us

Online Resources

Also, see the Online Resources Guide for recommendations about when to best enhance instruction to support these chapters.

www.coreknowledge.org/cksci-online-resources

LESSON 1

Kyle's Nature Adventures

At a Glance

Learning Objectives

- ✓ Explain how science is about being curious and observing nature.
- ✓ Explain that people from many backgrounds become scientists.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary practice
- drawing

NGSS and CCSS References

NOS4. Scientific Models, Laws, Mechanisms, and Theories Explain Natural Phenomena: Scientists use drawings, sketches, and models as a way to communicate ideas.

NOS5. Science Is a Way of Knowing: Science knowledge helps us know about the world.

RI.K.1. Key Ideas and Details: With prompting and support, ask and answer questions about key details in a text.

For detailed information about the NGSS and CCSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary and Language of Instruction

The Glossary at the end of this Teacher Guide lists definitions for Core Vocabulary and selected Language of Instruction.

Core Vocabulary terms are those that students should learn to use accurately in discussion. During instruction, expose students repeatedly to these terms but not through isolated drill or memorization.

colony **explorer** **guide**

Language of Instruction consists of additional terms that you should use when talking about concepts in the lesson. Students benefit from your modeling the use of these words without the expectation that students themselves will use or explain the words.

meadow **steel** **tracks** **weave**

Instructional Resources

Student Book

Ch. 1

Student Book, Chapter 1
"Kyle's Nature Adventures"

Activity Page

AP 1

Activity Page
Working Together (AP 1)

Materials and Equipment

Collect or prepare the following items:

- reference books and other research materials
- internet access and the means to project images/video for whole-class viewing
- colored pencils or crayons

Advance Preparation

Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter when opening their book. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all student books so that the first page of Chapter 1 is visible.

The Core Lesson

1. Focus attention on the lesson purpose.

Have students think of a time they went on a nature adventure. What types of plants and animals did they notice? If students are sharing similar adventures, share one of your own that involves a different environment.

2. Read together: "Kyle's Nature Adventures."

Student Book

Ch. 1

While some advanced students may be able to read words on a given page of the Student Book, as a general rule students should not be expected or asked to read aloud the text on the Student Book pages. The text in the Student Book is there so that adults can read it when sharing the Student Book with students.

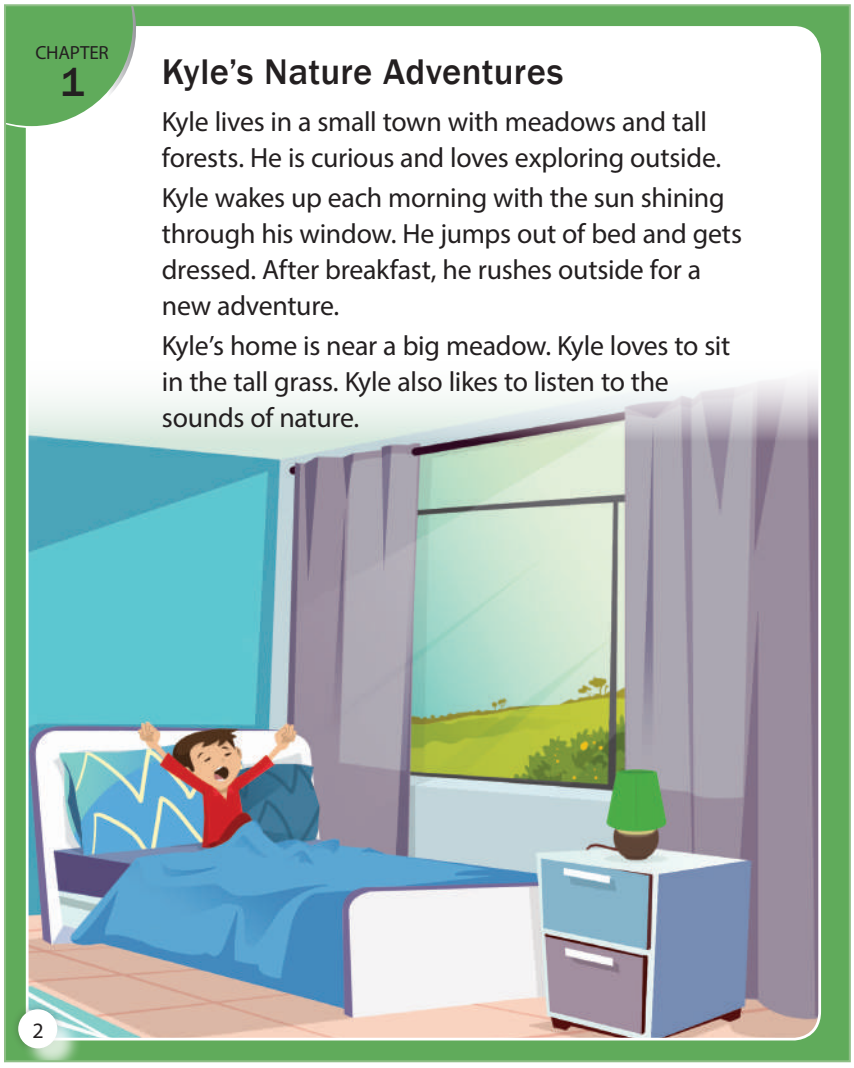
Guide students to open their books to Chapter 1 on page 2. Tell students that the title of this chapter is "Kyle's Nature Adventures," and alert them to pay special attention to the plants and animals Kyle, his mom, and Mr. Turner see on their adventures as you read.

Read Aloud Support

Page 2

Ask students to look at the image as you read aloud. Talk about what they notice about the boy in the room and the time of day.

Call attention to the view outside of Kyle's bedroom window.



Ask students the following questions:

LITERAL—What do you see outside of Kyle's window?

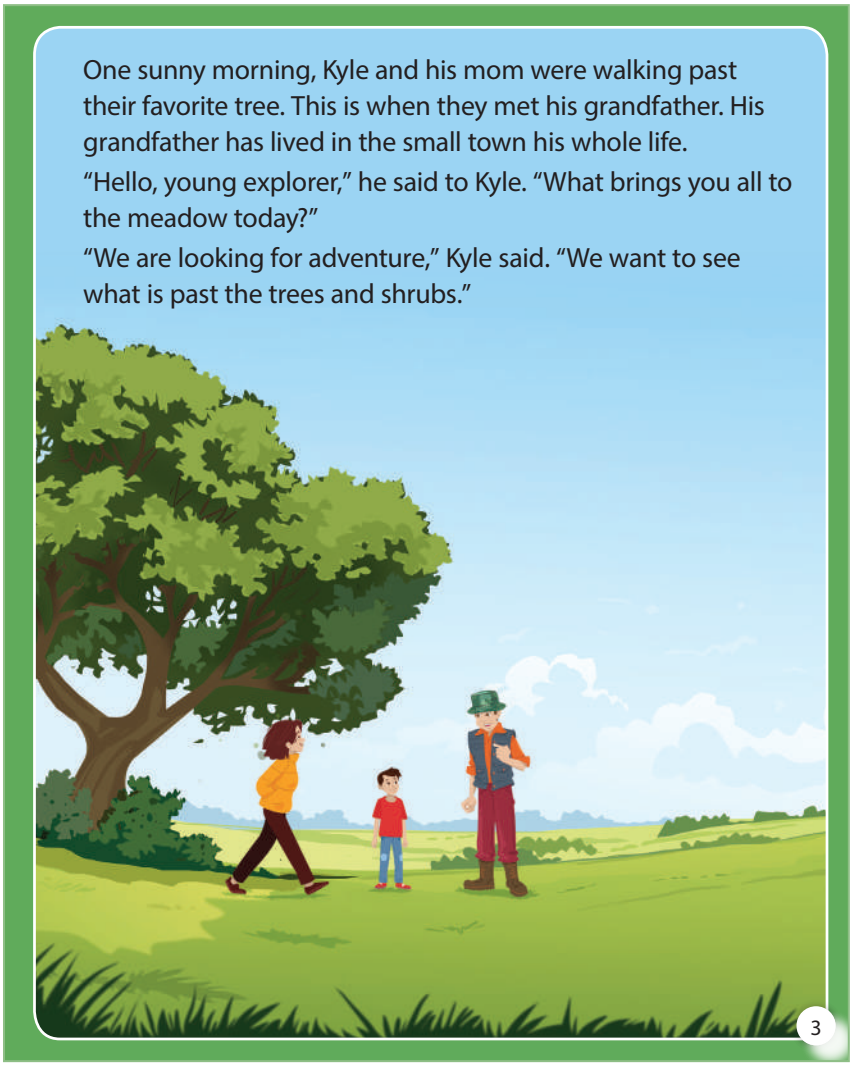
» trees and sunlight

INFERENTIAL—Why do you think Kyle is stretching in his bed?

» It is morning, and he is just waking up.

Page 3

Ask students to look at the image as you read aloud. Talk about what they notice about the setting and the people in the image.



INFERENTIAL—Why does his grandfather call Kyle a young **explorer**?

» He is out walking around the meadow looking for new adventures.

EVALUATIVE—Why is it important to know that his grandfather has lived in the small town his whole life?

» He probably knows a lot about the area if he has been there his whole life. And it is a small town, so he probably has been around the entire town.

Page 4

Ask students to look at the image and the called-out image as you read aloud. Talk about what they notice about the ground.

LITERAL—What do they see on the ground?

» foot tracks from small animals

INFERENTIAL—What does it mean that his grandfather became their **guide**?

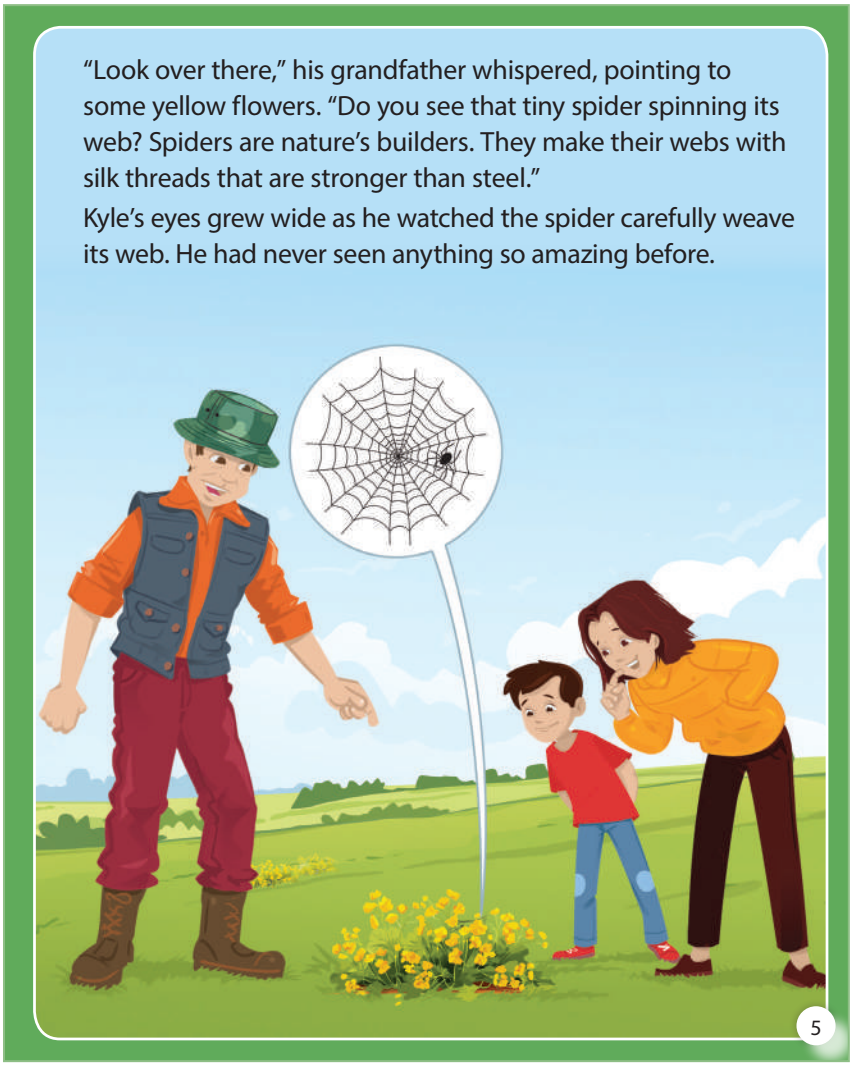
» that Mr. Turner will show them around the meadow

INFERENTIAL—Why is listening for animal sounds important?

» It can help you know if an animal is nearby.

Page 5

Ask students to look at the image as you read aloud. Talk about what they notice about the actions of the spider.



LITERAL—What is the spider doing?

» making a spiderweb

Call attention to the phrase "stronger than steel."

INFERENTIAL—What does it mean that silk threads are stronger than steel?

» Steel is very strong. If the silk threads are stronger than steel, they must be very strong.

INFERENTIAL—How does making strong silk threads help the spider?

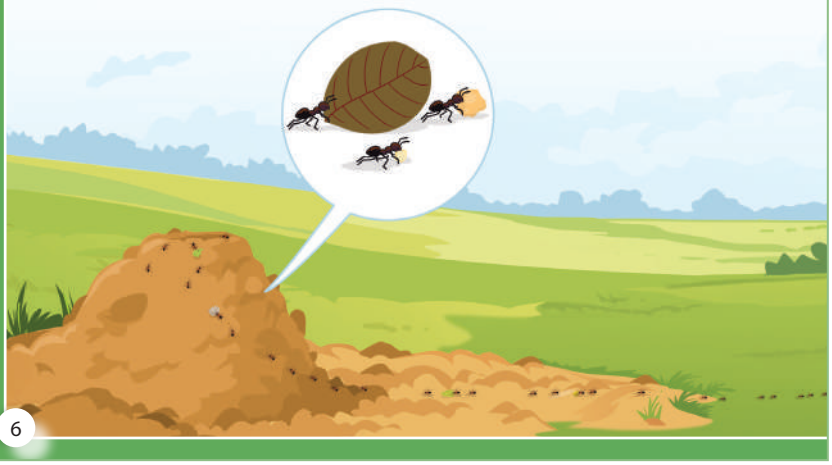
» The threads are hard for insects to break out of.

Page 6

Ask students to look at the images of the ant colony and the individual ants as you read aloud. Talk about what they notice about the ants.

As the days passed, Kyle, his mom, and his grandfather explored every area of the meadow together. They found ladybugs hiding under leaves, caterpillars chewing on green leaves, and even a family of mice sleeping inside a tree log.

But Kyle's favorite discovery of all was the ants. His grandfather showed Kyle how ants work together to build tunnels underground. They watched as ants carried pieces of leaves and crumbs of food.



6

LITERAL—What are the ants carrying?

» a crumb of food and a leaf

Point out the size of the ant and the size of what the ant is carrying.

EVALUATIVE—Why do you think ants can carry things heavier than them?

» They must have strong body parts. They also work together to move things.

Page 7

Ask students to look at the image across the two pages as you read aloud. Talk about what they notice about what ants can do.

INFERENTIAL—What is an ant **colony**?

» a group of ants

INFERENTIAL—Why do you think ants build tunnels underground?

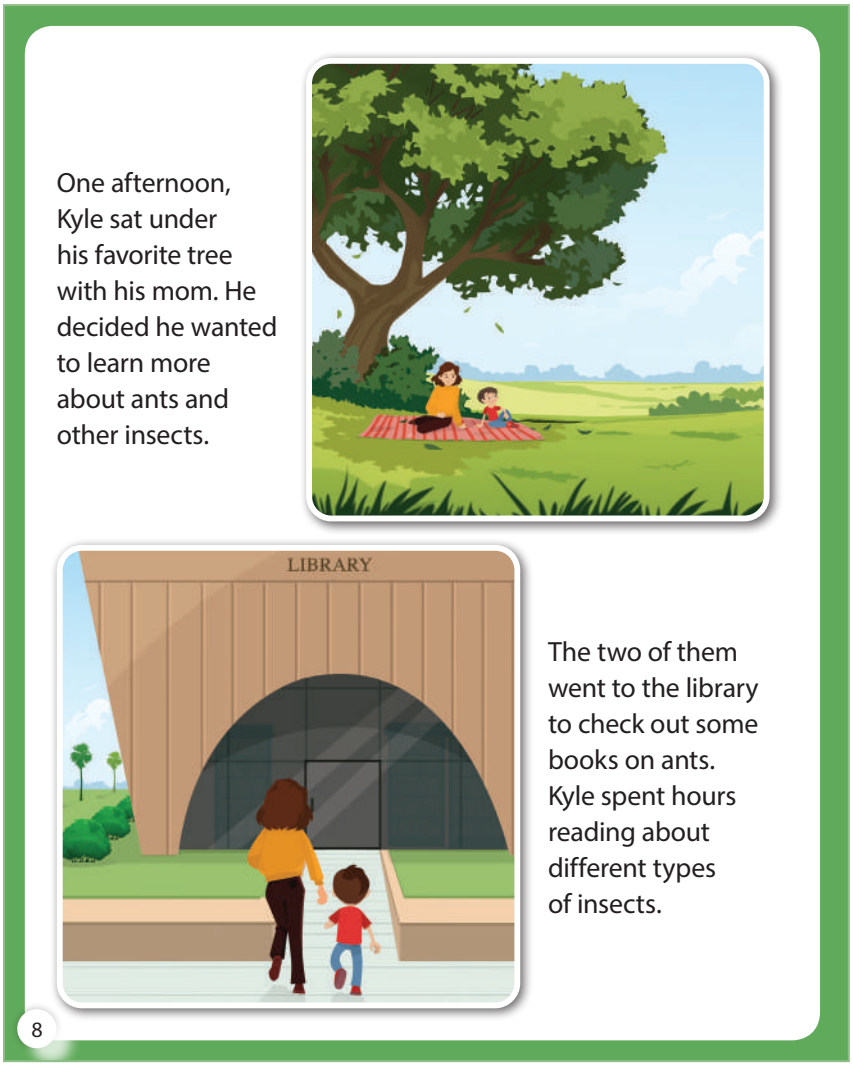
» to keep themselves safe

Online Resources

EXTEND—To further show how ants work together, locate videos online in which ants are working together to move items from one place to another. Some students may also be interested in seeing in a sped-up video showing how ants build tunnels underground.

Page 8

Ask students to look at the images as you read aloud. Talk about what they notice about the differences between the two images.



LITERAL—Why do Kyle and his mom go to the library?

» to get some books about ants

EVALUATIVE—How else can Kyle learn about ants?

» He can look online, ask Mr. Turner or other people that know about ants, and study them in nature.

Page 9

Ask students to look at the image as you read aloud. Talk about what they notice about the people Kyle shares his dreams with.

"I want to be an scientist when I grow up," Kyle announced to his parents one night at dinner.

Kyle's days became filled with ant adventures. He drew pictures of insects and of ants marching in lines and building their homes in the soil.

9

LITERAL—What does Kyle want to be when he grows up?

» an ant scientist

INFERENTIAL—How is Kyle keeping a record of what he learns?

» He draws what he sees ants do.

Know the Standards

NOS4. Scientific Models, Laws, Mechanisms, and Theories Explain Natural Phenomena Use this page as an opportunity to emphasize that Kyle is recording his observations when he draws the behaviors of the ants. His drawings are communicating ideas to others.

Page 10

Ask students to look at the image as you read aloud. Talk about what they notice about the setting.

LITERAL—Where did Kyle go the next summer?

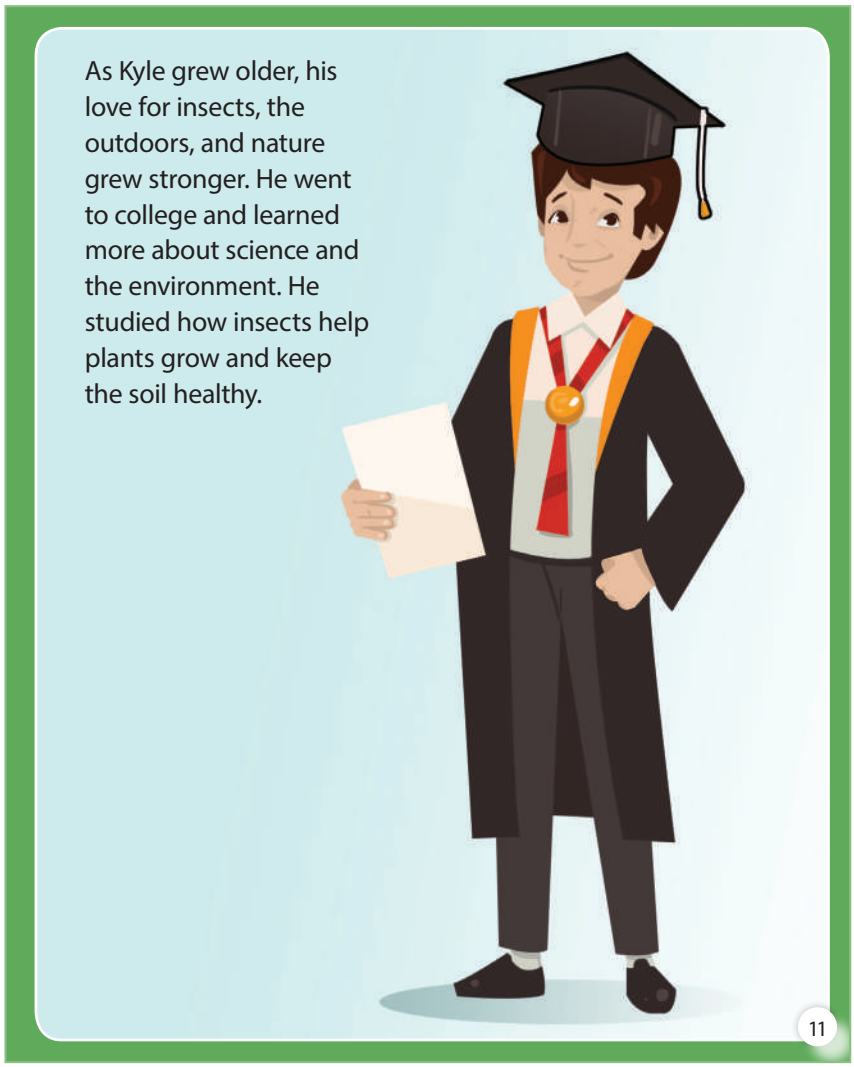
» nature camp

INFERENTIAL—Why do you think Kyle went to nature camp?

» to learn more about the plants and animals in the area and meet other people that are also interested in the same thing

Page 11

Ask students to look at the image as you read aloud. Talk about what they notice about the image.



EVALUATIVE—Why is it important that ants keep the soil healthy?

» We grow plants and food in soil. The soil needs to be healthy so we can have healthy plants and food.

3. Connect to lived experience.

Activity Page

AP 1

Invite students to share any details from the chapter that resemble someone or something familiar to them. Ask students to tell details about the chapter that interested them. Invite students to ask questions about details that might not have been clear to them.

Use Activity Page 1 to reinforce students' reflections about the chapter.

See the Activity Page Answer Key for correct answers and sample student responses.

LESSON 2

Kyle Bradford: Studying Ants

At a Glance

Learning Objectives

- ✓ Explain how science is about being curious and observing nature.
- ✓ Explain that people from many backgrounds become scientists.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary practice
- sorting
- drawing

NGSS and CCSS References

NOS2. Scientific Knowledge Is Based on Empirical Evidence: Scientists look for patterns and order when making observations about the world.

NOS5. Science Is a Way of Knowing: Science knowledge helps us know about the world.

RI.K.1. Key Ideas and Details: With prompting and support, ask and answer questions about key details in a text.

L.K.5.a. Vocabulary Acquisition and Use: Sort common objects into categories to gain a sense of the concepts the categories represent.

For detailed information about the NGSS and CCSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary and Language of Instruction

The Glossary at the end of this Teacher Guide lists definitions for Core Vocabulary and selected Language of Instruction.

Core Vocabulary terms are those that students should learn to use accurately in discussion. During instruction, expose students repeatedly to these terms but not through isolated drill or memorization.

biologist **microscope** **natural**

Language of Instruction consists of additional terms that you should use when talking about concepts in the lesson. Students benefit from your modeling the use of these words without the expectation that students themselves will use or explain the words.

grassy **native** **protect** **teamwork**

Instructional Resources

Student Book

Ch. 2

Student Book, Chapter 2
"Kyle Bradford: Studying Ants"

Activity Page

AP 2

Activity Page
Putting into Groups (AP 2)

Materials and Equipment

Collect or prepare the following items:

- reference books and other research materials
- internet access and the means to project images/video for whole-class viewing
- colored pencils or crayons
- a variety of classroom items of two different colors

Advance Preparation

When preparing materials, choose two sets of easily available classroom materials, with each set having the same or similar colors.

Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter when opening their book. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all student books so that the first page of Chapter 2 is visible.

The Core Lesson

1. Focus attention on the lesson purpose.

Have students think of insects they are aware of and give details about the insects. Suggest that students share the physical traits, such as color and body parts, and different behaviors insects show.

2. Read together: "Kyle Bradford: Studying Ants."

Student Book

Ch. 2

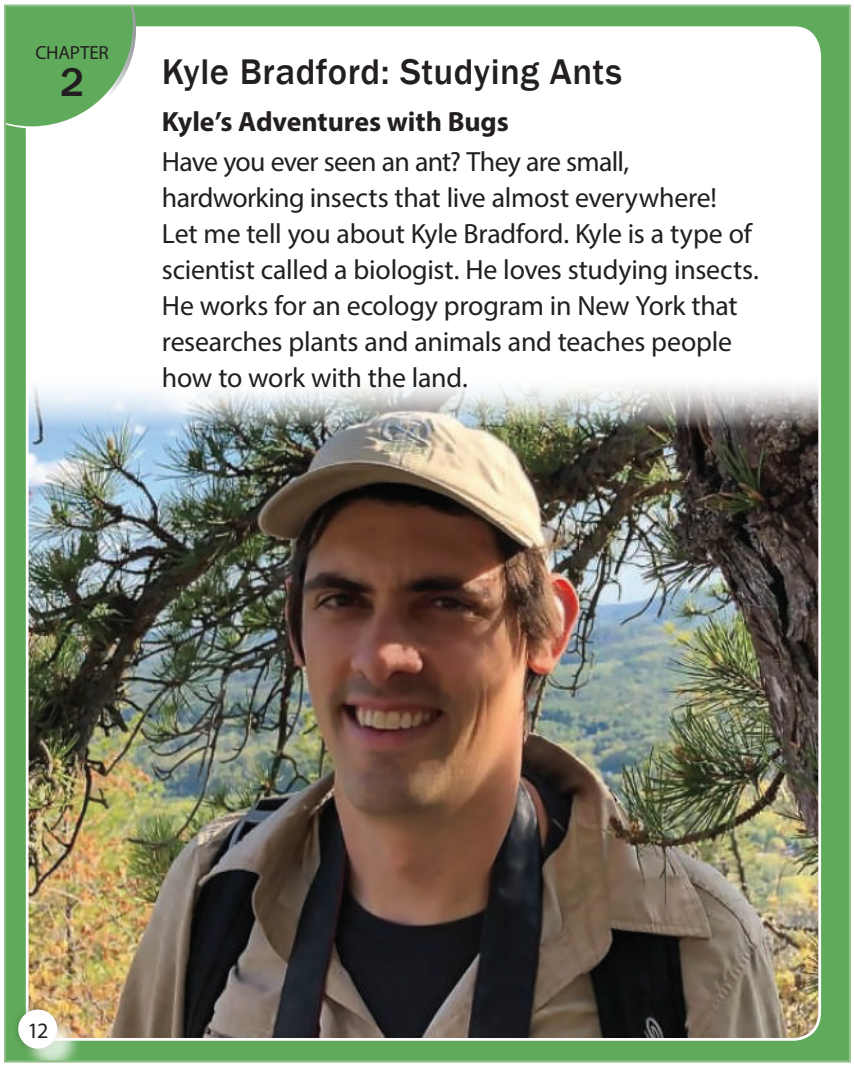
While some advanced students may be able to read words on a given page of the Student Book, as a general rule students should not be expected or asked to read aloud the text on the Student Book pages. The text in the Student Book is there so that adults can read it when sharing the Student Book with students.

Guide students to open their books to Chapter 2 on page 12. Tell students that the title of this chapter is "Kyle Bradford: Studying Ants," and alert them to pay special attention to how scientists, like Kyle, help protect nature.

Read Aloud Support

Page 12

Ask students to look at the image as you read aloud. Talk about what they notice about Kyle's job.



Ask students the following questions:

LITERAL—What type of scientist is Kyle?

» a **biologist**

INFERENTIAL—What do you think biologists do?

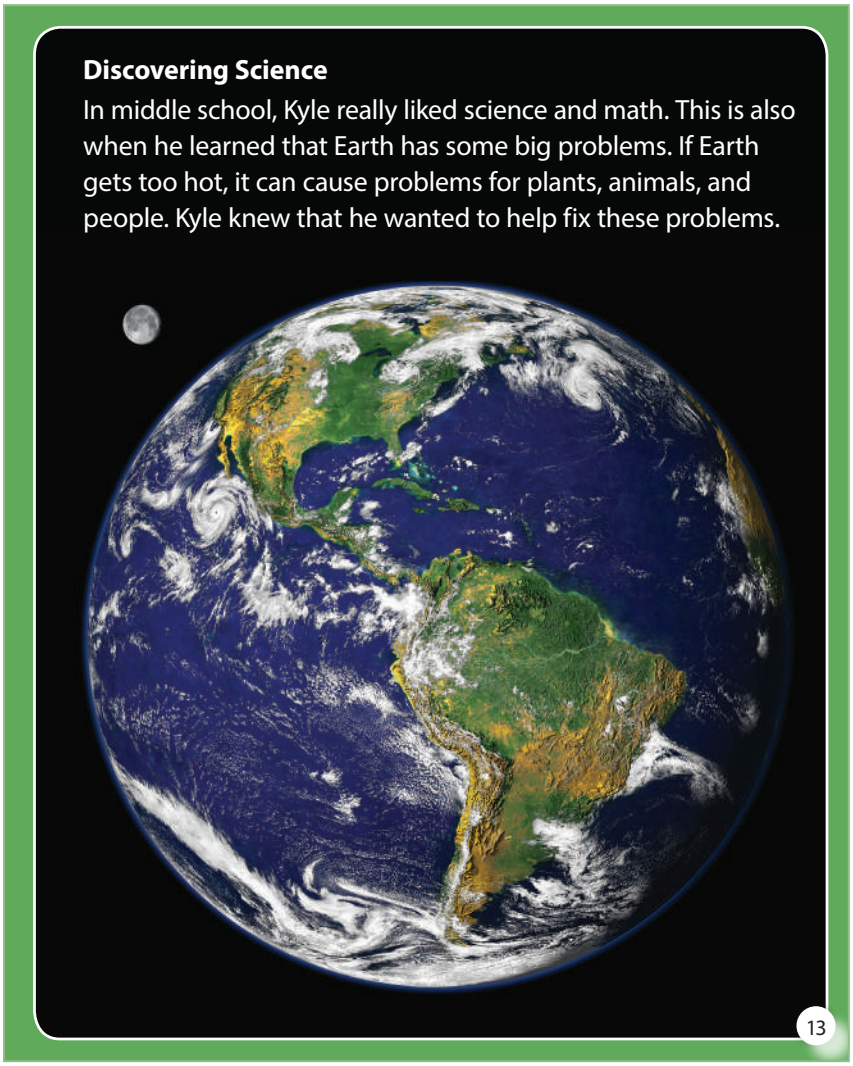
» They study things like plants and animals.

INFERENTIAL—How does studying plants and animals help biologists teach people how to work with the land?

» Biologists can teach people what plants and animals belong on the land near them.

Page 13

Ask students to look at the image as you read aloud. Talk about what they notice about the colors on Earth.



LITERAL—What did Kyle like studying in middle school?

» science and math

EVALUATIVE—Why do you think Kyle wants to help fix Earth's problems?

» He wants to make sure that plants, animals, and people are safe.

EVALUATIVE—How might Earth being too hot be dangerous?

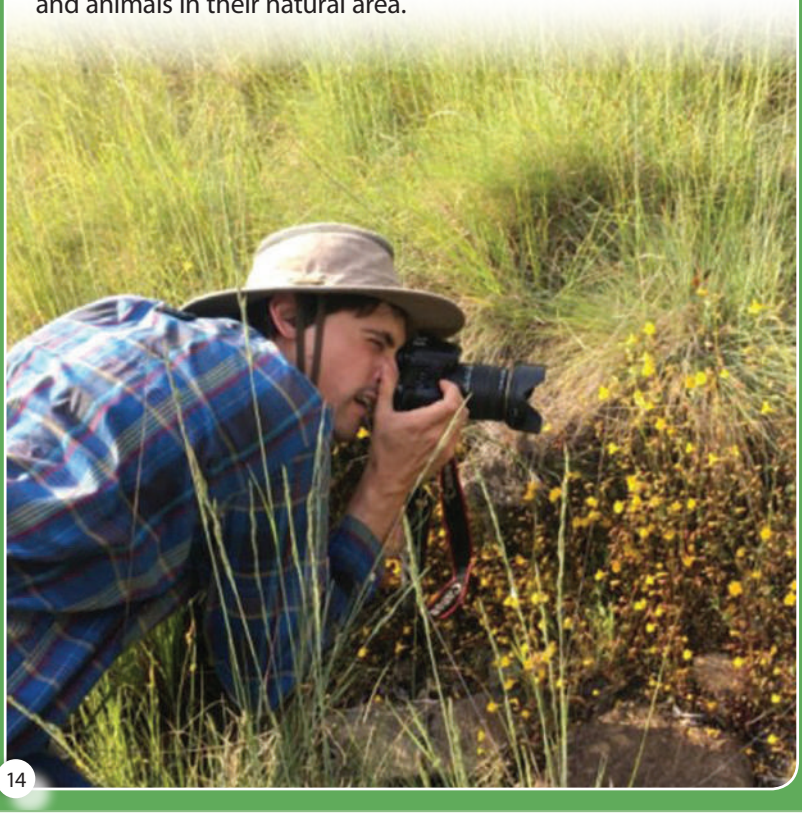
» There can be more fires and and bad weather.

Page 14

Ask students to look at the image as you read aloud. Talk about what they notice about the area Kyle is in.

Going to College

Kyle went to college at the University of Vermont. He learned how to farm in ways that are good for Earth. When he started working at an ecology program after college, he started learning about field biology. Field biology is studying plants and animals in their natural area.



14

LITERAL—What college did Kyle go to?

» University of Vermont

INFERENTIAL—What does **natural** mean?

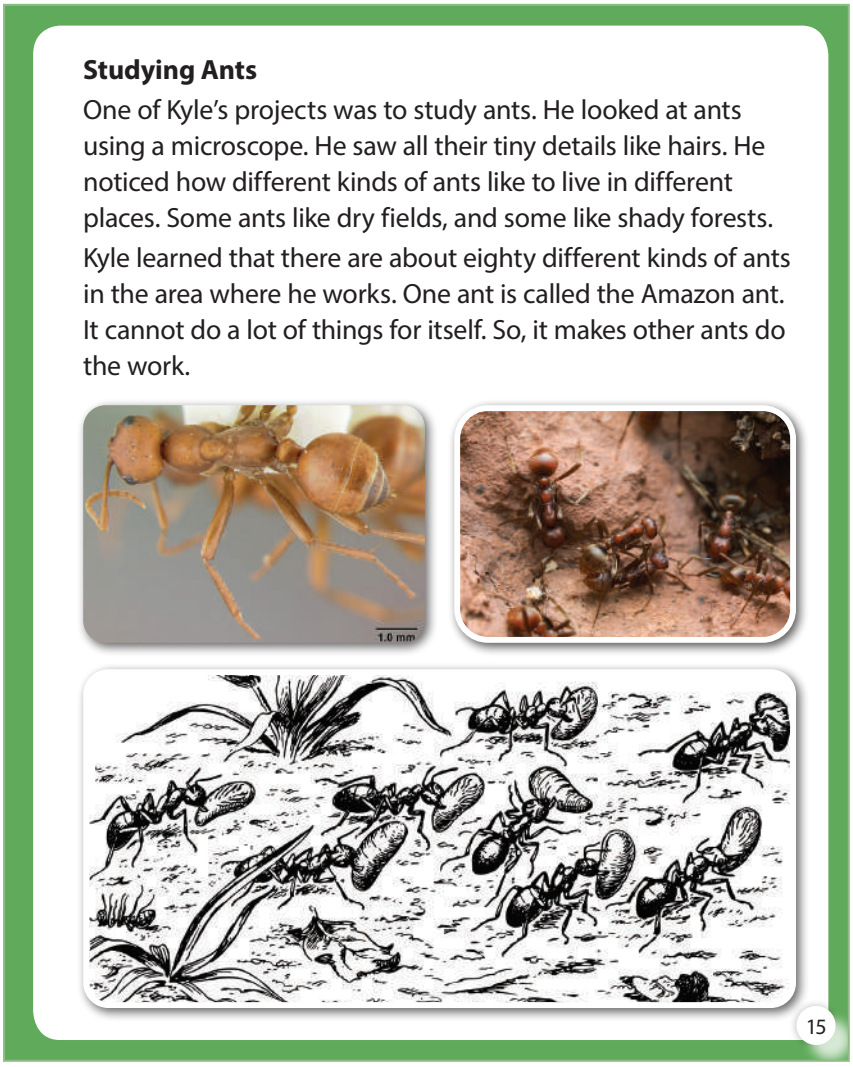
» things found in nature

EVALUATIVE—What do you think *good for Earth* means?

» It means helping things on Earth stay healthy.

Page 15

Ask students to look at the image and the called-out image as you read aloud. Talk about what they notice about the ant and its jaws.



INFERENTIAL—Why does Kyle use a **microscope** to study ants?

» to see the details of the ant

LITERAL—What is one kind of ant Kyle studies?

» Amazon ant

Call attention to the jaws of the Amazon ant.

INFERENTIAL—Why do you think the Amazon ant's jaws are curved hook-shaped?

» so they can grab things tightly

Know the Standards

NOS2. Scientific Knowledge Is Based on Empirical Evidence Use this page as an opportunity to emphasize that when Kyle observes differences and similarities, he is sorting things into categories.

Page 16

Ask students to look at the images of the ants as you read aloud. Talk about what they notice about what the ants are carrying.

LITERAL—What are the ants moving?

» seeds

Point out the different types of seeds the ants are moving.

INFERENTIAL—Why is it important that ants move seeds?

» so that plants can grow in many different places in nature

Online Resources

EXTEND—To further show how animals help pollinate, locate videos online in which animals, such as ants and mammals, help pollinate by moving seeds to other locations.

Page 17

Ask students to look at the image of the grassy areas as you read aloud. Talk about what they notice about the grassy fields.

INFERENTIAL—What does it mean to protect?

» to watch over and take care of

LITERAL—What will happen to the ants if the grassy fields change a lot?

» The ants can lose their homes.

Page 18

Ask students to look at the image across the two pages as you read aloud. Talk about what they notice about what is happening in the image.

Taking Care of Nature

One problem Kyle worries about is animals and plants losing places to live. When too many houses or roads are built, animals like ants can lose their homes. Kyle also worries about plants that are not native to the area. These plants can cause problems for plants and animals that have lived in the area for a long time.

18

LITERAL—What happens if too many houses or roads are built?

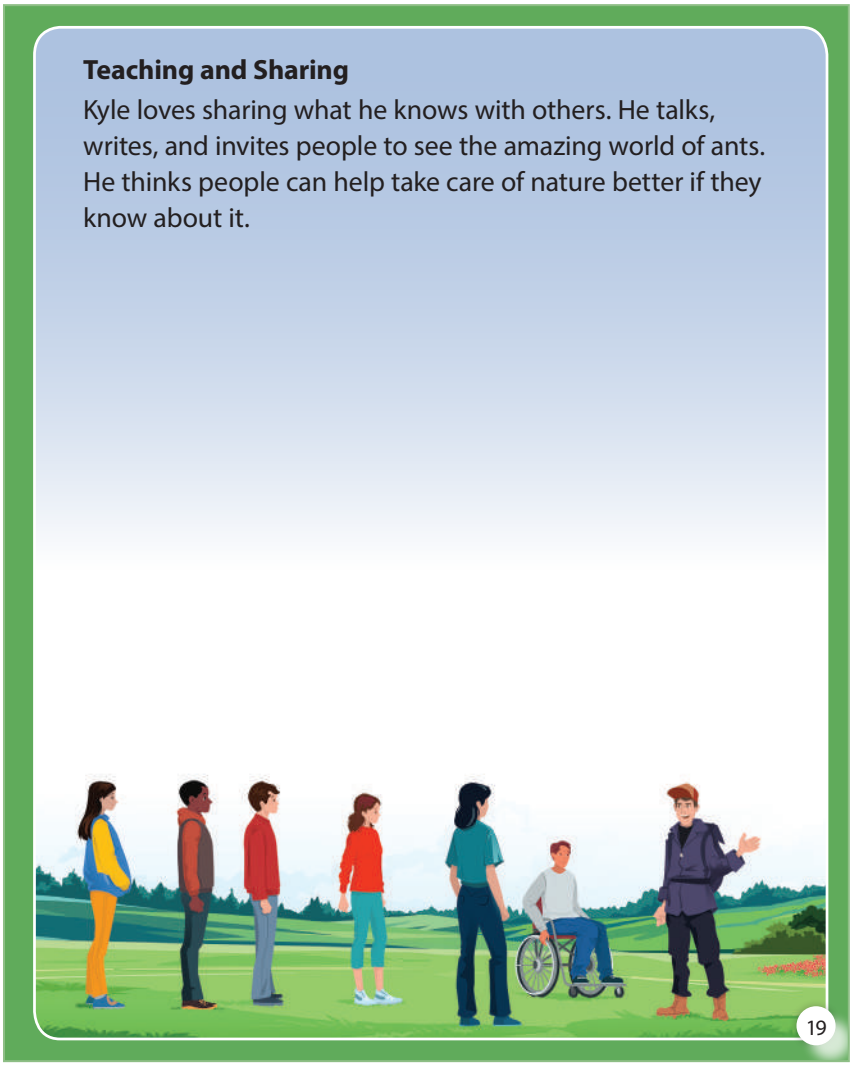
» Animals can lose their homes.

INFERENTIAL—What does it mean if animals are native to the area?

» The animals were born in the area.

Page 19

Ask students to look at the image as you read aloud. Talk about what they notice about what Kyle is doing.



LITERAL—What is Kyle doing in the picture?

» He is sharing what he knows and teaching others about ants and nature.

INFERENTIAL—Why does Kyle share what he knows about ants and nature with others?

» He thinks people will help take care of nature and Earth if they know more about it.

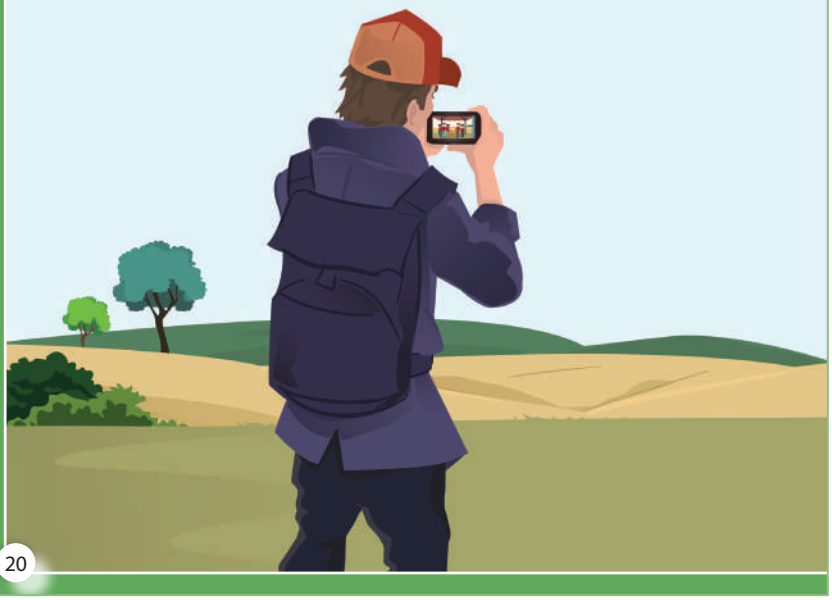
Page 20

Ask students to look at the image across the two pages as you read aloud. Talk about what they notice about the setting.

Working Together

Kyle believes that science isn't just about remembering facts. It is about exploring, imagining, and discovering new things. He thinks everyone can be a scientist if they are curious.

Kyle knows that protecting nature takes teamwork. Scientists need help from everyone, even artists and musicians. He hopes more people will learn about nature and help take care of Earth.



20

LITERAL—What does Kyle think science is about?

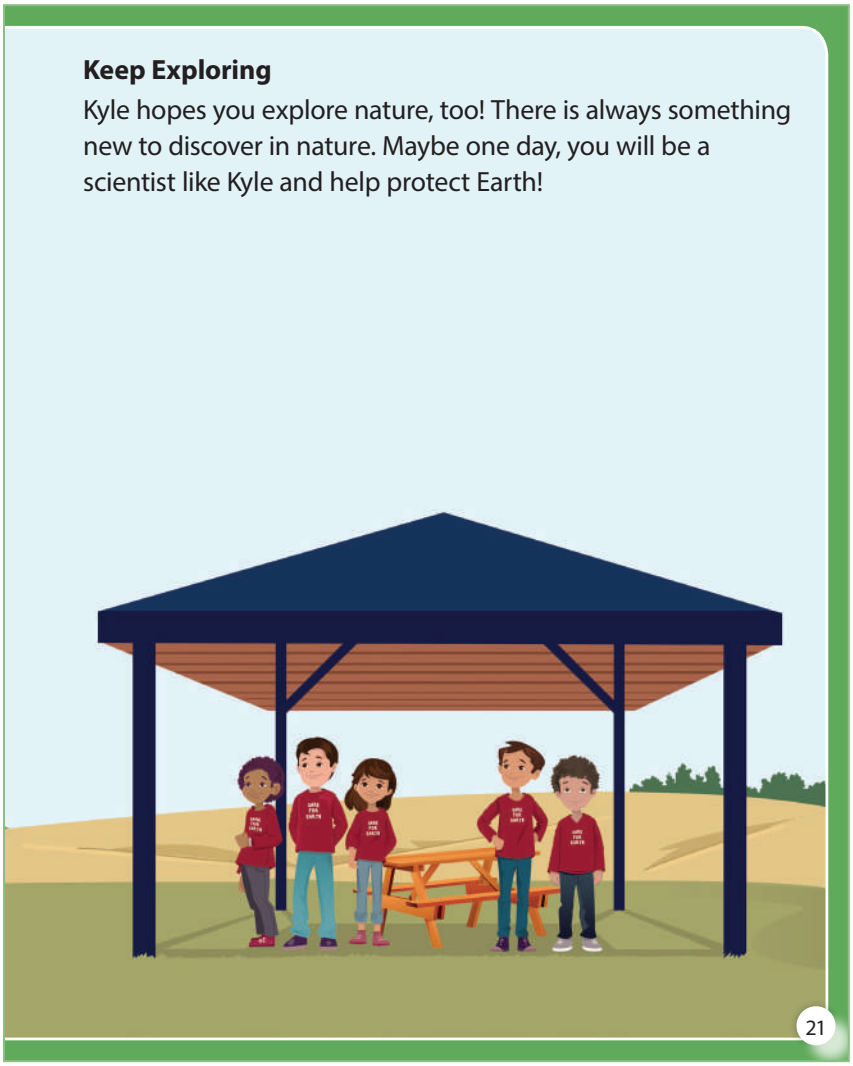
» exploring, imagining, and discovering

EVALUATIVE—What are some ways scientists can be curious?

» They can ask questions when they don't understand how something works. They can learn more about animals and plants and how to protect Earth.

Page 21

Ask students to look at the image across the two pages as you read aloud. Talk about what they notice about the children



LITERAL—Why does Kyle have a camera?

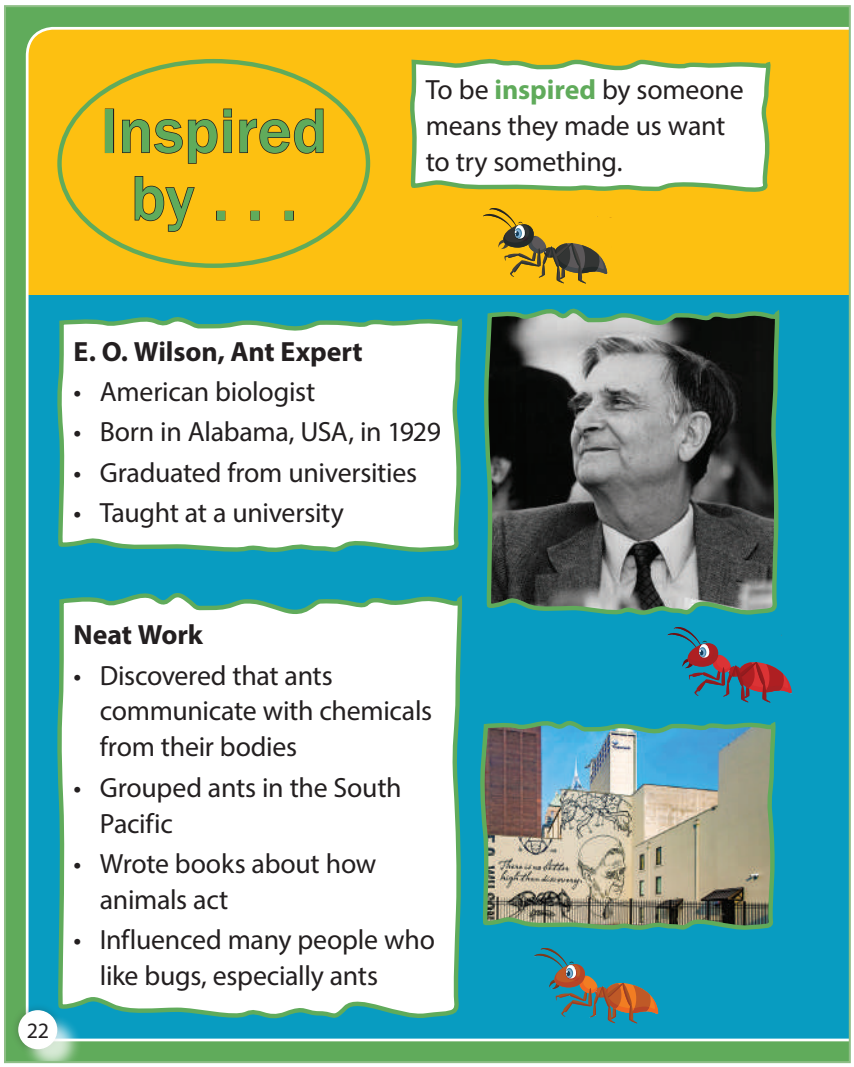
» to take pictures

INFERENTIAL—What do you think the children in the picture learned from Kyle?

» how to explore, more about ants, how to take care of Earth, how to protect nature

Page 22

Ask students to look at the images as you read aloud. Talk about what they notice about the person.



LITERAL—What is the name of this person?

» E. O. Wilson

INFERENTIAL—Why do you think Kyle was inspired by him?

» He knows a lot about ants, and Kyle likes ants.

Page 23

Ask students to look at the images as you read aloud. Talk about what they notice about the person.

LITERAL—What is classification?

» sorting things into groups

3. Connect to lived experience.

Activity Page

AP 2

Invite students to share any details from the chapter that resemble someone or something familiar to them. Ask students to tell details about the chapter that interested them. Invite students to ask questions about details that might not have been clear to them.

Use Activity Page 2 to reinforce students' reflections about the chapter.

See the Activity Pages Answer Key for correct answers and sample student responses.

LESSON 3

Jamieson's Explorations

At a Glance

Learning Objectives

- ✓ Explain how science is about being curious and observing nature.
- ✓ Explain that people from many backgrounds become scientists.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary practice
- drawing

NGSS and CCSS References

NOS2. Scientific Knowledge Is Based on Empirical Evidence: Scientists look for patterns and order when making observations about the world.

NOS5. Science Is a Way of Knowing: Science knowledge helps us know about the world.

RI.K.1. Key Ideas and Details: With prompting and support, ask and answer questions about key details in a text.

For detailed information about the NGSS and CCSS References, follow the links in the Online Resources Guide for this unit:

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Core Vocabulary and Language of Instruction

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Core Vocabulary terms are those that students should learn to use accurately in discussion. During instruction, expose students repeatedly to these terms but not through isolated drill or memorization.

canopy **nature** **pattern**

Language of Instruction consists of additional terms that you should use when talking about concepts in the lesson. Students benefit from your modeling the use of these words without the expectation that students themselves will use or explain the words.

challenge **research** **woods**

Instructional Resources

Student Book

Ch. 3

Student Book, Chapter 3
"Jamieson's Explorations"

Activity Page

AP 3

Activity Page
Finding Patterns in Nature (AP 3)

Materials and Equipment

Collect or prepare the following items:

- reference books and other research materials
- internet access and the means to project images/video for whole-class viewing
- colored pencils or crayons

Advance Preparation

Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter when opening their book. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all student books so that the first page of Chapter 3 is visible.

The Core Lesson

1. Focus attention on the lesson purpose.

Have students think of the different types of trees they have seen or know about. Ask them to think about how trees are alike and how they are different. Provide photos of a variety of trees that are not native to the area.

2. Read together: "Jamieson's Explorations."

Student Book

Ch. 3

While some advanced students may be able to read words on a given page of the Student Book, as a general rule students should not be expected or asked to read aloud the text on the Student Book pages. The text in the Student Book is there so that adults can read it when sharing the Student Book with students.

Guide students to open their books to Chapter 3 on page 24. Tell students that the title of this chapter is "Jamieson's Explorations," and alert them to pay special attention to the patterns that Jamieson notices in nature.

Read Aloud Support

Page 24

Ask students to look at the image as you read aloud. Talk about what they notice about the setting.

CHAPTER 3

Jamieson's Explorations

Nature's Playground

Jamieson loves exploring outside. He runs through fields, climbs trees, and looks under rocks. "What's hiding here?" he wonders.

He watches ants marching, butterflies fluttering, and birds chirping. Every day is a new adventure in nature for Jamieson.

He is excited to discover something new each time he steps outside. Nature is his favorite playground.

24

Ask students the following questions:

LITERAL—What is Jamieson's favorite playground?

» **nature**

INFERENTIAL—Why do you think Jamieson looks under rocks and climbs trees?

» He looks under rocks to see what is hiding. He climbs trees to see things high in the sky.

Page 25

Ask students to look at the images as you read aloud. Talk about what they notice about the different sizes of the trees.

In the Woods

The area where Jamieson lives has many trees. These areas are called woods.

There are young trees with thin trunks and smooth bark. Young trees are shorter. The tops with all the leaves are not wide because the young trees are still growing up.

There are older trees. These trees have wide trunks and are covered in rough bark. Older trees are taller. The tops of these trees are wide and full of leaves.

Over time, older trees can form a canopy. This is the top layer of a forest. Animals like birds and squirrels make their nests in the canopy of a forest.

25

LITERAL—What is the area with many trees called?

» the woods

INFERENTIAL—Why do you think the area is called the woods?

» It is called the woods because tree trunks are wood.

EVALUATIVE—Do you think animals like the **canopy** in the woods? Why?

» Yes; The canopies make shade. The shade helps it not be so hot for the animals. It is also a safe place for their nests and homes.

Page 26

Ask students to look at the image as you read aloud. Talk about what they notice about the trees.

Math in the Woods

Some days Jamieson enjoys the woods. Other days he goes to school. He loves to do math when he is at school.

Jamieson counts how many trees there are in a picture. He tells which things are big. He tells which things are little. He puts things in order from smallest to biggest.

In math class, Jamieson learns about patterns. A pattern is the way something repeats, or happens over and over again.

26

INFERENTIAL—Why do you think Jamieson put things in order from smallest to biggest?

» He wants to find a pattern.

Point out some patterns, such as trunks are at the bottom of the trees and leaves are at the top of the trees, in the image.

INFERENTIAL—What **patterns** do you notice in the trees?

» The trees are all tall, but some are shorter than others. The bottom parts of the trees are brown. The top parts of the trees are green and have leaves.

Know the Standards

NOS2. Scientific Knowledge Is Based on Empirical Evidence Use this page as an opportunity to emphasize the importance of finding patterns in nature.

Page 27

Ask students to look at the image as you read aloud. Talk about what they notice about the leaves.

Leaf Patterns

At first liked math much more than science. Jamieson science. But he started to realize how math and nature are related. Scientists study nature. Scientists use math to study nature. He looks at leaves in the woods. He sees how things repeat in both science and math pattern are important.

As he grows up, he likes doing math more and more. Knowing math helps him with science. Knowing science helps him with math.

27

LITERAL—What colors are the leaves?

» green, orange, yellow

LITERAL—What are some ways you could group these leaves?

» the number of leaves, if the leaf is one big leaf or has smaller leaves, by the number of points on the leaves

INFERENTIAL—How do you think scientists use math to study nature?

» They count the things in nature they are looking at. They measure the size of things in nature. They look for patterns in numbers they counted.

Page 28

Ask students to look at the image of the friends working together as you read aloud. Talk about what they notice about what the friends are doing.

Love for Math

In school, Jamieson loves math. He solves puzzles, makes graphs, and plays with robots. "Math helps me understand the world," he thinks.

Math becomes his favorite subject. He enjoys the challenge and feels proud when he solves problems.

28

LITERAL—What are the friends building?

» a roller coaster

EVALUATIVE—What problems have you solved that make you feel proud?

» Answers will vary but should explain feeling proud by not giving up on a problem that was difficult to solve.

Page 29

Ask students to look at the image as you read aloud. Talk about what they notice about the classroom setting.

Discovering Science

In high school, Jamieson starts to really like science classes. He learns about Earth and the environment. "Science is a big puzzle," he thinks. "And I love puzzles. Puzzles can have patterns." He did experiments with his friends. They studied plants, animals, and weather. His interest in science grows every day. He starts to dream about having a job that uses math and science.

29

INFERENTIAL—How do you think science is a puzzle?

» There are problems to solve and figure out.

INFERENTIAL—In science club, Jamieson studies plants, animals, and weather. What are some of your favorite things to study in science?

» Possible answers: flowers, birds, oceans, senses

EXTEND—To further increase curiosity in puzzles, provide a variety of puzzles, such as board puzzles, cube puzzles, brain teasers, logic puzzles, etc., for students to work on during the day. Have students share the patterns they notice in the different types of puzzles.

Page 30

Ask students to look at the image as you read aloud. Talk about what they notice about the building.

College Dreams

Jamieson works hard and gets into Clark University in Massachusetts. He studies environmental sciences.

He meets exciting professors and makes new friends. "This is where I belong," he thinks.

College is a great adventure for him. He learns a lot about nature. He also learns how he can help make nature better. His love for science and exploration continues to grow.

30

LITERAL—What college did Jamieson go to?

» Clark University

EVALUATIVE—Why do you think Jamieson feels he belongs at Clark University?

» He meets other people that like nature and math like him. He also can be part of a team to make nature better.

INFERENTIAL—How do you think college for Jamieson was the same as high school?

» He still studied nature and solved puzzles.

Page 31

Ask students to look at the image as you read aloud. Talk about what they notice about how Jamieson feels.

Graduation Day

The big day comes!
Jamieson graduates!
He wears a cap and gown.
"I did it!" he cheers.

Now that he has completed college, he is ready for the next big adventure. He feels proud and excited for the future. His family and friends celebrate with him. Jamieson is ready to start helping Earth. Now he can start looking for a job that will let him help Earth.

31

LITERAL—What is Jamieson ready for after graduating?

» the next big adventure

INFERENTIAL—Why do you think Jamieson feels proud?

» He worked hard to learn a lot of ways to help Earth.

Page 32

Ask students to look at the image as you read aloud. Talk about what they notice about the images on the computer screen.

Becoming a Scientist

Jamieson becomes a geographic information scientist. He uses special tools and satellites to study Earth. The special tools and satellites help Jamieson see things he cannot walk to.

"I'm helping to understand our planet," he says proudly. He loves his job and the work he does to help protect nature.

His research helps people understand the environment better. He feels happy to be helping the environment.

32

LITERAL—What is Jamieson's job?

» geographic information scientist

LITERAL—What tools does Jamieson use in his job?

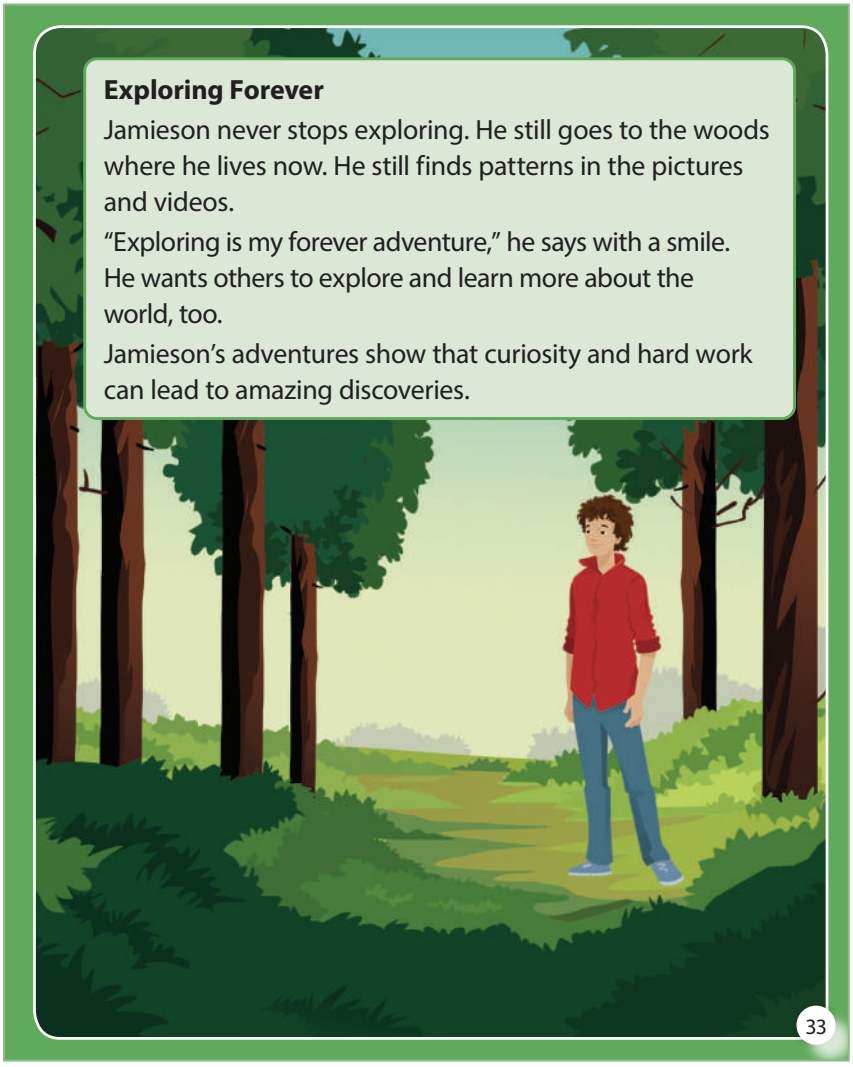
» computers, satellites

INFERENTIAL—Why do you think Jamieson needs to use special tools and satellites?

» Since he can't go to all the places, the special tools and satellites help him get information from those places to study.

Page 33

Ask students to look at the image as you read aloud. Talk about what they notice about the growth of the trees in the image now compared to when Jamieson was younger and exploring in the woods.



EVALUATIVE—Why is it important to keep exploring?

» to make new discoveries, to solve problems and puzzles, to keep learning

3. Connect to lived experience.

Activity Page

AP 3

Invite students to share any details from the chapter that resemble someone or something familiar to them. Ask students to tell details about the chapter that interested them. Invite students to ask questions about details that might not have been clear to them.

Use Activity Page 3 to reinforce students' reflections about the chapter.

See the Activity Pages Answer Key for correct answers and sample student responses.

LESSON 4

Jamieson Chaitman: Mapping Trees

At a Glance

Learning Objectives

- ✓ Explain how science is about being curious and observing nature.
- ✓ Explain that people from many backgrounds become scientists.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary practice
- reading maps

NGSS and CCSS References

NOS5. Science Is a Way of Knowing: Science knowledge helps us know about the world.

NOS7. Science Is a Human Endeavor: People have practiced science for a long time.

RI.K.1. Key Ideas and Details: With prompting and support, ask and answer questions about key details in a text.

For detailed information about the NGSS and CCSS References, follow the links in the Online Resources Guide for this unit:

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forest **geography** **map**

Language of Instruction consists of additional terms that you should use when talking about concepts in the lesson. Students benefit from your modeling the use of these words without the expectation that students themselves will use or explain the words.

data **disaster** **mangroves** **satellites**

Instructional Resources

Student Book

Ch. 4

Student Book, Chapter 4
"Jamieson Chaitman: Mapping Trees"

Activity Page

AP 4

Activity Page
Using Maps (AP 4)

Materials and Equipment

Collect or prepare the following items:

- reference books and other research materials
- internet access and the means to project images/video for whole-class viewing
- colored pencils or crayons

Advance Preparation

Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter when opening their book. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all student books so that the first page of Chapter 4 is visible.

The Core Lesson

1. Focus attention on the lesson purpose.

Have students think of maps they have seen and used. Ask them to share how the maps were used and why they were helpful.

2. Read together: "Jamieson Chaitman: Mapping Trees."

Student Book

Ch. 4

While some advanced students may be able to read words on a given page of the Student Book, as a general rule students should not be expected or asked to read aloud the text on the Student Book pages. The text in the Student Book is there so that adults can read it when sharing the Student Book with students.

Guide students to open their books to Chapter 4 on page 34. Tell students that the title of this chapter is "Jamieson Chaitman: Mapping Trees," and alert them to pay special attention to how scientists record their findings to help the environment.

Read Aloud Support

Page 34

Ask students to look at the image as you read aloud. Talk about what they notice about Jamieson.

CHAPTER 4

Jamieson Chaitman: Mapping Trees

Jamieson Cares for the Trees

Have you ever wondered who looks out for trees in a forest? Some forests are very large. The trees need people to help care for them.

Jamieson is one of those people. Jamieson helps out the United States Forest Service.

He helps take care of forests all over the country. He uses special pictures from satellites to look at trees and forests.

34

Ask students the following questions:

LITERAL—What does Jamieson use to take care of trees and **forests**?

» special pictures from satellites

INFERENTIAL—Why do you think forests need people to take care of them?

» so they can be healthy

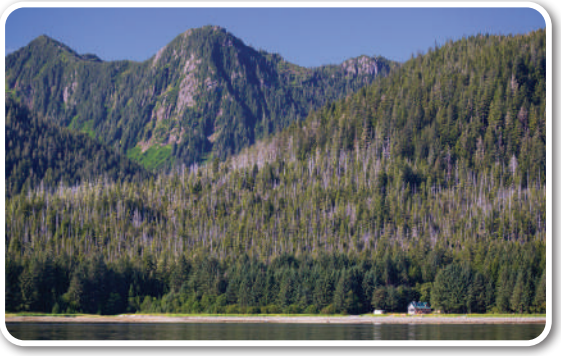
Page 35

Ask students to look at the images as you read aloud. Talk about what they notice about the different forests.

Watching Over All Forests

Jamieson works from his home. However, he gets to see forests everywhere! He has even studied trees in Alaska. One time, he studied mangroves.

Some of his work comes after a natural disaster. He finds ways to help trees that were damaged in tornadoes or hurricanes.



35

LITERAL—Where does Jamieson work?

» at his home

INFERENTIAL—What is a natural disaster?

» something bad that happens in nature that isn't done by humans

EVALUATIVE—How do you think the forests in Alaska are different from the forests in Florida?

» There are probably different types of trees. The trees must be able to live in the weather at the place where they grow. A tree in Alaska might not be able to live in the hot weather in Florida.

Page 36

Ask students to look at the image as you read aloud. Talk about what they notice about the satellite.

LITERAL—How does Jamieson make **maps**?

» with his computer

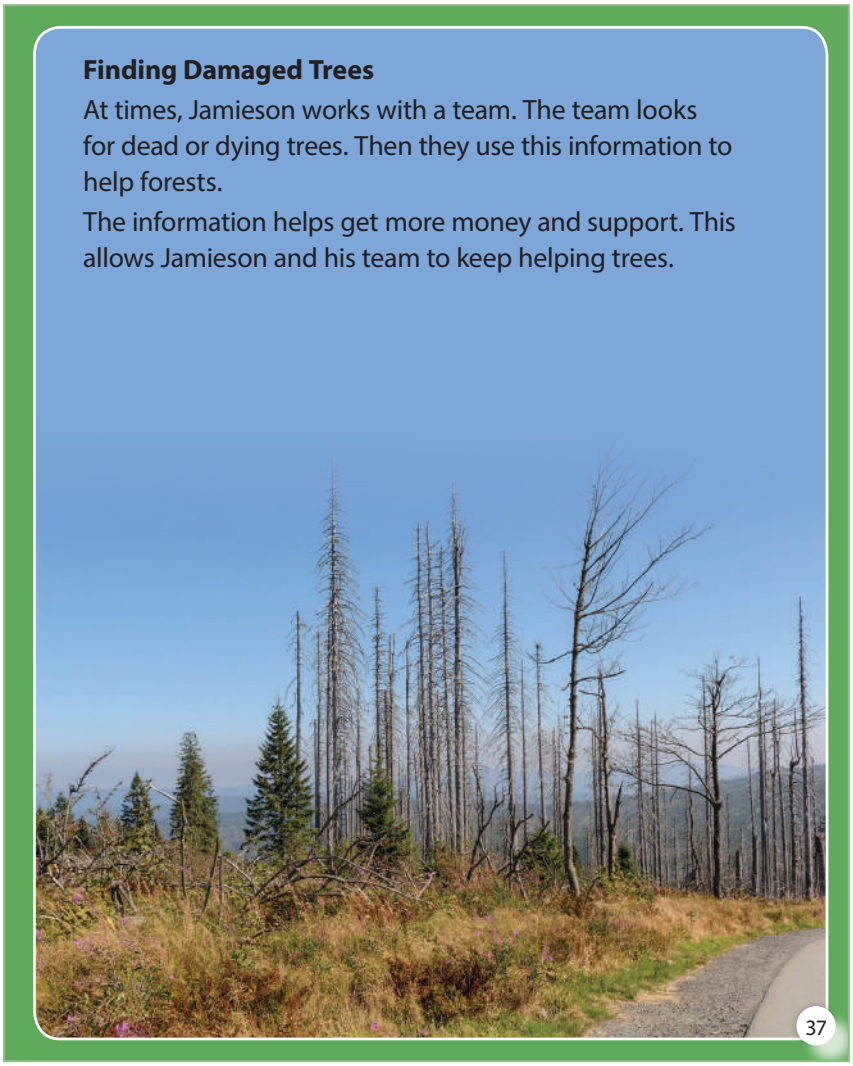
Call attention to the sentence, "Jamieson knows some satellites are always taking pictures."

EVALUATIVE—Why do you think some satellites are always taking pictures?

» to record things that are happening

Page 37

Ask students to look at the image as you read aloud. Talk about what they notice about the trees.



LITERAL—What do Jamieson and his team look for?

» dead or dying trees

Call attention to the trees in the image.

INFERENTIAL—What do you think happened to the brown trees in the picture?

» They were damaged in some way. Maybe insects hurt the trees, or maybe there was a natural disaster.

Page 38

Ask students to look at the image as you read aloud. Talk about what they notice about the part of the tree the person is holding.

Fixing Nature's Problems

Jamieson always liked math in school. And he made good grades in science and math classes.

Growing up around nature made him want to know more about it. He explored the outdoors and the woods by his home.

In high school, he learned about environmental science. Environmental science is learning about problems in nature and ways to fix the problems.

38

INFERENTIAL—How do you think exploring outdoors when Jamieson was younger helps him with his job today?

» He probably learned a lot about trees by looking at them.

LITERAL—What is environmental science?

» learning about problems in nature and ways to fix the problems

Page 39

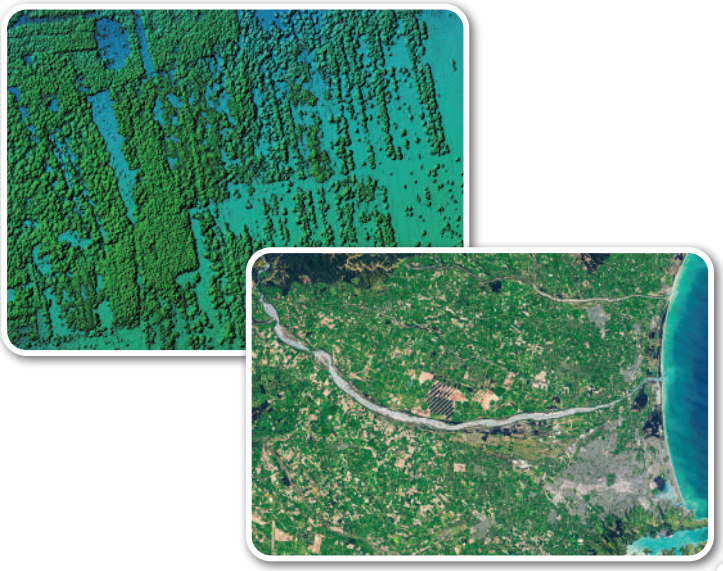
Ask students to look at the images of the different views of the satellite pictures as you read aloud. Talk about what they notice is different.

Going to College

Jamieson went to Clark University. He learned about environmental science and geography. Geography is the study of the parts of Earth.

He also learned about Geographic Information Systems (GIS). GIS is a computer tool that collects information.

After college, he decided to find work collecting data about the surface of Earth. Collecting data about Earth's surface is called remote sensing. Jamieson graduated and is now a geographic information scientist.



39

LITERAL—What is **geography**?

» the study of the parts of Earth

INFERENTIAL—Why do you think Jamieson uses GIS?

» to collect data about trees

INFERENTIAL—How do the trees look the same and different when seen from above?

» The trees are still green, but you can see a lot more of them.

Page 40

Ask students to look at the images as you read aloud. Talk about what they notice about the images.

First Job

Jamieson's first job as a scientist was in Hawaii. He used GIS to make maps. The maps helped bees.

The bees were in trouble. They needed a new place to live. Jamieson used information from satellite pictures to help the bees. The information helped find better places for the bees to live.

40

LITERAL—What did the bees need?

» a new home

EVALUATIVE—Why do you think it is important to help the bees?

» The bees help move pollen to other places to make new plants.

INFERENTIAL—What kind of places would the bees move to?

» places with trees and flowers

Page 41

Ask students to look at the images as you read aloud. Talk about what they notice about the two images.

Making Maps

The way Jamieson makes maps is different from how people did it a long time ago. Maps a long time ago were made on paper. People would draw parts of Earth on paper.

Jamieson uses satellites and computers to make detailed maps. His maps help people make important decisions about the environment.

This photo shows a rice-growing area of California.

This photo shows the same area after a year with little rain.

41

INFERENTIAL—Do you think computer maps or paper maps take longer to make? Why?

» paper maps, because people have to go to the exact location to know what to draw on the map

INFERENTIAL—Why do you think there is less green in the picture on the right?

» It hasn't rained much. Plants need water to stay healthy.

Page 42

Ask students to look at the images of the different maps as you read aloud. Talk about what they notice about the maps.

Using Maps Every Day

Have you used a map before? You might use a map to find where your school is located. Maps are important on nature trails. Adults use maps on their phones to know where to drive. Maps are part of everyday life.

From the maps on our phones to maps that help protect forests, maps are important. Jamieson helps keep our environment healthy with the maps he makes.

42

LITERAL—How does Jamieson keep the environment healthy?

» by making maps

INFERENTIAL—What is the same and different about the maps on the page?

» They help get you where you want to go. There are different names and areas on the maps.

EVALUATIVE—What maps have you used before?

» Possible answers: amusement park maps, school maps, street maps

EXTEND—To further show how maps are helpful, provide a variety of maps for students to review. If possible, include some maps with accessibility features, such as audio descriptions, text descriptions, and tactile capabilities.

Page 43

Ask students to look at the image as you read aloud. Talk about what they notice about Jamieson.

Keep Learning

Jamieson wants you to keep learning about trees and nature, too! There are always new things to learn.

In 2024 rains from a strong hurricane. caused great damage in the hills of western North Carolina. Jamie and his team were called on by the Forest Service to assess the terrible damage. Data from Jamie and his team will help restore the forests.

Maybe one day, you will use computers like Jamieson and help save trees and other parts of nature.

43

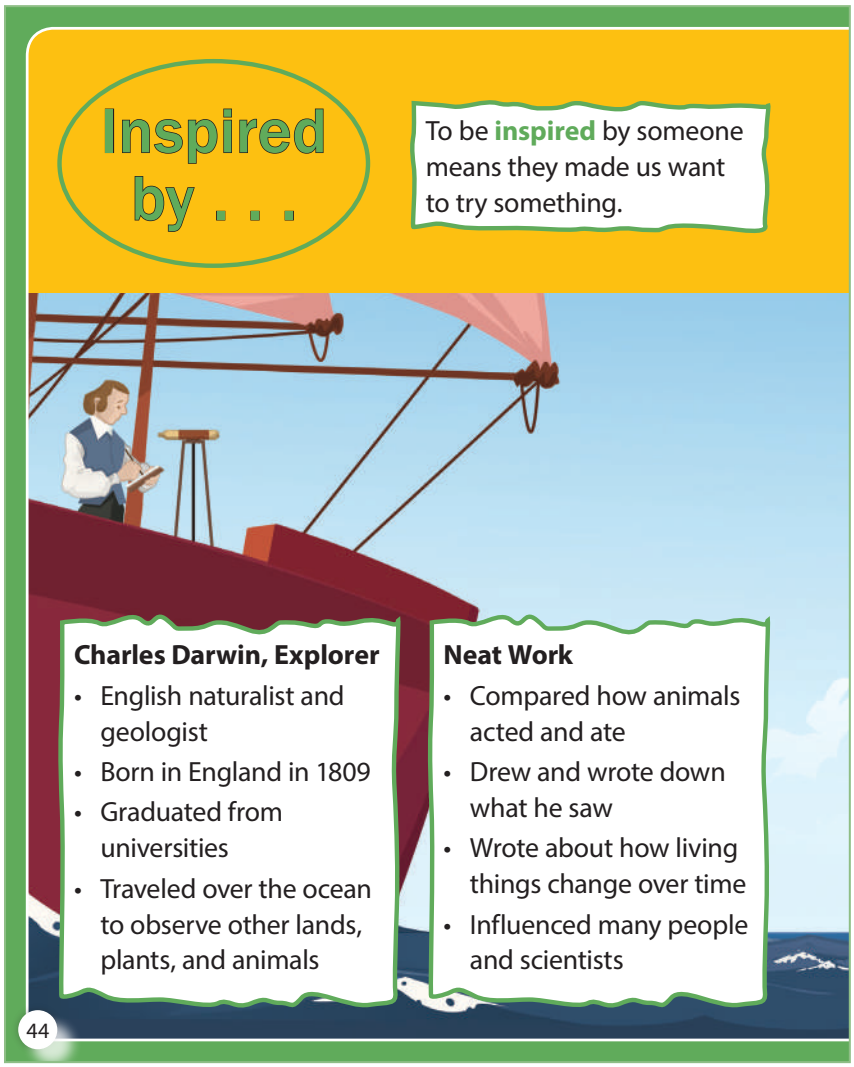
LITERAL—Why does Jamieson want you to keep learning?

» because there are always new things to learn

EVALUATIVE—What are ways you can learn about nature?

» read books, listen to people talk about nature, explore nature with others

Page 44 **Ask students to look at the image across the two pages as you read aloud.** Talk about what they notice about the person.



LITERAL—What is the name of this person?

» Charles Darwin

INFERENTIAL—Why do you think Jamieson was inspired by him?

» He did a lot of exploring to learn more about nature and recorded what he saw to share with others.

Know the Standards

NOS7. Science Is a Human Endeavor Use this page as an opportunity to emphasize how science has been studied for a long time.

Page 45

Ask students to look at the image as you read aloud. Talk about what they notice about the two people who inspired Jamie.

EVALUATIVE—Jamieson was influenced by one of his teachers. What people are you influenced by?

» Possible answers: parents, teachers, friends, principal, coach

3. Connect to lived experience.

Activity Page

AP 4

Invite students to share any details from the chapter that resemble someone or something familiar to them. Ask students to tell details about the chapter that interested them. Invite students to ask questions about details that might not have been clear to them.

Use Activity Page 4 to reinforce students' reflections about the chapter. Consider identifying which building on the map is school, which building(s) are home, and where the forest is located.

See the Activity Pages Answer Key for correct answers and sample student responses.

GRADE K

Teacher Resources

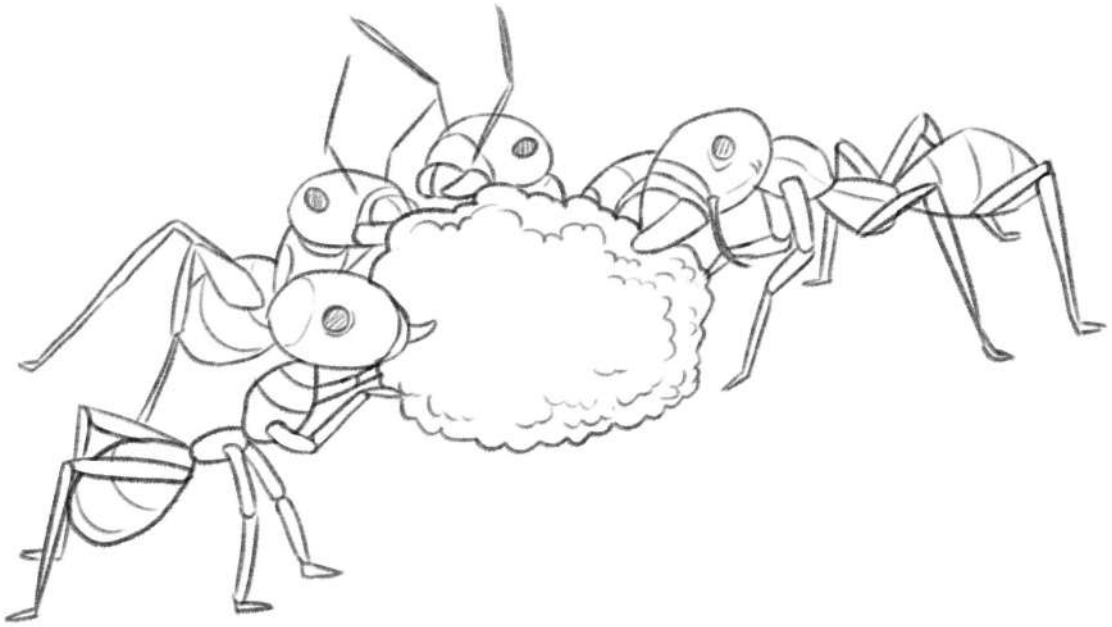
Activity Pages

Name _____ Date _____

Activity Page 1 Use with Lesson 1

Working Together

Think about how ants work together. Draw ways you work together with others.

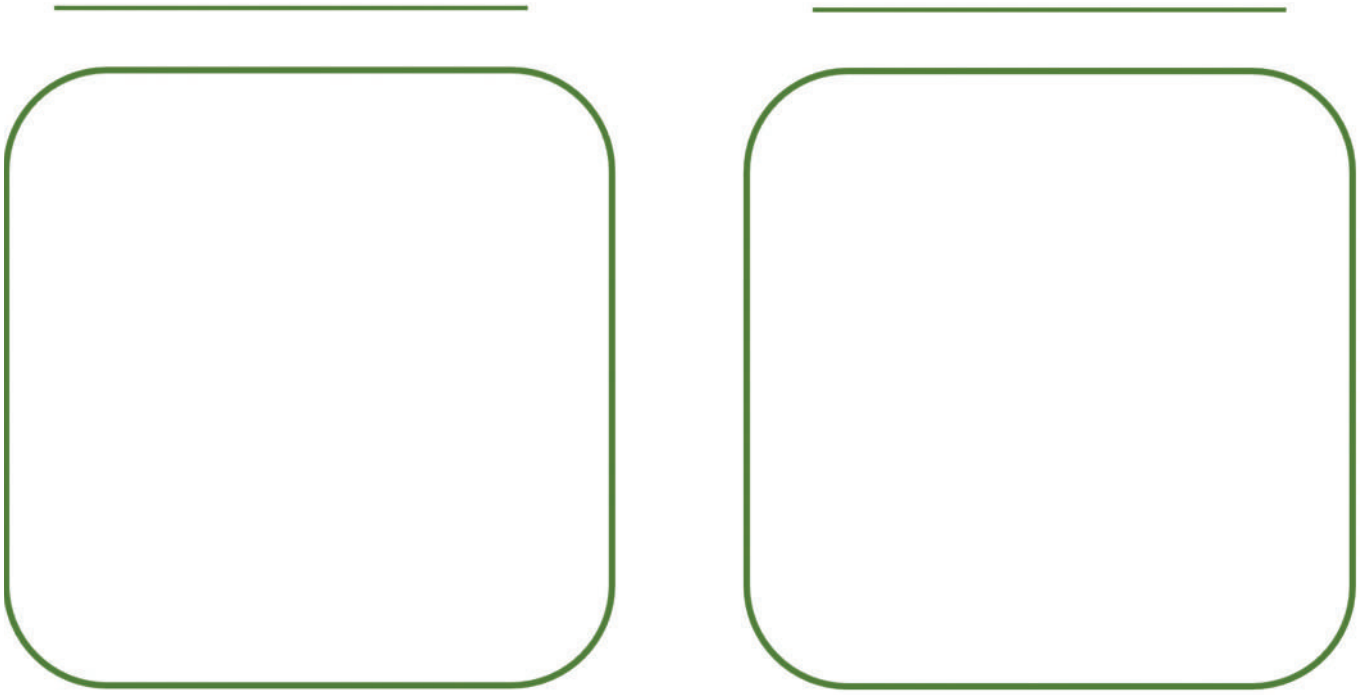


Name _____ Date _____

Activity Page 2 Use with Lesson 2

Putting into Groups

Scientists sort things into groups. This helps them see how things might be the same or different. Sort the things into different groups. Draw the things you sorted.



Name _____ Date _____

Activity Page 3 Use with Lesson 3

Finding Patterns in Nature

Think about the patterns Jamieson found in nature. Draw some pictures of patterns you have seen in nature.

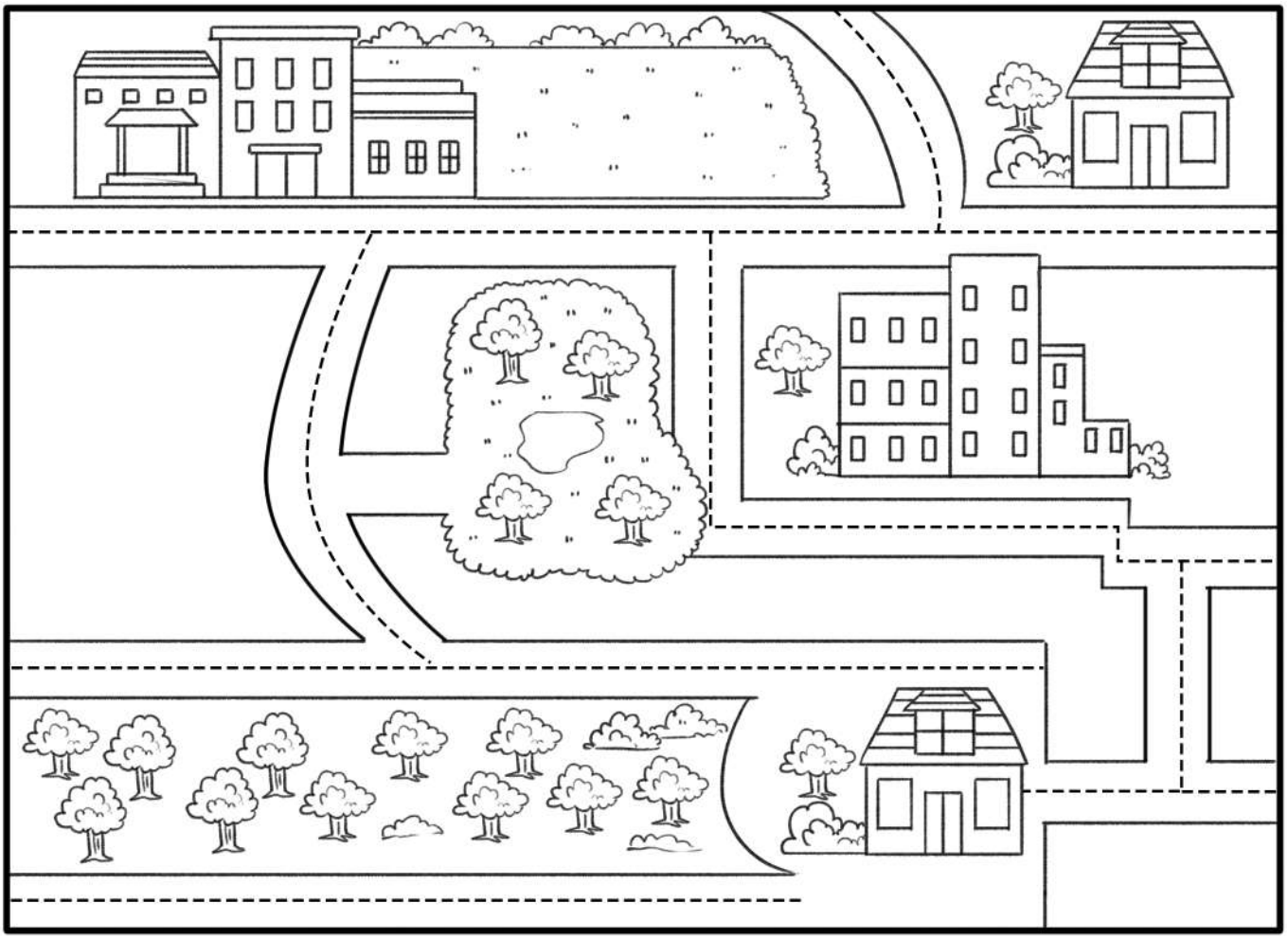
Name _____ Date _____

Activity Page 4 Use with Lesson 4

Using Maps

Maps help us know where to go. Look at the map. Draw the paths to the different places.

- Use green to draw a path from home to school.
- Use orange to draw a path from home to the lake.
- Use blue to draw a path from home to the forest.



Answer Key

This answer key offers guidance to help you assess your students' understanding. Here, you will find descriptions of expectations, reasonable sample responses for open-ended items, and, where called for, singularly correct answers for each activity page of this grade level.

Working Together (AP 1) (page 66)

Sample answers: helping family members cook, working as a team in physical education, solving problems together in class, building a model

Putting into Groups (AP 2) (page 67)

Check that students drew pictures showing that items have been correctly sorted in the groups provided.

Finding Patterns in Nature (AP 3) (page 68)

Sample answers: seashells, flowers, stars, trees, ocean waves, animal tracks

Using Maps (AP 4) (page 69)

Check that students used green for home to school, orange for home to the lake, and blue for home to the forest.

Appendix A

Glossary

Green words and phrases are Core Vocabulary in the lessons, though the terms are not called out with color or bold treatment on the Student Book pages. **Boldface words and phrases** are additional vocabulary terms related to the lessons that you should model for students during instruction. Many of these also appear in the Student Book. Vocabulary words are not intended for use in isolated drill or memorization.

B

biologist, n. scientist who studies living things

C

canopy, n. a layer of something that spreads out over an area

challenge, n. a hard task or problem

colony, n. a group of the same species local to an area

D

data, n. information that is observed or measured and recorded

disaster, n. an event with great damage or loss

E

explorer, n. a person who travels in search of information

F

forest, n. an area with many trees and other plants

G

geography, n. study of the parts of Earth

grassy, adj. covered with grass

guide, n. a person who explains points of interest

M

mangroves, n. type of trees found near the ocean that grow large root structures

map, n. a representation of an area and locations or objects within it

meadow, n. an open area of grass and flowers

microscope, n. a tool used to view small objects such as cells and microbes

N

native, adj. plant or animal that is found naturally in a habitat

natural, adj. something that is based on or existing in nature

nature, n. places, wild plants, and wild animals that are not made by humans

P

pattern, n. a regular or repeated way in which something occurs

protect, v. to keep something safe

R

research, n. careful study and investigation to discover and explain new knowledge

S

satellites, n. objects or devices that orbit a planet or other celestial body

steel, n. strong metal made of iron and carbon

T

teamwork, n. working together as a group

tracks, n. a set of footprints in soil

W

weave, v. to lace strands together

woods, n. an area with many trees

Appendix B

Safety

Classroom Safety: In the Core Knowledge Science program (CKSci), activities and demonstrations are a vital part of the curriculum and provide students with active engagement related to the lesson content. The activities and demonstrations in the Science in Action lessons make comparatively modest use of materials and hands-on science experiences. Some activities and demonstrations do make use of materials and equipment that are typically deemed classroom safe and readily available.

Safety should be a priority when engaged in science activities. With that in mind, observe the following safety procedures when the class is engaged in activities and demonstrations:

- Report and treat any injuries immediately.
- Check equipment prior to usage, and make sure everything is clean and ready for use.
- Clean up spills or broken equipment immediately using the appropriate tools.
- Monitor student behavior to ensure they are following proper classroom and activity procedures.
- Do not touch your eyes, ears, face, or mouth while engaging in an activity or demonstration.
- Review each step of the lesson to determine if there are any safety measures or materials necessary in advance.
- Wear personal protective equipment (e.g., safety goggles, aprons, etc.) as appropriate.
- Check for allergies to foods, latex, and other materials that students may have, and take appropriate measures.
- Secure loose clothing, hair, or jewelry.
- Establish storage and disposal procedures for chemicals as per their Safety Data Sheet (SDS), including household substances such as vinegar and baking soda.

Internet Safety: Though online resources present many rich opportunities for student learning, unsupervised online activity for children is not advised. The U.S. Department of Justice provides the following guidelines, Keeping Children Safe Online:

- Discuss internet safety and develop an online safety plan.
- Supervise young children's use of the internet.
- Review games, apps, and social media sites.
- Adjust privacy settings and use parental controls for online games, apps, social medial sites, and electronic devices.
- Tell children to avoid sharing personal information, photos, and videos online.
- Teach children about body safety and boundaries.
- Be alert to potential signs of abuse.
- Encourage children to tell a parent, guardian, or other trusted adult if anyone asks them to engage in sexual activity or other inappropriate behavior.
- Copy and distribute the Student Online Safety Contract, found on the next page. Prior to the start of the first lesson, do a read-along, and have students agree to the expectations for when they engage in computer and online activities.

Online Resources

For additional support concerning internet safety and online instruction, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Student Safety Contract

Dear Parent or Guardian,

During science class, we want to create and maintain a safe classroom. With this in mind, we want students to be aware of the behavior expectations for engaging in online science activities. Please review the safety rules below with your student and sign this contract. If you have any questions, please feel free to contact me.

For important safety information about children, computers, and the internet, consider resources at these sites:

https://protectyoungeyes.com/

https://sharedhope.org/

https://www.justice.gov/coronavirus/keeping-children-safe-online

---

Teacher signature and date

_____ _____/_____/_____/

Parent or guardian signature and date

_____ _____/_____/_____/

When doing online activities, I will do the following:

- Only do online activities with the supervision of an adult.
- Only visit websites and use apps that I am guided to by my teacher, parent, or trusted adult guardian.
- Never use my real name or reveal personal information if I communicate with others online.
- Tell a trusted adult right away if anyone online asks questions about my name, where I live, or where I go to school.
- Be careful around electronic devices and only plug them in or unplug them when an adult is supervising.

I understand and agree to the safety rules in this contract.

Student signature and date

_____ _____/_____/_____/

Print name

_____

Appendix C

Strategies for Acquiring Materials

The materials used in the Core Knowledge Science in Action program are readily available and can be acquired through both retail and online stores. Some of the materials are reusable and are meant to be used repeatedly. This includes items such as plastic cups that can be safely used again. Often, these materials are durable and will last for more than one activity or even one school year. Other materials are classified as consumable and cannot be used more than once.

Online Resources

The Material Supply List for this unit's activities can be found online. Follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

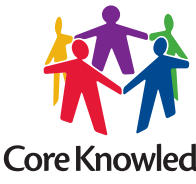
Ways to Engage with Your Community

The total cost of materials and technology can add up for an entire science program, even when the materials required for activities and demonstrations have been selected to be individually affordable. The time needed to acquire the materials adds up, too. Reaching out to your community to help support STEM education is a great way to engage parents, guardians, and others in the teaching of science, as well as reduce the cost and time of collecting the materials. With that in mind, the materials list can be distributed or used as a reference for the materials teachers will need to acquire to teach the unit.

Consider some of the following as methods for acquiring the science materials:

- School Supply Drive—If your school has a supply drive at any point in the year, consider distributing materials lists as wish lists for the science department.
- Open Houses—Have materials lists available during open houses. Consider having teams of volunteers perform an activity to show attendees how the materials will be used throughout the year.
- Parent-Teacher Organizations—Reach out to the local PTO for assistance with acquiring materials.
- Science Fair Drive—Consider adding a table to your science fair as part of a science materials drive for future units.
- College or University Service Project—Ask service organizations affiliated with your local higher education institutions to sponsor your program by providing materials.
- Local Businesses—Some businesses have discounts for teachers to purchase school supplies. Others may want to advertise as sponsors for your school/programs. Usually, you will be asked for verifiable proof that you are a teacher and/or for examples of how their sponsorship will benefit students.

Remember: If your school is public, it will be tax-exempt, so make sure to have a Tax Identification Number (TIN) when purchasing materials. If your school is private, you may need proof of 501(c)(3) status to gain tax exemption. Check with your school for any required documentation.



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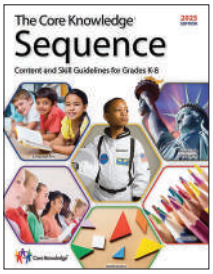
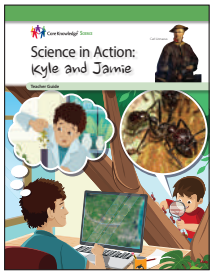


What is the Core Knowledge Sequence?

The *Core Knowledge Sequence* is a detailed guide to specific content and skills to be taught in Grades K–8 in language arts, history, geography, mathematics, science, computer science, and the fine arts. In the domain of computer science, the *Core Knowledge Sequence* outlines topics that build systematically grade by grade to support student learning progression coherently over time.



For which grade levels is this book intended?

In general, the content and presentation of this book are appropriate for students in the early elementary grades. For teachers and schools following the *Core Knowledge Sequence*, this book is intended for Kindergarten and is part of a series of **Core Knowledge SCIENCE** units of study.

For a complete listing of resources in the
Core Knowledge SCIENCE series,
visit **www.coreknowledge.org**.

CKSci™

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