

Science for Everyone



Science Literacy Teacher Guide

Patterns and predictions



Problems and solutions



Curiosity





Science for Everyone

Science Literacy Teacher Guide

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Science for Everyone
Science Literacy Teacher Guide
 Core Knowledge Science™ 1

Introduction

ABOUT SCIENCE LITERACY

The goal of teaching students science from Kindergarten through high school graduation is not to turn every student into a scientist by profession, but rather it is to make scientifically literate citizens of them. At first glance, the term *science literacy* implies knowledge of the procedures and skills involved in scientific processes. A science-literate citizen does not necessarily commit to memory great volumes of content knowledge about the physical, life, or earth and space sciences. That person might know factual information, but science literacy is not limited to knowing facts. A science-literate person knows how to employ scientific thinking. Science literacy is a mindset that values the importance of observing, hypothesizing, and testing. Science literacy involves awareness of how scientists obtain and analyze data, what a conclusion is, how conclusions are shared, and what it means for an idea to be elevated to the status of a scientific theory or law. Furthermore, a person who is science-literate understands that science grows and that the science behind any subject may change as new facts become established. Certainly, science literacy must encompass all of these notions.

Expanding on this vision, a science-literate citizen understands the role of science in our society, acknowledging the importance of science knowledge in helping private and public groups make decisions based not on emotion, rumor, gossip, or hearsay but rather on the foundation of careful research and established scientific facts. One ethical commitment of a scientifically literate populace is a willingness to incorporate scientific thought into aspects of popular thought, emotion, and mood, and so scientific thinking helps balance discussions at all levels of government and all levels of private decision-making.

An even wider view of science literacy is that it can apply to all aspects of human learning, such as art, history, biography, mathematics, music, philosophy, and literature. To these areas of human endeavor, the scientifically literate person applies scientific thinking to make informed judgments about a novel or a painting to understand the artist's vision. A scientifically literate view of history, for example, focuses on how science and society interacted in the past, determines at what times science flourished, and examines when and why at other times it did not.

Core Knowledge Foundation is committed to a broad view of the term *science literacy* and to curricula that fosters science literacy in students incrementally over time. A person, no matter what age, can be conversant with grade-appropriate science processes. Young learners can consider science and its relationship to society. Relating a scientific mindset to other areas of human thought builds citizens capable of contributing, clarifying, and communicating worthy viewpoints to all aspects of societal life. Indeed, building a science-literate citizenry is an elevated goal.

Designed instructionally into the Core Knowledge curriculum, science literacy means students know the following:

- what science is,
- how to describe science and participate in it, and
- how to evaluate information as evidence and use data for decision-making.

With practice, students can grow into their own science literacy by knowing how to read about—and for emerging readers, listen to—scientific topics and discern validity. Science literacy is made more achievable for all learners with fortified background knowledge.

- In Grades K and 1, science literacy is focused on students learning science words.
- In Grades 2 and 3 science literacy expands to reading comprehension, to recognizing science concepts, and to students making connections from chapter contents
 - to processes in the day-to-day, and
 - to other content areas and disciplines.
- In Grades 4–5, science literacy expands to students understanding the uses of background knowledge and new information for decision-making and problem-solving.
- In Grades 6–8, science literacy increases in complexity with the evaluation of the quality of information and the legitimacy of claims and the evidence used to support them.

Vocabulary fluency is integral to background knowledge and literacy. By the end of the CK Science Literacy series for Kindergarten through Grade 5, students will have been repeatedly exposed to the meanings of dozens of science domain terms across multiple contexts.

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 discreet 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 Literacy 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.

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The Common Core State Standards (CCSS) are the domain of the National Governors Association Center for Best Practices and the Council of Chief State School Officers. Neither entity was involved in the production of this product, and their endorsement is not implied.

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 D.C.

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.

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.

Reading Standards for Informational Text

Key Ideas and Details:

- **CCSS.ELA-LITERACY.RI.1.1:** Ask and answer questions about key details in a text.
- **CCSS.ELA-LITERACY.RI.1.2:** Identify the main topic and retell key details of a text.
- **CCSS.ELA-LITERACY.RI.1.3:** Describe the connection between two individuals, events, ideas, or pieces of information in a text.

Craft and Structure:

- **CCSS.ELA-LITERACY.RI.1.4:** Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.
- **CCSS.ELA-LITERACY.RI.1.5:** Know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) to locate key facts or information in a text.
- **CCSS.ELA-LITERACY.RI.1.6:** Distinguish between information provided by pictures or other illustrations and information provided by the words in a text.

Integration of Knowledge and Ideas:

- **CCSS.ELA-LITERACY.RI.1.7:** Use the illustrations and details in a text to describe its key ideas.
- **CCSS.ELA-LITERACY.RI.1.8:** Identify the reasons an author gives to support points in a text.
- **CCSS.ELA-LITERACY.RI.1.9:** 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.1.10:** With prompting and support, read informational texts appropriately complex for grade 1.

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 Grade 1 classrooms across the country with a wide range of prior experiences. Some students have attended preschool, while others have not. 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

Online Resources



The *Science for Everyone* Student Book includes twenty chapters, intended to be read aloud by the teacher as the students look at images on each page.

The Student Book is spiral bound to allow students to lay it flat when reading or following along. To help students locate the correct chapter, each chapter has a unique, color-coded border at either the top, bottom, or outer side edge of a page. Core Knowledge offers a template for a bookmark. (See the Online Resources Guide for a link to the template www.coreknowledge.org/cksci-online-resources) When starting any unit of study, you may wish to download the template, print one per student, and have each student create a personal bookmark.

As you will note when you examine the Student Book, limited text is included on each page. Instead, colorful photos and engaging illustrations dominate the Student Book pages. The design of the Student Book in this way is intentional because students in Kindergarten–Grade 2 are just learning to read. At these grade levels, students 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 Literacy 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.

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 176–197. 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—What Would You Do? (AP 1)

Lesson 2—A Few of My Favorite Things (AP 2)

Lesson 3—Practice Measuring (AP 3)

Lesson 4—Questions to Investigate (AP 4)

Lesson 5—Mária Telkes—Connect the Ideas! (AP 5)

Lesson 6—Fix This Mix-Up! (AP 6)

Lesson 7—My, How You Grow! (AP 7)

Lesson 8—Sort It Out (AP 8)

Lesson 9—Problem-Solving Invention (AP 9)

Lesson 10—Cookie Mystery (AP 10)

Lesson 11—Finding Information (AP 11)

Lesson 12—Spotting Patterns (AP 12)

Lesson 13—Cause, Effect, Problem, and Solution (AP 13)

Lesson 14—Quantities (AP 14)

Lesson 15—System Parts (AP 15)

Lesson 16—Fast Fasteners (AP 16)

Lesson 17—Types of Materials (AP 17)

Lesson 18—Change or No Change (AP 18)

Lesson 19—Discovery or Invention (AP 19)

Lesson 20—Problems and Solutions (AP 20)

Online Resources and Digital Engagements

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. In addition to resources supporting specific chapter activities, Core Knowledge also offers a collection of Digital Engagements designed for teacher-facilitated classroom use.

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 Literacy 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

- fine salt
- spoon
- small bowl of room temperature water
- scissors
- sheet of paper
- glue or paste

Lesson 3

- 1-foot length of elastic cord
- tape measure, yardstick, or ruler
- empty cardboard box
- digital scale or classroom pan balance
- various classroom objects for measuring

Lesson 5

- globe or world map

Lesson 6

- 1-quart zip-close plastic bag
- 10 popcorn kernels
- 1 paper towel
- spray bottle with water

Lesson 7

- index cards
- ball or board eraser

Lesson 8

- pattern blocks or plastic building blocks
- drawing materials such as colored pencils, crayons, markers, and paper
- measuring tools (ruler, measuring tape, stopwatch, scale, beakers or measuring cups)

Lesson 10

- image of a messy room
- cutouts for each student for Activity Page 10

(optional)

Lesson 17

- materials to design a space-themed diorama (challenge)

Lesson 20

- materials to design a room (challenge)

PACING

The Core Knowledge Science Literacy Student Book consists of twenty chapters, each six 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 Literacy 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 Literacy chapter to help pair the chapters meaningfully with other units.

Science Literacy Chapter	Has content that ties to ...	Science Literacy Chapter	Has content that ties to ...
1. Think Like a Scientist	Physical, life, and earth science	11. Science Information	Physical science, light
2. What Is Nature?	Physical, life, and earth science	12. Learning from Patterns	Physical science, sound
3. What Is Measuring?	Physical, life, and earth science, machines	13. Demi's Difficult Day	Physical science, machines
4. Questions to Investigate	Earth and space science	14. Counting Quantities	Life science, survival
5. The Sun Queen	Earth and space science	15. Systems Art Show	Life science, survival
6. Investigate!	Life science, survival	16. Fascinating Fasteners	Physical science, machines
7. Data and Predictions	Physical science, light and sound	17. The Right Material for the Job	Earth and space science
8. How Much and How Many?	Physical science, light and sound	18. Things That Change	Life science, traits
9. Super Solver!	Physical science, machines	19. Invention and Discovery	Physical science, light
10. Tulip Mystery	Physical science, sound	20. How Do They Do That?	Physical science, light and sound

Online Resources



Also, see the Online Resources Guide for recommendations about when to best enhance instruction through the use of the Core Knowledge Science Literacy Digital Engagements designed to support these chapters.

www.coreknowledge.org/cksci-online-resources

LESSON 1

Think Like a Scientist

AT A GLANCE

Lesson Question

How does science happen?

Learning Objectives

- ✓ Characterize science as a method of satisfying curiosity.
- ✓ Identify common steps and methods in various examples of scientific activities.
- ✓ Order provided steps in a scientific process.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- hands-on science activity

Main Science Idea

Science happens when curious people observe phenomena, conduct investigations, and obtain results.

NGSS and CCSS References

NOS1. Scientific Investigations Use a Variety of Methods: Science investigations begin with a question. Scientists use different ways to study the world.

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

RI.1.1: Ask and answer questions about key details in a text.

RI.1.7: Use the illustrations and details in a text to describe its key ideas.

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.

curious

investigate

science

scientist

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.

observations

results

Instructional Resources

Student Book



Ch. 1

Student Book, Chapter 1
“Think Like a Scientist”

Activity Page



AP 1

Activity Page
What Would You Do? (AP 1)

Materials and Equipment

Collect or prepare the following items:

- fine salt
- spoon
- small bowl of room temperature water
- scissors
- sheet of paper
- glue or paste

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

THE CORE LESSON

1. Focus attention on the Lesson Question.

Online Resources



Read aloud a selection from children’s literature about sunsets, nighttime, and bedtimes, such as *Next Time You See a Sunset* by Emily Morgan, *Hello, Moon* by Evan Turk, or *I Am Not Sleepy and I Will Not Go to Bed* by Lauren Child. Encourage students to ask science questions about what they hear. (See the Online Resources Guide for a link to the recommended selections. www.coreknowledge.org/cksci-online-resources)

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: How does science happen?

2. Read together: “Think Like a Scientist.”

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 “Think Like a Scientist,” and tell them to listen as you read about things people do, say, and think when they act like scientists.

Read Aloud Support

Page 2

Ask students to look at the image as you read aloud. Have them think about clues from the photo that it is bedtime but still daytime.

CHAPTER
1

Think Like a Scientist

“It is eight o’clock. Time for bed!” Sofia’s dad says.
“But the sun is still up. It’s still daytime!” Sofia replies.
Sofia remembers other bedtimes when it was dark at eight o’clock.
Sofia notices the world around her.
She wonders about it.
Observing the world around you is a part of science.
Wondering is a part of science, too.



INFERENTIAL—How can you tell from the photo that the sun is still up?

» There is bright light coming through the window.

INFERENTIAL—What might Sophia be doing with the notebook and pencil?

» Possible answers: She might be writing in her diary before going to bed.
She might be writing down where the sun is at her bedtime.

Write the Core Vocabulary term **science** in the center of a chart. Leave space to draw a word map around it. Point out the last line on this page, and explain that you are adding “wondering” to the word map because wondering about the world around us is part of doing science. Use connector lines as you add ideas to the map.

Have students look at the images as you read aloud and point to each photo.

Have students identify asking sentences. Make sure they notice that all asking sentences end in a question mark.

Science can begin when you ask questions.



How come my bedtime is sometimes before the sun sets?

What does a wild bunny eat?



Where does salt go when I mix it with water?

Asking many questions means you are curious.
Being curious is part of doing science!

3

LITERAL—How many asking questions do you count on this page?

» three

EVALUATIVE—Which of these questions would you most like to find an answer to? Why?

» Sample answer: I'd like to find out where salt goes when I mix it in water. I have always wondered why the salt seems to disappear.

Ask students to identify ideas from this page that can be added to the word map you began earlier. Continue building the map by writing supporting ideas and connecting them with lines to the word *science*. For example, “asking questions” and “being **curious**” help define science.

Ask students to picture themselves working on science questions with the children in the image as you read aloud.

Science also includes talking to others about your questions.

You tell them what you observed.

You ask them what they think the answers are.

You ask, "How do we know?"



4

LITERAL—What questions do the students in the photo ask one another?

» "What do you think the answer is?" "How do we know?"

Have students picture themselves in the classroom with the students. Point out the questions about the sun, wild bunny, and salt water on the previous page. Then invite them to share what they think the answers are to those questions.

INFERENTIAL—How is it helpful to talk to other people about your science questions?

» Other people may have answers and ideas that I did not think of.

Point out that talking to others is one of the steps in finding answers to science questions.

Continue building the word map by connecting "talking to others" and "asking 'How do you know?'" with connecting lines to the word *science*.

Ask students to look at the three images as you read aloud. Point out that there are different ways to **investigate** the world (See Know the Standards).

Science includes planning a way to find an answer to your question.



You might write down what time the sun sets each day.

You might put out three foods and watch which ones the bunny eats.



You might mix a spoonful of salt in water and leave it for a few days.

5

Take out the salt, spoon, and bowl of water. Ask students which question they can investigate with these materials. (Where does salt go when I mix it with water?) Have a volunteer put one spoonful of salt into the water. Have another student make observations and report that the salt is visible in the bowl. Then have a student stir until the salt dissolves. Set the bowl in the sun or over a heat source. Allow students to check it over the next day or so and observe that, when the water evaporates, the salt remains in the bowl.

Know the Standards

NOS1. Scientific Investigations Use a Variety of Methods This is the first of eight NGSS Nature of Science Standards. In Grades K–2, students focus on asking scientific questions and exploring different ways to answer them. In Grades 3–5, they connect the methods and materials required by the different types of questions they ask.

Have students listen for suggested people they can do science with as you read aloud.

Science includes comparing what you observed to what others observed.

Do you all agree?

Does anyone disagree?

You can ask someone older to look up sunset times online. Do the times match your observations, or are they different?



You can ask a neighbor what they see bunnies eat. Does your neighbor's answer support what you found?

You can ask a friend to try what you did with salt and water. Does your friend get the same results as you?



6

INFERENTIAL—What older people could you ask to help you if you want to find information online?

» a brother or sister, a parent or grandparent, a librarian

INFERENTIAL—What could you do if your observations are different from those of another person?

» Possible answers: Ask the other person why they said what they did. Look for their reasoning.

Continue building the shared word map by connecting “comparing observations” to the word *science* at the center of the map. Review the map, and discuss how the details surrounding the word *science* describe ways they can think like a scientist.

Ask students to think of questions about the photo as you read aloud. Point out that the students are wearing glasses to protect their eyes while viewing a solar eclipse. Explain that during a solar eclipse, the moon moves between the sun and Earth, blocking the sun's light from reaching Earth.

People do science to learn how the world works.
 Scientists are curious people.
 They ask questions.
 They observe.
 They investigate.
 They know they might be wrong.
 So, they compare what they discover with others.
 Kids like you and Sofia can do these things.
 Then you are thinking like a scientist!



Main Science Idea

Science is a way to find out about things we are curious about. Science includes observing, asking questions, and investigating as a process for discovery.

7

INFERENCE—How do you know these students are curious about science?

» They are smiling and seem excited to see the solar eclipse.

3. Check for understanding.

Activity Page



AP 1

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms.

Distribute Activity Page 1. Read the captions for each image aloud, making sure students understand that *results* are what they observe during a science investigation. Distribute scissors, glue or paste, and sheets of paper so that students can follow the directions to put the steps in order. Have them share their ideas, and if student responses differ, allow them to defend their choices.

See the Answer Key for sample or correct answers.

LESSON 2

What Is Nature?

AT A GLANCE

Lesson Question

What is certain about nature?

Learning Objectives

- ✓ Define nature as everything that occurs without human influence.
- ✓ Differentiate examples of natural versus human-determined objects, processes, and outcomes.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration

Main Science Idea

Our world consists of materials and objects found in the natural world as well as material and objects that are made by people.

NGSS and CCSS References

NOS8. Science Addresses Questions About the Natural and Material World: Scientists study the natural and material world.

RI.1.7: Use the illustrations and details in a text to describe its key ideas. (Also **L.1.S.C** and **L.1.4.A**)

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.

design

human-made

natural

nature

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.

process

Instructional Resources

Student Book



Ch. 2

Student Book, Chapter 2
“What Is Nature?”

Activity Page



AP 2

Activity Page
A Few of My Favorite Things
(AP 2)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing

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

THE CORE LESSON

1. Focus attention on the Lesson Question.

Have students share their ideas on what it means to be “in nature.” If needed, scaffold the discussion by asking students if they have been outdoors in a park with trees, birds, and other wild creatures. Explain that many people enjoy taking a walk in nature.

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: What is certain about nature?

2. Read together: “What Is Nature?”

Student Book

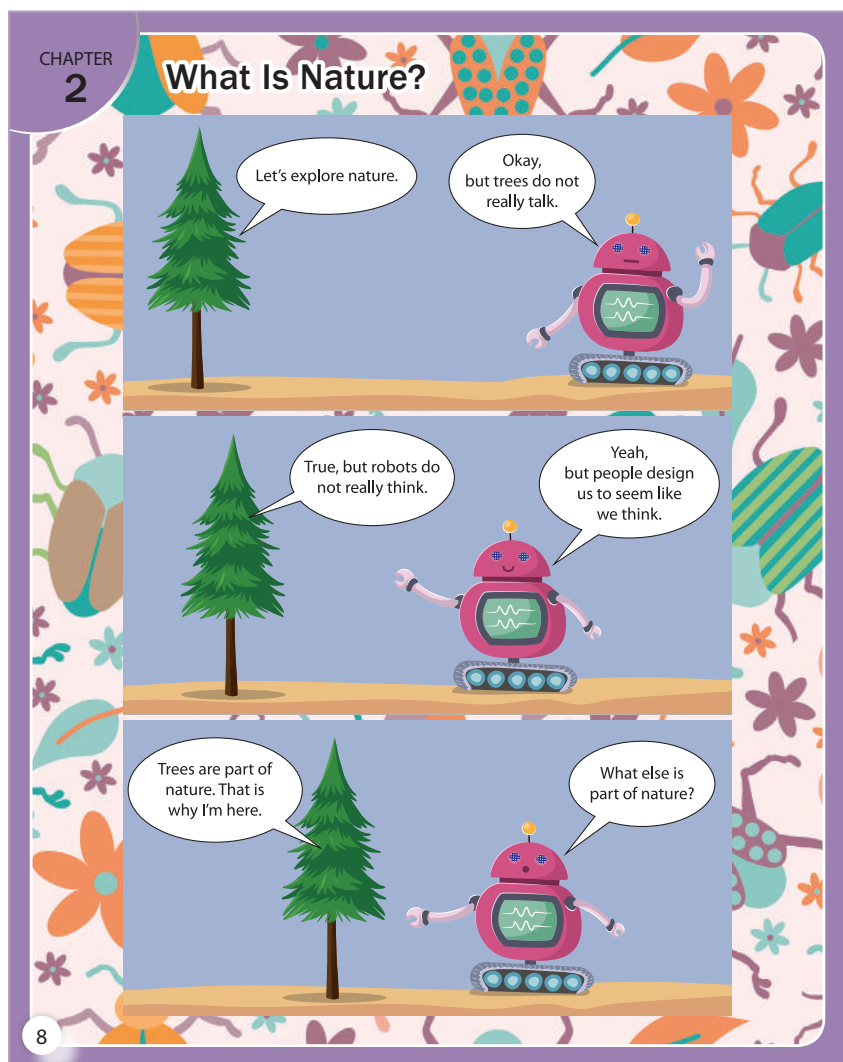


Ch. 2

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 8. Tell students that the title of this chapter is “What Is Nature?” and tell them to pay special attention to the differences between things people make and things people do not make as you read.

Ask students to look at the three comic panels as you read aloud and point to each speech bubble. Make sure students understand that each speech bubble has a tail pointing to the character who is speaking.



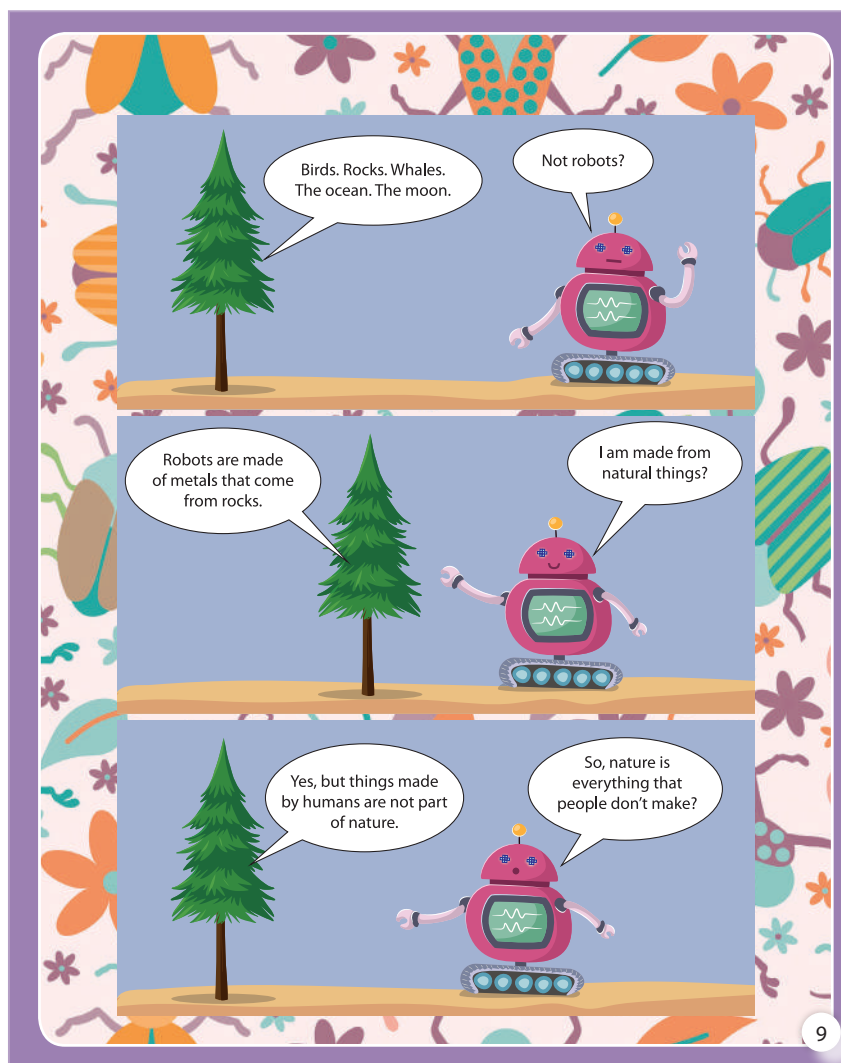
LITERAL—What are the two characters on this page?

» an evergreen tree and a robot

LITERAL—What word or idea are they discussing?

» *nature*

Call attention to the final question on the page, and invite students to try to answer it. Have them share any uses of the word **nature** they have heard or used outside of school.



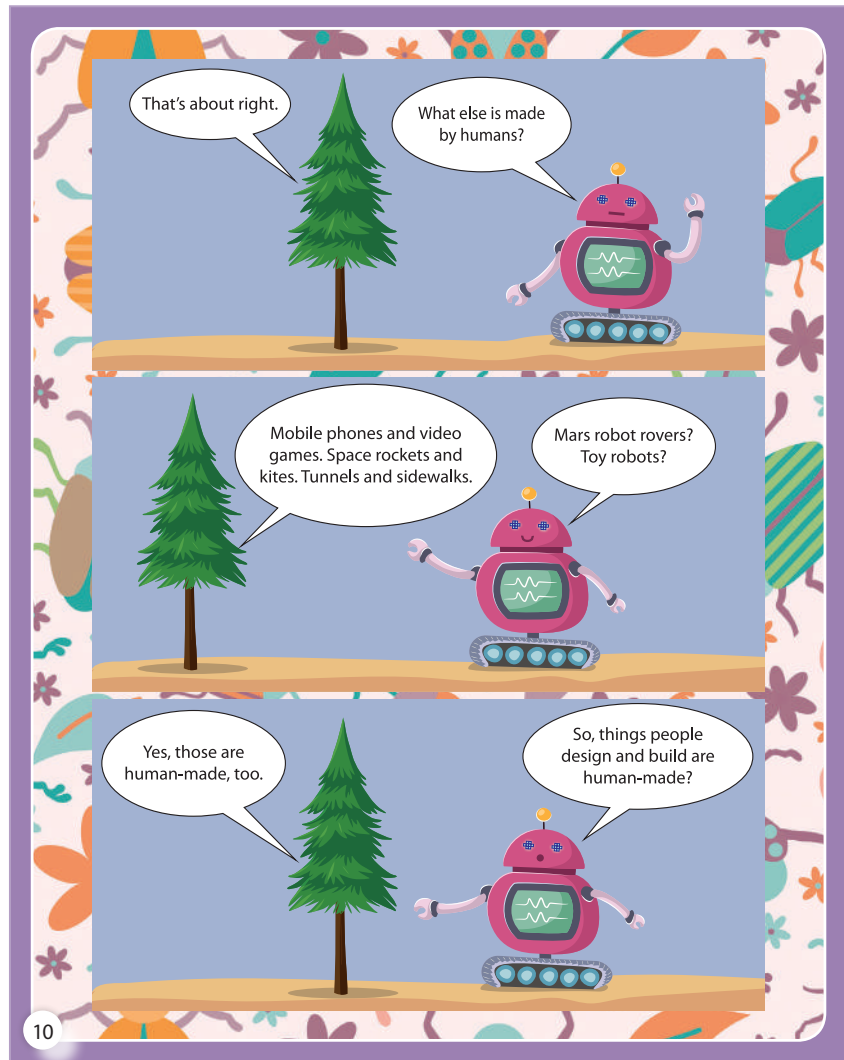
INFERENTIAL—Which character on this page acts more like a learner, and which acts more like a teacher? How do you know?

- » The robot seems more like a learner because it asks a lot of questions. The tree seems more like a teacher because it answers the questions.

INFERENTIAL—The robot says it is made from natural things. What does **natural** mean?

- » It means things found in nature.

Call attention to the examples of parts of nature in the first panel. Write the word *nature* in the center of a board, and write the examples around it, connected by lines. Then invite students to continue to build the word map by identifying other things that are part of nature. Possible responses: dandelion plants, butterflies, snakes, clouds, snow, air.



Draw a word map for the term **human-made**. Have students dictate the examples from the text as you add them to the map.

INFERENTIAL—What other things in your world are human-made?

- » Possible responses: computers, basketballs, baseball gloves, water bottles, buses, cars, bridges, machines

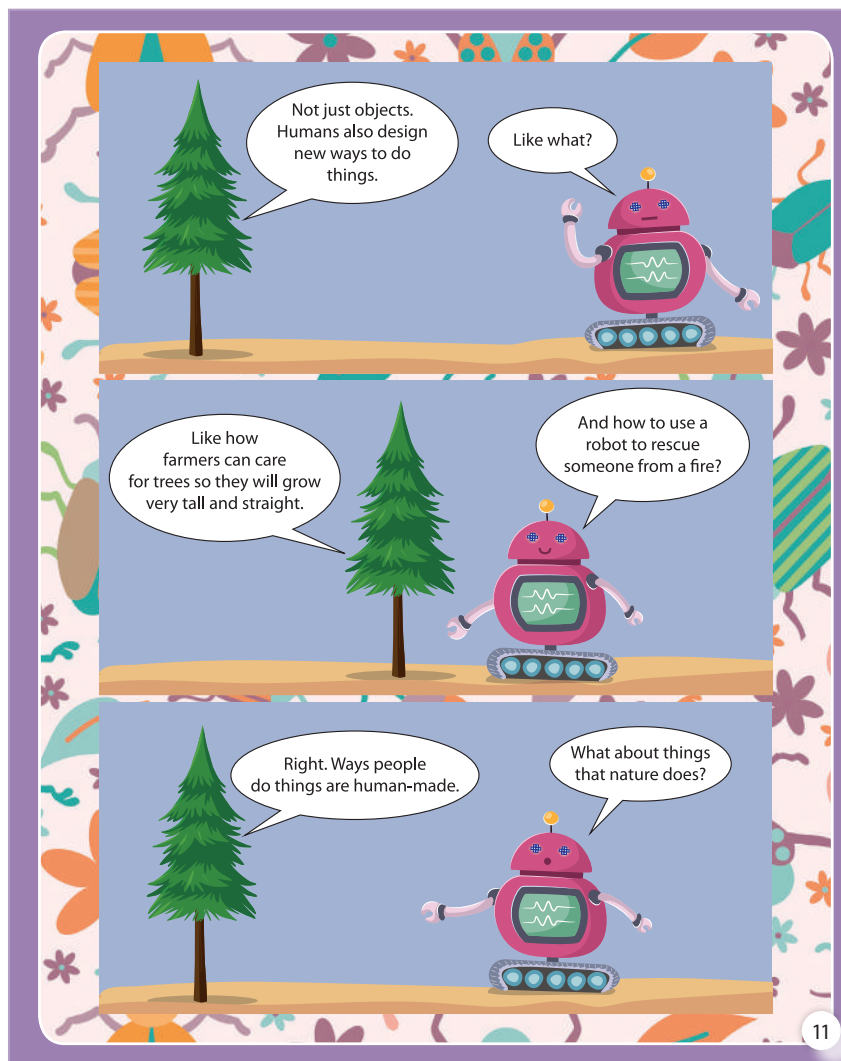
INFERENTIAL—What does the word **design** mean?

- » It means to build or invent things.

Know the Standards

Science Addresses Questions About the Natural and Material World While the standard says “material” world, this chapter uses “human-made.” Note that the intent of the standard is that science is limited to questions that can be answered by evidence from investigations and that not all questions can be answered by science.

Ask students to notice as you read aloud which character asks all the questions.



LITERAL—What is one example from the comic of a new way to do something that humans design?

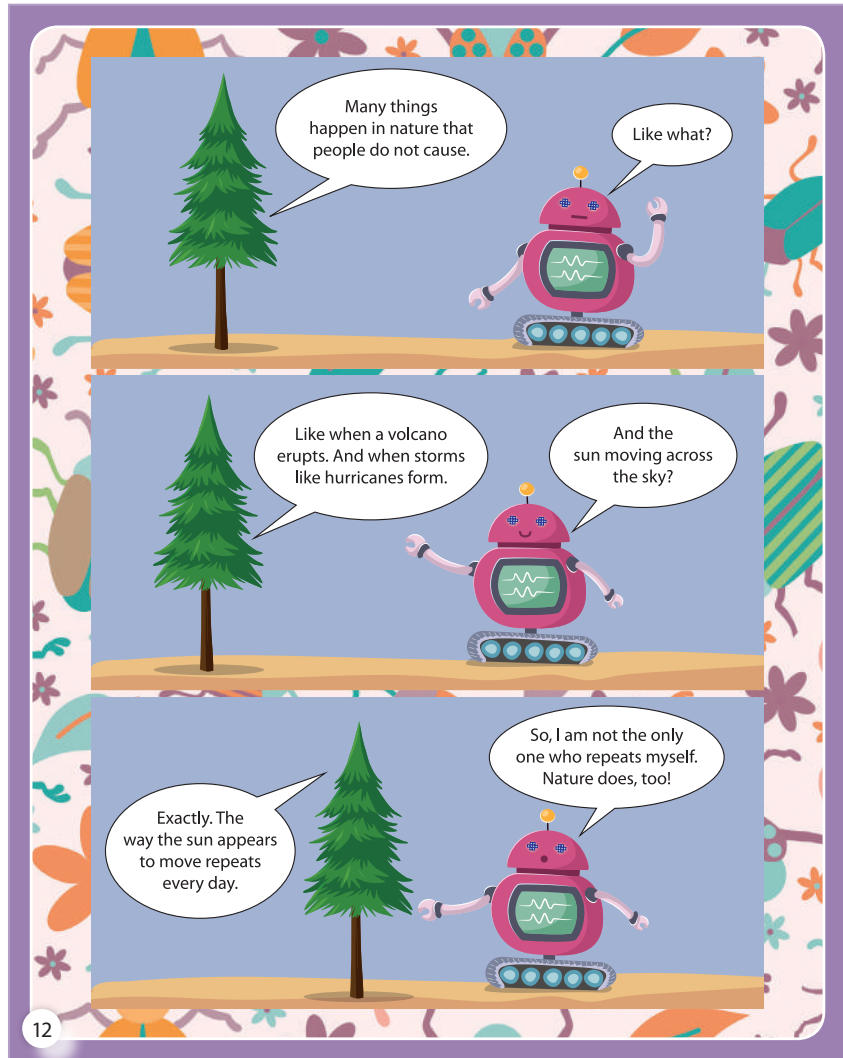
» Sample answer: how to use robots to rescue people from fires

INFERENTIAL—What is another example of a new way to do things designed by people?

» Possible responses: designing a new video game or a new way to cut down trees

CHALLENGE—Interested students can design a new way to do something useful in your classroom. Have them work in teams to plan and demonstrate their designs. Examples might include a new system for lining up students at the door or a new way to arrange the books on the classroom bookshelf.

Ask students to look at the images as you read aloud. Talk about other natural processes or events that students may have observed directly or through media.



LITERAL—What happens in nature that the characters point out?

- » volcanic eruptions, storms, the sun seeming to move across the sky every day

INFERENTIAL—When the robot says it repeats itself, what does it mean?

- » Possible answer: It is making a joke about asking questions such as “Like what?” over and over again.

Brainstorm with students other events in nature that repeat. Examples of natural cycles might include the moon phases repeating each month, high and low ocean tides repeating each day, the changing seasons repeating each year, the water cycle, animal life cycles, or plant life cycles.

Ask students to look at the comic panels as you read aloud. Talk about the new character.

Main Science Idea

Nature includes everything that exists or happens without people making it so.

13

LITERAL—Who is the new character in this comic?

» a scientist

Explain that the Main Science Idea is the big idea to remember after finishing the chapter.

3. Check for understanding.

Activity Page



AP 2

Online Resources



Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms.

Play a video of the song “My Favorite Things” from *The Sound of Music* for students. Distribute Activity Page 2 and writing materials to students. Have them follow the directions to classify some of their favorite things as *in nature* or *human-made*. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

See the Answer Key for sample or correct answers.

LESSON 3

What Is Measuring?

AT A GLANCE

Lesson Question

What is measuring?

Learning Objectives

- ✓ Cite examples in which knowing measurements is useful.
- ✓ Describe the process of taking different basic length measurements.
- ✓ Match provided measurements visually to the height, depth, and width of a box.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- hands-on science activity

Main Science Idea

Measuring is the means by which science can determine the size or amount of something.

NGSS and CCSS References

NOS3. Scientific Knowledge Is Open to Revision in Light of New Evidence: Science knowledge can change when new information is found.

RL.1.3: Describe characters, settings, and major events in a story, using key details.

SL.1.2: Ask and answer questions about key details in a text read aloud or information presented orally or through other media.

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.

length

measure

weight

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.

estimate

Instructional Resource

Student Book



Ch. 3

Student Book, Chapter 3
“What Is Measuring?”

Activity Page



AP 3

Activity Page
Practice Measuring (AP 3)

Materials and Equipment

Collect or prepare the following items:

- 1-foot length of elastic cord
- internet access and the means to project images/video for whole-class viewing
- tape measure, yardstick, or ruler
- empty cardboard box
- digital scale or classroom pan balance
- various classroom objects for measuring

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

THE CORE LESSON

1. Focus attention on the Lesson Question.

Show students an elastic cord, and explain that you want to make a beaded bracelet that is the right length to fit your wrist. Ask students to propose ways to make sure the bracelet will be just right. If needed, ask, “Will measuring help?”

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: What is measuring?

2. Read together: “What Is Measuring?”

Student Book



Ch. 3

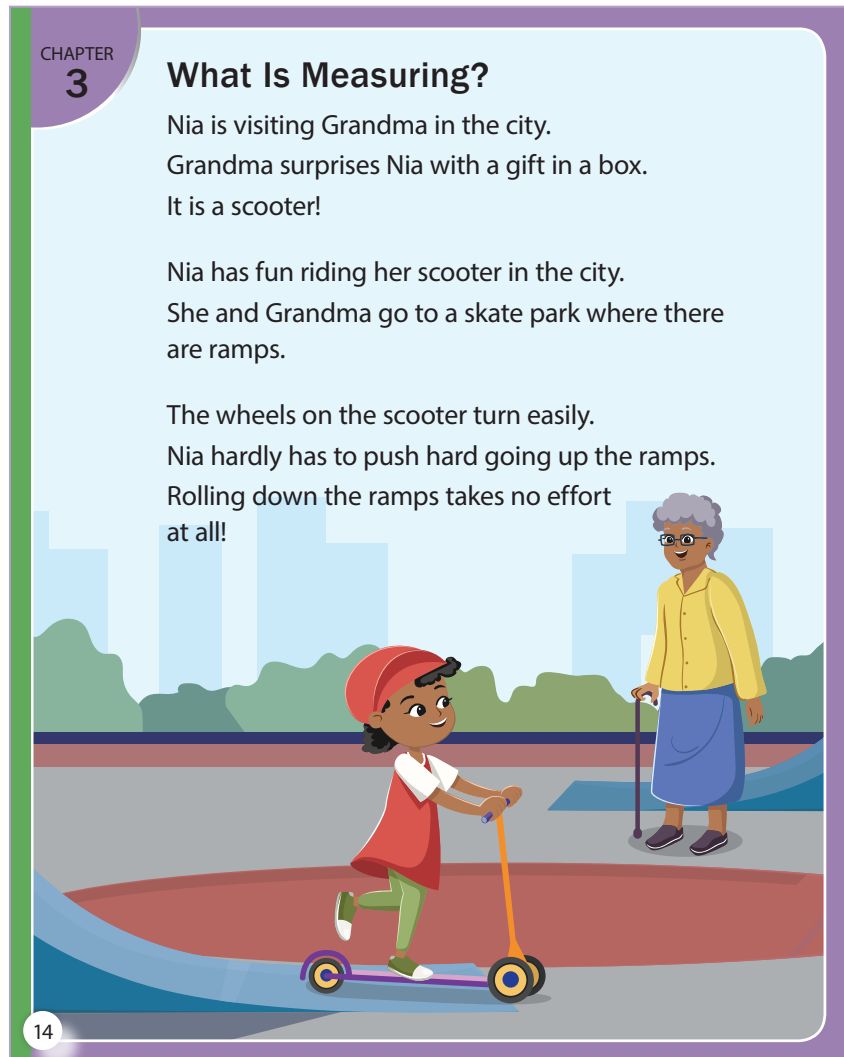
While some advanced students may be able to read words on a given page of the Student Book, as a general rule students should not be expected or asked to read aloud the text on the Student Book pages. The text in the Student Book is there so that adults can read it when sharing the Student Book with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

Guide students to open their books to Chapter 3 on page 14. Point out that the outside edges of the pages of this chapter are all green. Tell students that the title of this chapter is “What Is Measuring?” and tell them to pay special attention to how to measure the lengths of objects as you read.

Read Aloud Support

Page 14

Ask students to preview the illustration before you read aloud. Invite students to predict what the story is about and to share their own experiences with riding or watching people ride scooters.



LITERAL—Where is Nia when the story begins?

» She is at a skate park in the city.

INFERENTIAL—What makes riding her new scooter fun for Nia?

» Sample response: She can roll up and down hills fast with other children.

Use the story as an opportunity to anticipate the unit called “Simple Machines.” Ask students to identify the parts of a scooter (wheels, handlebar, platform), and explain that the front two wheels of the scooter are connected to a straight bar called an *axle* and that the rear wheel has its own axle.

Page 15

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



LITERAL—What Nia is worried about?

- » She is worried she will not be able to take her new scooter on the bus when she travels home.

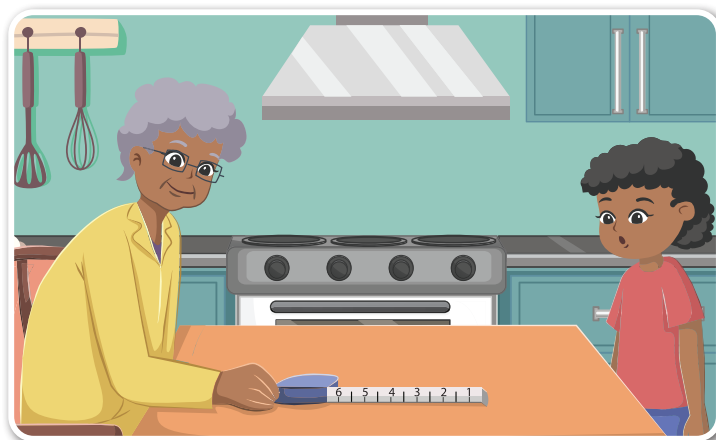
INFERENTIAL—What tools can Nia and Grandma use to measure to find out if the scooter is too long or too heavy?

- » Possible response: ruler or scale

Note that “too long” refers to the property of length and “too heavy” refers to the property of weight. Other properties of matter that first-grade students can measure are volume and temperature.

Ask students to look at the illustration and identify the tool used for measuring as you read aloud.

Nia learns how to measure length.
She uses a tape measure that has marks along it.
Some marks have numbers.
She can count them.
For the marks in between, she can count them, too.



Larger objects have higher measurements than smaller objects.

16

LITERAL—What can Nia measure with a tape measure?

» She can measure lengths, or how long or wide an object is.

Note that the units that could be used for measuring in this situation are inches or centimeters. There is no need for students to convert between the metric (centimeters, meters) and customary (inches, feet, yards) systems.

Show students an actual tape measure, measuring stick, or ruler. Invite volunteers to measure the length of some common classroom objects, such as a pencil or the edge of a desk, by placing the object alongside the tool.

SUPPORT—Provide students with counting or measurement cubes, and demonstrate how to lay the cubes alongside an object and express its length in whole units.

Ask students to look at the list of bus rules as you read them and the rest of the page aloud.

Nia and Grandma read the bus rules.

Grandma gets her bathroom scale.

"Put your suitcase on the scale. What is its weight?" she asks.

Nia reads the numbers on the scale. "It says 16 pounds."

"Now, put your scooter in its box, and put the box on top of your suitcase," says Grandma.

Nia reads the scale again. "It is now 22 pounds."

Will Nia's item meet the bus rules?



City Bus Lines

Personal Items
Personal items must fit in the rack over your seat.

Items must be smaller than:

- 29 inches in length
- 12 inches in width
- 6 inches in height

Items must be less than 50 pounds.

Plan Ahead! Measure!

17

INFERENTIAL—Does Grandma want Nia to take her scooter home in its box or leave the box behind in the city?

- » take it home in the box

Use a tape measure or yardstick to show students lengths of 29, 12, and 6 inches. Then have students estimate the size of the box that a child's scooter comes in.

INFERENTIAL—Do you think the box will fit on the bus? How do you know?

- » Sample response: yes, because I don't think a kid's scooter is much longer than 29 inches

INFERENTIAL—Why did Nia weigh her suitcase, scooter, and box together?

- » She had to see if the total was less than 50 pounds.

Ask students to look at the illustration as you read aloud. Talk about what Grandma and Nia are doing.

Grandma shows Nia how to figure out if the box will fit in the rack on the bus.

They estimate the size of the box in inches.

About how long is it?

It is about as long as Nia's arm. About 20 inches.

About how wide is it?

If they fold the handle, it is about 10 inches.

"About how high is it?"

"It is about the height of my hand. About 6 inches."

Will those measurements meet the bus rules?



Point out the word *estimate*, and explain that when someone guesses how big something is without measuring, they are estimating.

Allow students to answer the text question at the bottom of the page. To do so, they should compare the estimated lengths on this page to the bus rules on page 17.

INFERENTIAL—What should Nia do to be sure the box will fit?

» She should use the tape measure.

Show an empty cardboard box to the class. Guide the students to estimate if this box can fit on the rack inside the bus Nia will ride. Have students visually compare the length, width, and height of the box to the maximum allowed measurements in the bus rules on page 17.

Ask students to look at the illustration as you read aloud. Talk about what Nia is doing.

"I think it will fit!" Nia says.

"If you want to be sure, run and get the tape measure," says Grandma.

They measure the size of the box, and Nia smiles.

Her new scooter gets to ride home on the bus with her!



Main Science Idea

Measurements let us know and describe the sizes of things.

19

Now that students have estimated the size of the box you showed them, allow them to check their estimates by using a tape measure. Make sure they understand that they have to measure three dimensions—length, width, and height. Ask them if the box will fit on the bus Nia is taking. Discuss what might happen if one of those measurements is larger than the measurements listed in the bus rules.

LITERAL—Why is Nia happy at the end of the story?

» because she will be able to take her scooter home with her

3. Check for understanding.

Activity Page



AP 3

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. Distribute Activity Page 3 to students with writing materials. After reading the directions with students, scaffold the exercise to meet their needs.

See the Answer Key for sample or correct answers.

Questions to Investigate

AT A GLANCE

Lesson Question

What kinds of questions can be answered by investigations?

Learning Objectives

- ✓ Differentiate questions that are good candidates for science investigations from a provided set.
- ✓ Identify and explain, from provided examples, questions that cannot effectively be answered by scientific investigations.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration

Main Science Idea

Scientists can generate questions for investigations, and the information they find may be facts or opinions.

NGSS and CCSS References

SEP1. Asking Questions and Defining Problems: Ask and/or identify questions that can be answered by an investigation.

RI.1.2: Identify the main topic and retell key details of 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.

investigation

opinion

question

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.

pattern

Instructional Resources

Student Book



Ch. 4

Student Book, Chapter 4
"Questions to Investigate"

Activity Page



AP 4

Activity Page
Questions to Investigate (AP 4)

Materials and Equipment

Collect or prepare the following items:

none

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

THE CORE LESSON

1. Focus attention on the Lesson Question.

Ask student to recall a time in their lives when they could see the night sky. Invite them to share what they wondered and what questions they have about the night sky.

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: What kinds of questions can be answered by investigations?

2. Read together: "Questions to Investigate."

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 20. Point out that the outside edges of the pages of this chapter are all light blue. Tell students that the title of this chapter is "Questions to Investigate," and tell them to pay special attention to the difference between science and opinion questions as you read.

Ask students to look at the image and share what they think the two people are doing. Have them listen for **questions** as you read aloud.



Discuss the last question on the page, guiding students to recognize that the suggested investigation could answer the question “Will the night sky look the same a month from now as it does tonight?”

Call attention to the word **investigation**. Point out that it has the same root word as *investigate*, a word students learned in Chapter 2. Explain that a science investigation is an activity one does to try to answer a science question.

EXTEND—Read a picture book about science investigations and experiments to your students called *Cece Loves Science* by Kimberly Derting and Shelli R. Johannes. If students enjoy it, have a librarian obtain the rest of the Cece series for them.

Ask students to look at the images as you read aloud. Talk about how the text suggests what the children are doing (messaging and exchanging photos with a friend who lives far away).

What kind of investigation would answer the other question?



You could message your friend who lives far away.
He could take a photo at 8:00 p.m. on the same day you do.
Then you could compare the photos.

Which question would this science investigation answer?

You would find that the night sky looks different from different places on Earth.

21

Have students identify which question about the night sky this science investigation answers. If they struggle to identify “Does the night sky look the same from all parts of Earth?” suggest they look for clues about where the photos should be taken to answer the question.

INFERENTIAL—How does being curious help you think of science questions to investigate?

» Curious people ask a lot of questions about the world around them.

EVALUATIVE—Does this science investigation sound like a fun thing to do? If you think so, tell why.

» Possible answer: yes, because it’s fun to figure things out

Guide students to look at the image as you read aloud. Invite a volunteer to trace the pattern of the seven stars with their finger. Talk about whether the shape reminds them of something else.

Long ago, people drew pictures over the patterns of stars.
They made up stories about the pictures.
The stories helped them remember the patterns.



They thought this group of stars looked like the tail and back of a bear.

22

Call attention to the word *pattern* on this page. Point out that, in this use, it refers to the arrangement of the stars in relationship to one another.

Note that many ancient cultures, including the Romans and the Micmac and the Iroquois of North America, interpreted this pattern of stars as being part of a bear.

EVALUATIVE—What does this pattern of seven stars look like to you?

» Possible answers: a soup ladle or a wagon that you can pull

Point out to students that the question they just answered is not a science question because it cannot be answered with an investigation.

Have students compare the three images before you read aloud. Talk about any similarities and differences they notice in the artworks.

Which of these star pictures of the Great Bear is the best one?

Which one is your favorite?

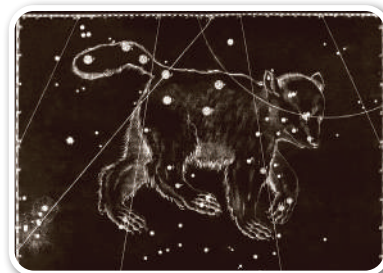
These are not questions that science investigations can answer.

The answers are opinions. An opinion is not correct or incorrect.

But you could ask, “Which star picture do the most people like?”

That is a science question you could investigate.

You could ask many people and count their answers.



23

LITERAL—What makes some questions **opinion** questions?

» The answer is not correct or incorrect.

INFERENTIAL—What words in the two questions at the top of the page indicate that these are opinion questions?

» *best* and *favorite*

Poll the students in your class to collect data on their opinions about which of the pictures of the Great Bear is the best. Give each student a slip of paper, and have them write A, B, or C for their preferred picture. Collect the papers, tabulate the results, and share them with the class.

Give students a chance to discuss the results and support their choices with explanations.

Ask students to look at the image and listen for opinion questions as you read aloud.

Look at this picture of the daytime sky.
Notice the clouds and the shadows within them.



What do you think the clouds look like?
Are the clouds pretty?
These are not questions you could answer with a science investigation.
The answers are opinions.
They are just what you think, not something that can be proven.

24

LITERAL—Why are the two questions on this page not science questions?

- » because the answers to them are opinions and you cannot answer them with a science investigation

Invite students to share their answers to the two opinion questions. Point out that even if all the students in the class agree the clouds look like sheep and are pretty, these are still opinion questions, not science questions.

Have students ask questions about the clouds that can be answered with a science investigation. Model a suitable question, and explain how it can be investigated. For example, “In what direction are the clouds moving?” is a question that can be answered by watching the clouds and using a compass to determine the direction of motion.

Ask students to look at the images as you read aloud. Talk about how they show something similar.

Let's ask some more questions.



Do shadows always point in the same direction?

How do the positions of the shadows change through the day?



These are questions you could answer with science investigations. How would you investigate each question?

Main Science Idea

Some questions can be answered through science investigations, but science cannot answer all questions.

25

Point out that viewers can see more than one shadow in each photo.

INFERENTIAL—How are the shadows within each photo the same?

» They point in the same direction.

3. Check for understanding.

Activity Page



AP 4

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms.

Distribute Activity Page 4, and read the directions with students. Read each question aloud, and have students circle the questions that can be investigated scientifically. Invite students to share their reasoning, looking for evidence that they understand that science can answer questions that can be investigated but that answers to some questions are a matter of opinion and investigation cannot determine whether the answers are correct or not.

See the Answer Key for sample or correct answers.

LESSON 5

The Sun Queen

AT A GLANCE

Lesson Question

What is a model?

Learning Objectives

- ✓ Describe how given models and that which they represent are alike.
- ✓ Identify ways in which given models and that which they represent differ.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration

Main Science Idea

Models are used in science to represent and predict phenomena. Models can be in many formats, such as drawings, smaller-scale models, and predictive math.

NGSS and CCSS References

SEP2. Developing and Using Models: Distinguish between a model and the actual object, process, and/or events the model represents.

RI.1.3. Key Ideas and Details: Describe the connection between two individuals, events, ideas, or pieces of information 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

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invention **model**

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.

represent

solar

working model

Instructional Resources

Student Book



Ch. 5

Student Book, Chapter 5
“The Sun Queen”

Activity Page



AP 5

Activity Page
Mária Telkes—Connect the Ideas! (AP 5)

Materials and Equipment

Collect or prepare the following items:

- globe or world map
- internet access and the means to project images/video for whole-class viewing

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 5 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Show students a model you have in your classroom—a globe (Earth model) or a world map. Discuss what actual object or thing it represents. Ask them to explain how the model is similar to and differs from the real thing. Accept all reasonable answers.

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: What is a model? (And how are models like and different from the real thing?)

2. Read together: “The Sun Queen.”

Student Book



Ch. 5

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 5 on page 26. Point out that the outside edges of the pages of this chapter are all red. Tell students that the title of this chapter is “The Sun Queen,” and tell them to pay special attention to what the Sun Queen invented and how she used models as you read.

Ask students to look closely at the illustration as you read aloud. Talk about what Mária Telkes is wearing around her neck.

CHAPTER
5

The Sun Queen

People called scientist Mária Telkes the “Sun Queen.”

Why?

Because she invented so many ways to use sunlight.



Each of her inventions began with a model.

Models are used to explain ideas.

Scientists use models to make things clear and simple.

A model also can show something you want to build.

There are many kinds of models.

Drawings and diagrams can serve as models.

So can objects that can be handled.

26

INFERENTIAL—Why do you think Mária Telkes wore a sun-shaped necklace?

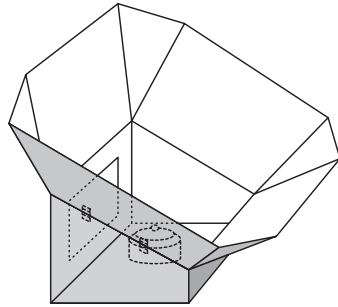
» because she was famous for her inventions that used light from the sun

Build students’ understanding of **models** by starting a class list that you can add to as students think of specific examples. Start by displaying a globe or world map. Have students look around the room for other examples of models, such as miniature cars or trucks and labeled diagrams.

Mária Telkes lived from 1900 to 1995. She was born in Hungary and moved to the United States at the age of twenty-four, after earning a PhD in physical chemistry. Over the next fifty years, she developed many new **inventions** that utilized solar energy.

Ask students to look at the images as you read aloud. Talk about any differences they notice in the two models.

Mária Telkes thought about how people could use sunlight to cook food.



First, she made a drawing of a solar oven to share her idea.

Then, she built a working model. It could bake many foods, such as chicken and cookies. People still use her oven today!



How is the drawn model like the working model oven?
How are they different?

27

INFERENTIAL—What kind of model did Mária Telkes first make of her solar oven? Why did she choose this kind of model?

- » It was a drawing. Maybe she used this kind of model because a drawing is inexpensive and faster and easier to make than a real object.

Have students discuss answers to the two questions:

INFERENTIAL—How is the drawn model like the working model oven?

- » They both show the shape of the oven and its parts.

INFERENTIAL—How are they different?

- » One is a picture on paper, and the other is a real object. Only the real object can cook foods.

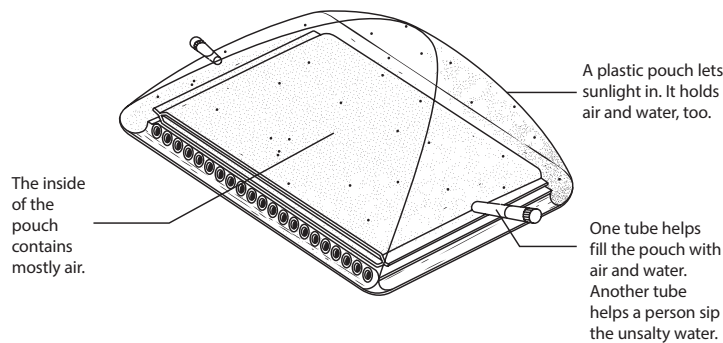
Call attention to the term *working model*, and point out that a working model can actually do what the inventor wants it to do.

Mária Telkes also invented a device to make drinking water from salt water.

It fit into a life raft.

If someone was lost at sea, they could use the device to get unsalty water to stay alive.

Mária Telkes made a drawing to show the parts.



28

INFERENTIAL—Why couldn't people lost at sea drink the ocean water to stay alive?

» It is too salty and would make them sick.

Read the labels on the drawing to the students.

EVALUATIVE—How useful are the labels in helping you understand the model? Explain.

» Sample response: very useful, because I wasn't sure what all the parts were

Online Resources



Explain how the device uses evaporation and condensation.
(For a more detailed explanation, see the Online Resources Guide. www.coreknowledge.org/cksci-online-resources)

Ask students to find Mária Telkes's invention in the illustration as you read aloud.

Later, working models were built in a factory.
The models were tested by sailors.
It worked! It could save lives!



A working model can change from the first design.
That's part of figuring out the best solution.

29

INFERENTIAL—Where are the sailors testing the working model?

» in a lifeboat in the ocean

Point out that when people design and build a thing, the finished version doesn't always look exactly like the drawings of the ideas. Ask students to spot examples of how this is true by comparing the pictures on pages 28 and 29. Ask the following questions:

INFERENTIAL—How is the working model like the drawing?

» It has a clear covering that can fill with air.

INFERENTIAL—How is it different?

» The covering is round in the working model, but in the drawing it was a rectangle. Also, the sailors are using a pump to blow air under the covering.

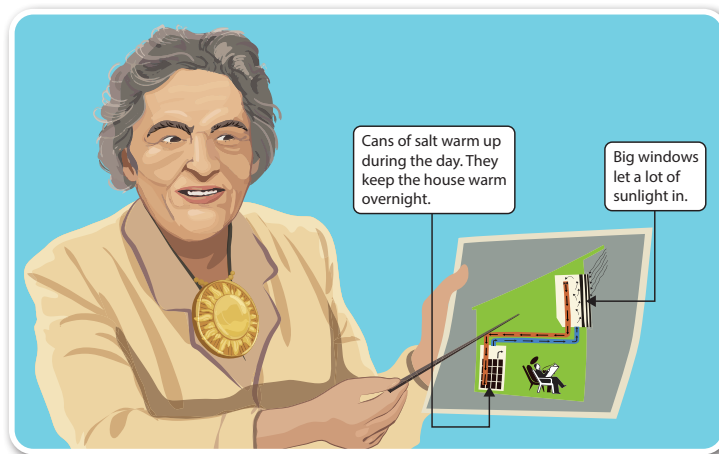
Note that the problem Mária Telkes was asked to solve by the U.S. government was how to save the lives of military personnel whose planes were shot down during World War II over the Pacific Ocean.

Page 30

Ask students to look at the illustration as you read aloud. Talk about what they think Mária Telkes is holding.

The Sun Queen even invented a house heated only by the sun. She figured out how to keep the house warm at night, when the sun was not shining.

Her drawings showed a wall of very big glass windows. That wall would face the part of the sky that got the most sunlight.



30

INFERENTIAL—What type of model is Mária Telkes holding in this picture?

» It is a diagram.

LITERAL—What is the source of energy that warms the house?

» the sun, sunlight

Online Resources



Note that the system Telkes designed to heat the Dover Sun House involved a substance called Glauber's salt. (For a more detailed explanation, see the Online Resources Guide. www.coreknowledge.org/cksci-online-resources)

Have students look at the illustration as you read aloud. Make sure they understand that this is a true story.

The model house was called the Dover Sun House.
A little boy and his parents moved in.
Curious people came to tour the house.
They felt how warm it was inside, even when it was cold outside!



What would you like to invent?
How could a model help you share your ideas?

Main Science Idea

A model represents something else. In some ways, a model is like the real thing. In other ways, it differs.

31

Have students answer the two questions at the bottom of the page. Discuss how models are useful for explaining solutions to other people or for testing how well a solution works.

Online Resources



EXTEND—Students might enjoy a video interview of the man who was the little boy who lived in the Dover Sun House. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

3. Check for understanding.

Activity Page



AP 5

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. Distribute Activity Page 5, and read the directions to students. Tell students they may draw or write words in each shape to complete the graphic organizer.

See the Answer Key for sample or correct answers. Look for evidence that students can identify models and connect ideas from the text.

LESSON 6

Investigate!

AT A GLANCE

Lesson Question

How can we plan and carry out investigations?

Learning Objectives

- ✓ Order provided steps in multiple examples of age-appropriate investigations.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration

Main Science Idea

Science investigations are planned to predict the results from a carefully planned set of steps that will lead to observations.

NGSS and CCSS References

SEP3. Planning and Carrying Out Investigations: Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question.

L.1.6. Vocabulary Acquisition and Use: Use words and phrases acquired through conversations, reading and being read to, and responding to texts. . . . (Also **SL.1.2**)

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

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observation **observe**

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.

predict

Instructional Resources

Student Book



Ch. 6

Student Book, Chapter 6
“Investigate!”

Activity Page



AP 6

Activity Page
Fix This Mix-Up! (AP 6)

Materials and Equipment

Collect or prepare the following items:

- 1-quart zip-close plastic bag
- 10 popcorn kernels
- 1 paper towel
- spray bottle with water

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 6 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Remind students that they learned the word *investigation* in Lesson 4. Have students recall what it means by giving examples.

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: How can we plan and carry out investigations?

2. Read together: “Investigate!”

Student Book



Ch. 6

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 6 on page 32. Point out that the outside edges of the pages of this chapter are all dark blue. Tell students that the title of this chapter is “Investigate!” and tell them to pay special attention to how the steps in an investigation are ordered as you read.

Ask students to notice the numbers before some sentences as you read aloud. Talk about why the author used numbers.

CHAPTER
6

Investigate!

How do popcorn kernels sprout?

Try this investigation at home to find out.

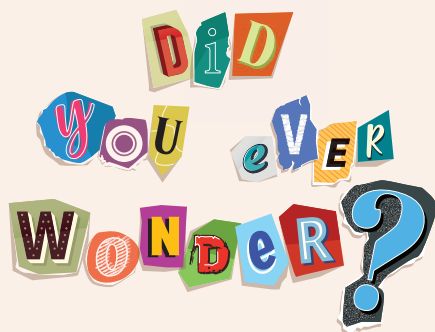
- 1 Ask an adult for ten popcorn kernels.
- 2 Spread out the kernels on a paper towel.
- 3 Spray or sprinkle the towel with water until it is damp but not too wet.
- 4 Fold the towel in half, slide it into a zipper plastic bag, and seal the bag.
- 5 Place the bag inside a cabinet or closet.
- 6 Observe the kernels each day. What changes do you notice? What parts sprout first—roots or stems?

Point out the word **observe** in Step 6. Have students act out how they would observe the kernels. Explain that it means to look carefully but can also involve using other senses, such as hearing and smell.

EVALUATIVE—Does this sound like an interesting investigation? Explain.

» Sample answer: yes, because I didn't know that popcorn kernels are seeds

Show students the materials needed for this investigation. Based on the reading, carry out Steps 1–4 in order. Invite a volunteer to take the setup home to carry out Steps 5 and 6. The kernels should sprout in about seven days. Tell students who try it at home to open the bag for a minute or so every other day to release some of the water.



What do insects drink?

Try this investigation with an adult to find out.

- 1 Put warm water in a small cup.
- 2 Add a spoonful of salt. Stir until the salt seems to disappear.
- 3 Pour a little salt water into a bottle cap.
- 4 Do Steps 1–3 again, but use sugar instead of salt.
- 5 Place the two caps next to each other on the ground outside.
- 6 Check the caps during the day to see if insects visit them.



33

INFERENTIAL—Why does Step 4 say to repeat Steps 1–3?

- » Sample response: because you have to set up two bottle caps, one with salt and one with sugar

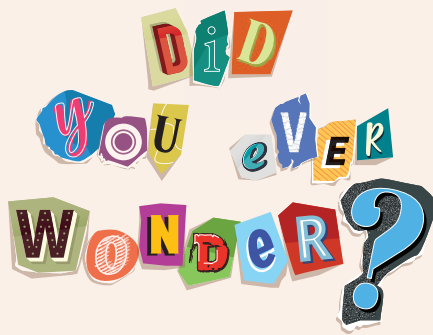
INFERENTIAL—What word that you learned when we read about investigating popcorn could the author have used instead of *check* in Step 6?

- » observe

Invite students to predict what they will observe. Have students support their claims with reasoning.

This investigation requires few materials and might be carried out at home or at school. If you do it at school, find an out-of-the-way patch of grass or soil on which to place the bottle caps.

ALERT—If students plan to do this at home, call attention to the safety message to work with an adult.



Do plants sense sunlight?

- 1 Ask an adult to cut off the top of a carrot, leaving about 2 cm of the orange root.
- 2 Place a few pebbles in a small container.
- 3 Sit the carrot root on top of the pebbles. Add water halfway up the root.
- 4 Put the container near a sunny window. Check it each day, but do not turn the container. When the water gets low, add more.
- 5 Draw what you observe each day.



34

INFERENTIAL—Which steps make sure the carrot will sit upright?

» Steps 1–3

INFERENTIAL—What part or parts of a carrot plant do you predict will grow from a carrot root?

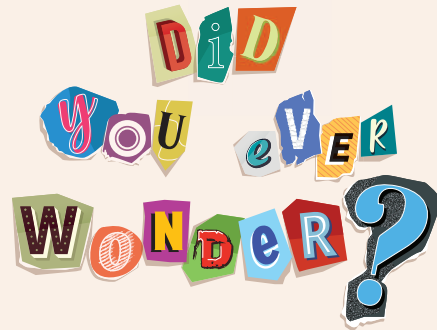
» stems, leaves

Discuss whether there are other ways to answer the question “Do plants sense sunlight?” If students are not sure how to respond, ask, “Are there any other plant parts that could grow leaves?” or “What about using a plant that already has leaves?”

EXTEND—The first four investigations described in this chapter are well suited for students to carry out at home with an adult. If students plan to do so, encourage them to make drawings that show their results, and have them share their drawings with the class.

There are wildlife guides for cities and states but not for your neighborhood.

You can solve this problem!



How can you plan a wildlife trail for your neighborhood?

- 1 With an adult, walk around your neighborhood.
- 2 Look for wild animals. They can be small and on the ground, like worms or chipmunks. They can be large and in trees, like birds.
- 3 Draw a map to show where to walk to find wild animals.
- 4 Make an X at each place you can stop and observe animals.
- 5 Label your map to tell what to look or listen for at each stop.
- 6 Share your wildlife trail map with your family and friends.



35

LITERAL—How does Step 4 say to mark your map where there are wild animals?

» with an X

INFERENTIAL—What kinds of animals do you predict people can observe in our school neighborhood?

» Answers will vary with the local geography.

Have students imagine they are walking around their neighborhood with a camera. Then ask, “Where in the list of steps would you add a step to take photos? Why?”

» between Steps 2 and 3, because the photos will help me remember what kinds of animals to draw on my map

Ask students to look at the image as you read aloud. Have them talk about what the student on the right is doing.

You can carry out investigations to answer science questions.
You can also solve problems with the help of investigations.



Investigation steps tell what to do and in what order.
They tell what materials to use.
They tell when to record observations.

36

INFERENTIAL—What is the student on the right doing?

- » Possible responses: checking off investigation steps as they are finished, writing down observations

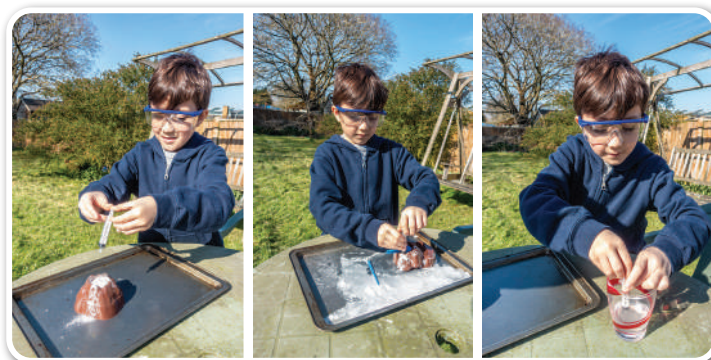
LITERAL—What are three things investigation steps tell you?

- » what to do and in what order, what materials to use, when to record observations

Point out that the word **observation** has the same root as a word they learned earlier in this lesson—*observe*. Explain that when they observe, they draw or write down observations. Note that *observe* is a verb and *observation* is a noun but that CCSS ELA standards do not require students to identify words by their parts of speech until Grade 3.

Have students compare the three images as you read aloud. Talk about what the student is doing in each photo.

You can also plan your own investigations.
Write steps using numbers to show their order.
After you try the investigation, give the steps to someone else.
Then they can repeat the steps in the same order.
You can talk and compare what they observed to what you observed.
Look at these photos of an investigation.
They are not in the correct order.
How would you order them?



Main Science Idea

Investigations follow a series of steps.

37

Have students answer the question “How would you order them?” Explain that the student is modeling a volcano using baking soda and vinegar. Steps: 1. right photo, student uses a syringe to take vinegar from a cup; 2. left photo, he squirts the vinegar onto the volcano; 3. middle photo, the baking soda–vinegar mixture is spread over the tray.

INFERENTIAL—Why is writing numbered steps for your own investigations helpful?

- » because then other people can try the investigation the way you did it and see if they observe the same things

3. Check for understanding.

Activity Page



AP 6

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. Distribute Activity Page 6, and scaffold the exercise to meet the needs of your students. Explain that their numbers should be written in the circle next to each picture.

See the Answer Key for sample or correct answers.

Data and Predictions

AT A GLANCE

Lesson Question

How can we make predictions from data?

Learning Objectives

- ✓ Predict an outcome using a given set of data in provided age-appropriate scenario.
- ✓ Project the next value in a series of provided data.
- ✓ Describe how to determine the accuracy of a grade-appropriate, data-driven prediction.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- demonstration

Main Science Idea

Scientists can examine data to determine patterns from the data. These patterns can be used to predict what will happen.

NGSS and CCSS References

SEP4. Analyzing and Interpreting Data: 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.

RI.1.1. Key ideas and Details: Ask and answer questions about key details in a text.

L.1.4.A. Vocabulary Acquisition and Use: Use sentence-level context as a clue to the meaning of a word or phrase.

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

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data

predict

prediction

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graph

pattern

Instructional Resources

Student Book



Ch. 7

Student Book, Chapter 7
"Data and Predictions"

Activity Page



AP 7

Activity Page
My, How You Grow! (AP 7)

Materials and Equipment

Collect or prepare the following items:

- index cards
- ball or board eraser

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 7 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Present a relatable data set to your students. Say the following: "Our school cafeteria served chicken tenders every Monday and pizza every Friday for the past four weeks." Then ask, "What do you predict will be served next Friday?" Based on the pattern, students should recognize that it is likely pizza will be served.

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: How can we make predictions from data? (Then, how can we check to see if the predictions were correct?)

2. Read together: "Data and Predictions"

Student Book



Ch. 7

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 7 on page 38. Point out that the outside edges of the pages of this chapter are all dark purple. Tell students that the title of this chapter is "Data and Predictions," and tell them to pay special attention to the different ways data can be displayed as you read.

Ask students to listen carefully to the story as you read aloud.

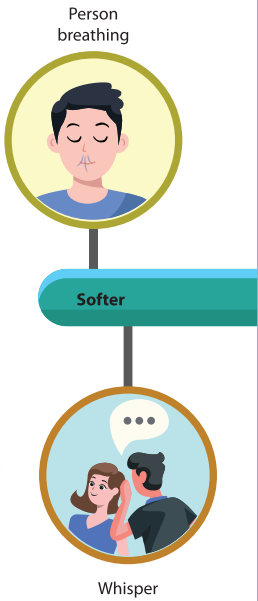
CHAPTER 7

Data and Predictions

Dr. Fuertes is visiting Riverside School today to talk about healthy hearing. She brings a diagram showing sounds that are softer and louder.



Dr. Fuertes explains where the data, or information, come from. Scientists pointed a tool at a sound maker. The tool measured the loudness of the sound. They wrote down each measurement. Then they arranged them on a line from softest to loudest. Dr. Fuertes explains that very loud sounds can harm people's hearing.



Person breathing

Softer

Whisper

LITERAL—What information does Dr. Fuertes share about sounds?

- » that some are soft and some are loud and that loud sounds can hurt people

Have students read the information on the diagram to answer the following questions:

INFERENTIAL—Which is the softest sound? the loudest?

- » The softest sound is a person breathing. The loudest sound is a fireworks show.

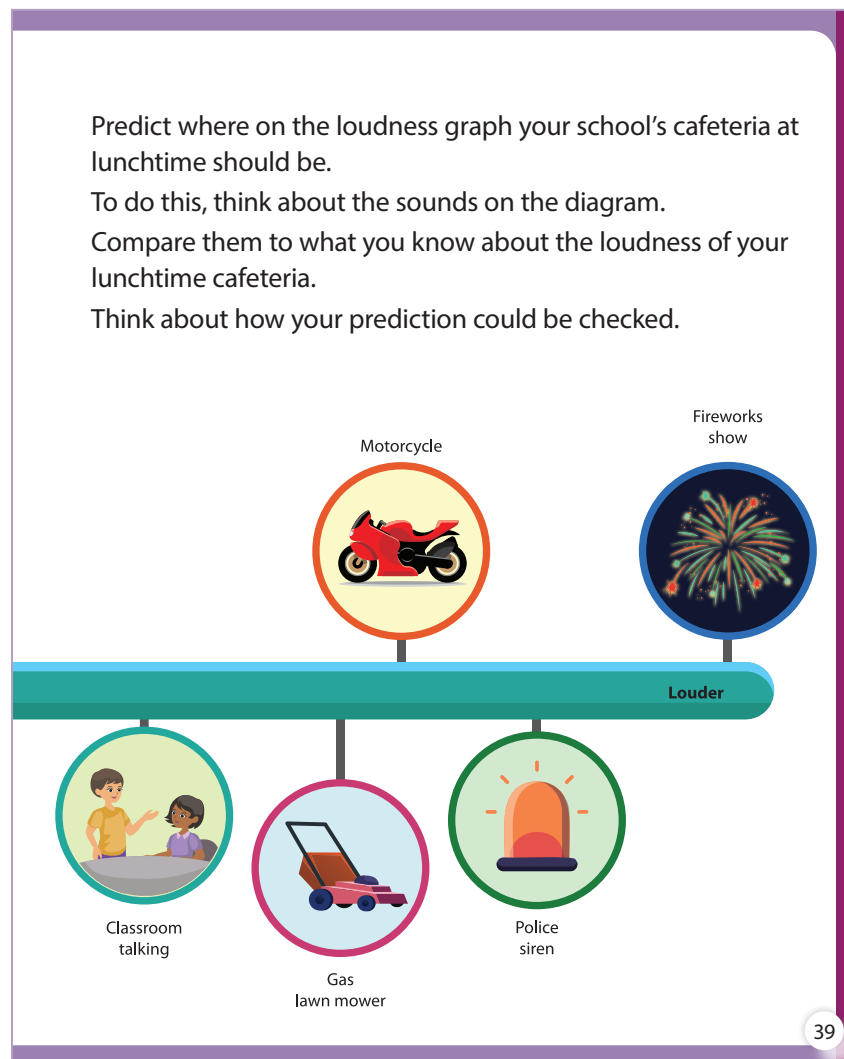
INFERENTIAL—Which sounds are louder than a motorcycle?

- » a police siren and a fireworks show

Call attention to the word **data**. Point out that the word *information* has a similar meaning. Distribute index cards, and have students write *data* on one side and *information* on the other side. Tell students to listen for the word *data* as you read and hold their cards up when they hear it.

Before reading, hold a ball or board eraser with your extended hand. Ask students to **predict** what will happen when you let go. When they respond that it will fall and bounce, explain that they have just *predicted*.

Have students continue to look at the diagram as you read aloud.



Clarify the meaning of the word **prediction** by having students use contextual clues and identifying its root word on this page.

INFERENTIAL—What does *prediction* mean?

» It is the thing you predict.

Have students follow the text directions to predict where on the diagram their lunchtime cafeteria falls. Then have volunteers share with the class.

INFERENTIAL—Where do you predict our lunchtime cafeteria would be on the softer-louder diagram? How do you know?

» between classroom talking and a motorcycle, because everyone is talking at once and there are kitchen sounds, too

Turn off and on the overhead lights in your classroom. Discuss how the light is dimmer when the lights are off and brighter when the lights are on.

Ask students to listen carefully to the story as you read aloud.



The Wilson family is car camping. They set up their tent right next to their parked car. Mr. Wilson puts out the campfire at bedtime. But the kids want to read comic books before they go to sleep. It would be useful to know about light sources. Which sources of light are dimmest and brightest?



40

Have students use contextual clues to define car camping.

LITERAL—What is car camping?

» It's when you set up and sleep in a tent right next to your car.

SUPPORT—For students who are unfamiliar with car camping, search online for images showing how families car camp.

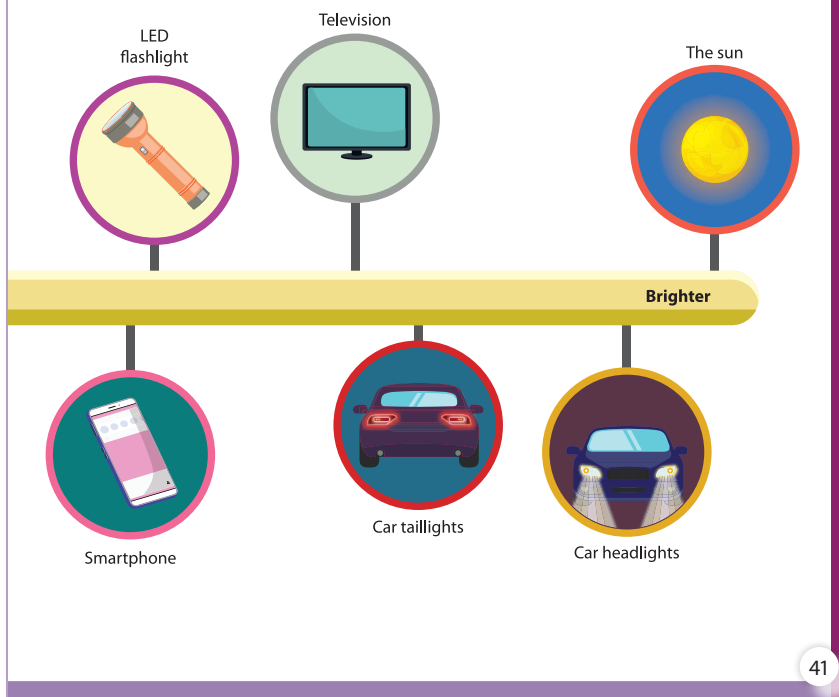
INFERENTIAL—What is the problem the kids want to solve?

» Sample response: where to get enough light to read their comic books

Call attention to the diagram, and discuss its similarities to the sound diagram on pages 38–39. Make sure students understand that dimmer light sources are to the left and brighter sources are to the right.

Have students look at the diagram as you read aloud. Students should raise their index cards when they hear the word *data*.

Think about the sources of light at the campground.
 Think about the brightness of light needed to read.
 Use the data in the diagram to compare.
 Predict which source would be best for reading comic books.
 How would you check your prediction?



Remind them that the words *data* and *information* have similar meanings and that the diagram contains information that they can use to compare the brightness of light sources.

INFERENTIAL—Which light sources do you predict would work best for reading comic books in a tent? Explain.

- » Sample response: An LED flashlight or the flashlight app on a smartphone would work because they are safe and can be pointed right at the comic book.

INFERENTIAL—Which light sources do you predict would not work well and why?

- » Sample response: A candle would be too dim and is not safe. Car taillights might work, but we would have to move the car next to the tent. The car headlights would be too bright. There is no sun at night.

Ask students to look at the photo and chart as you read aloud. Students should raise their index cards when they hear the word *data*.

This desert tortoise is only a couple of years old.
It is about 3 inches in length.
It will grow a little more each year, until it is an adult.



The chart shows how many inches long this little fellow will be from ages 5 to 7 years.

Age	5 Years	6 Years	7 Years	8 Years
Inches	6	7	8	?

What length do you predict it will be at 8 years old?
How did the data in the chart help you answer?

42

Make sure students understand what quantity “a couple” implies.

INFERENCE—How old is the turtle in the photo?

» about two years old

Guide students to use the data in the chart to answer the two text questions.

INFERENCE—What length do you predict it will be when it is eight years old?

» nine inches

INFERENCE—How did the data in the chart help you answer?

» Sample answer: I looked for a pattern in the inches row.

Note that the data provided is for desert tortoises (*Gopherus agassizii*), native to the southwestern United States.

EXTEND—Students can use online sources to find more data about desert tortoises. Guide them to use the search terms “desert tortoise fact sheet” to answer their questions.

Ask students to look at the image and chart as you read aloud. Students should raise their index cards when they hear the word *data* in the Main Science Idea.

A tree grower sells young white oak trees for planting.
The trees are 6 feet tall when they are sold to buyers.



The chart shows how tall the tree will be in the first three years after it is planted.

	First Year	Second Year	Third Year	Fourth Year
Feet	6	8	10	?

How tall do you predict it will be after the fourth year?

How do you know?

Main Science Idea

Data are information. Data can help you predict some things.
You can check to see if your prediction was correct.

43

INFERENTIAL—What pattern do you see in the tree height data?

» After each year, the tree grows two feet.

INFERENTIAL—How tall do you predict a white oak will be after the fourth year? How do you know?

» twelve feet tall, because the pattern shows it will grow another two feet in a year.

3. Check for understanding.

Activity Page



AP 7

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. Distribute Activity Page 7, and read the directions to students. Students can use counting skills (counting by tens, counting on from any number under 120) to determine and write the next value in the table.

See the Answer Key for sample or correct answers.

LESSON 8

How Much and How Many

AT A GLANCE

Lesson Question

What can be measured with numbers, and what cannot?

Learning Objectives

- ✓ Define *quantity* as how much or how many of something.
- ✓ Sort characterizations into groups by their descriptions of quantity versus quality.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- hands-on science activity

Main Science Idea

Science uses quantity to describe the natural world. Science also uses quality, something that cannot be measured, to describe the natural world.

NGSS and CCSS References

SEP5. Using Mathematics and Computational Thinking: Mathematics such as counting can be used to describe the natural world. As students learn to use quantity and quality, they are better able to display this data in graphs or other appropriate organizers, and find patterns in these numbers.

RI.1.7. Integration of Knowledge and Ideas: Use illustrations and details in a story to describe its characters, setting, or events.

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.

measure

quality

quantity

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.

observation

Instructional Resources

Student Book



Ch. 8

Student Book, Chapter 8
“How Much and How Many”

Activity Page



AP 8

Activity Page
Sort It Out (AP 8)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing
- pattern blocks or plastic building blocks
- drawing materials such as colored pencils, crayons, markers, and paper
- measuring tools (ruler, measuring tape, stopwatch, scale, beakers or measuring cups)

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 8 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Make a simple building using the blocks. Keep the building hidden from students. Describe the building using descriptors like number of blocks, colors, shapes, etc. Have students draw the building as best they can. Then reveal the building, and have students compare their drawings with the building. Tell students that in this chapter, they will be thinking about the ways we describe things.

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: What can be measured with numbers, and what cannot?

2. Read together: “How Much and How Many.”

Student Book



Ch. 8

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 8 on page 44. Point out that the outside edges of the pages of this chapter are all orange. Tell students that the title of this chapter is “How Much and How Many,” and tell them to pay special attention to the way things are being described as you read.

Read Aloud Support

Page 44

Ask students to look at the images as you read aloud. Ask students to describe what they see.

CHAPTER
8

How Much and How Many

In science, we use numbers to measure.
We can measure length, weight, time, and more.
Think about things that can be measured.



What's the distance around a tree trunk?



How long does it take to win a race?



How many meercats are keeping watch?

44

INFERENTIAL—What does it mean to **measure** something? What words do we use to describe measurements?

- » It means to describe the exact size of something, how heavy something is, or the amount of something. We use words like *height*, *width*, *weight*, *time*.

INFERENTIAL—What tools do we use to measure things?

- » We use tools like rulers, measuring tapes, stopwatches, and scales to measure things.

Show students some measuring tools (ruler, measuring tape, stopwatch, scale, measuring cups or beakers). Talk about when you would use each tool (e.g., you use a ruler to measure length or width). Consider using a bulletin board to display the measuring tools and the measurement words that apply to each tool.

Page 45

Ask students to look at the images as you read aloud. Talk about what they notice about the different things that could be measured and described with numbers.

Quantity means how much or how many of something.
The number of units helps us tell sizes and amounts.



How many people are in line?



How tall is the plant?



How much liquid
is in the flask?

45

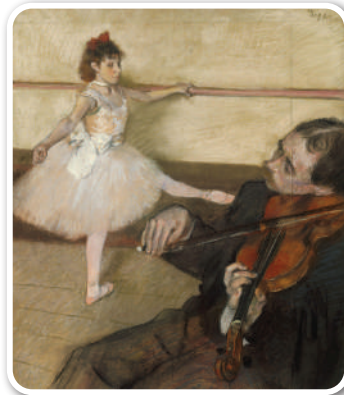
LITERAL—What does **quantity** mean? How do you find quantity?

» *Quantity* means how much or how many of something. You find quantity by counting with numbers.

SUPPORT—If possible, show students various instruments, such as beakers and measuring spoons, that are used to measure liquid volume. Show students a measure of water in one container, and write down the volume. Then transfer it to the other container, and have students note the volume.

Ask students to look at the images as you read aloud. Talk about how they would describe the images. Would they still use numbers (quantity)? Why or why not?

Some things cannot be measured with numbers.
How something looks, tastes, or feels can't be measured.



How beautiful is a painting?



How good does
breakfast taste?



Which stuffed animal
feels nicest?

46

On the board, write, “quality = how something looks, tastes, smells, sounds, or feels = CANNOT be measured.”

Point out that we may not be using numbers to describe these objects, but we are using our five senses! Have students make observations and create descriptions about how the objects look, taste, smell, sound, or feel. Tell them that they are using **quality** to describe the objects!

LITERAL—Describe the difference between quality and quantity.

- » Quality tells how something looks, tastes, smells, sounds, or feels. Quantity tells how much or how many. You can measure quantity but cannot measure quality.

For the following prompt, have students pair-share with a neighbor.

EVALUATIVE—Look at some items on your desk or in the room. Describe the quality of the objects.

- » Sample answer: My pencil is super sharp. The lamp is very bright. The room looks like a happy place.

Page 47

Ask students to look at the image as you read aloud. Ask students to make observations and describe the image.

Some things about nature can be measured.
Others cannot.
We cannot measure how pretty a flower is.
But we can measure how many bees collect nectar from it.



EVALUATIVE—How would you use quality to describe the things in the picture. Why?

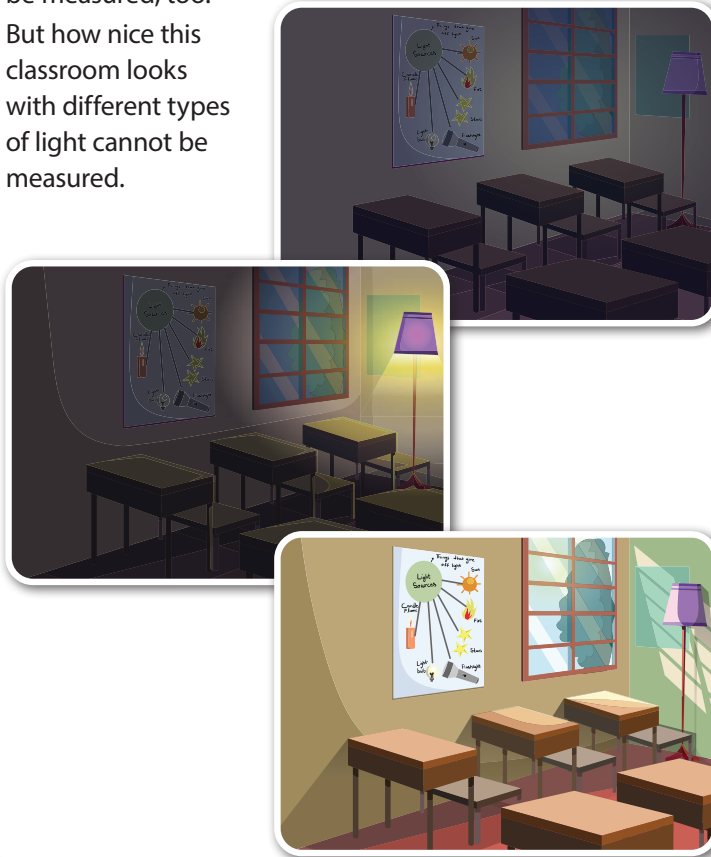
- » I would describe the beauty of the picture, its colors, and how it might smell there. These things describe quality because you cannot measure them.

EVALUATIVE—How would you use quantity to describe the things in the picture?

- » I could count the number of flowers, count the number of different colors, or measure the flowers. I might even be able to weigh the things in the picture.

Ask students to look at the images as you read aloud. Ask students to think about how the pictures are different from each other. How would they describe these differences to another person?

You can measure how bright each of these classrooms is. How close you must stand to see the poster in each light can be measured, too. But how nice this classroom looks with different types of light cannot be measured.



48

Explain to students that the brightness of light is measured using lumens. More lumens means it's a brighter light; fewer lumens means it's a dimmer light.

INFERENTIAL—How could you use quality to describe light?

» I could say the light is very bright, very dim, or bright white.

EVALUATIVE—When describing how close you must stand to see the poster, are you describing quantity or quality?

» That is quantity.

EVALUATIVE—Look at the pictures of the classroom. What other ways can you describe it. Make sure to think about quantity and quality.

» You can see five desks. That is a quantity. You can see a red floor. That is a quality.

Ask students to look at the images as you read aloud. Talk about what they notice about the qualities and quantities in the pictures.

Let's practice sorting things into groups.

Which are details that can be measured?

Which show details that cannot be measured?



A thermometer can measure how hot it is.



But you can't measure how happy a person is.



A scale can measure how heavy a puppy is.



But we can't measure how beautiful the sunset is.

Main Science Idea

Quantity means how much or how many of something. Some things can be counted or measured precisely. Other things cannot.

49

LITERAL—Which are details that can be measured? Which show details that cannot be measured?

- » The temperature and puppy's weight can be measured. The person and sunset cannot be measured; their qualities should be described by using the five senses.

3. Check for understanding.

Activity Page



AP 8

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. *Quantity* means how much or how many of something. Some things can be counted or measured precisely. Other things cannot.

Use Activity Page 8 to check student understanding regarding things that can be measured and things that cannot be measured.

See the Answer Key for sample or correct answers.

LESSON 9

Super Solver!

AT A GLANCE

Lesson Question

How do we design things that solve problems?

Learning Objectives

- ✓ Match designed solutions to problems that they solve.
- ✓ Recognize multiple solutions for the same problem.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- hands-on building activity

Main Science Idea

The design process, much like the scientific process, follows a set of steps to develop a solution to a problem.

NGSS and CCSS References

SEP6. Constructing Explanations and Designing Solutions: The goal of engineering design is to find solutions to problems, with the solutions being based in scientific knowledge. These solutions must meet certain criteria and constraints.

RI.3.3. Key Ideas and Details: Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

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.

problem

solution

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.

design

Instructional Resources

Student Book



Ch. 9

Student Book, Chapter 9
“Super Solver!”

Activity Page



AP 9

Activity Page
Problem-Solving Invention
(AP 9)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 9 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Before class starts, place something in a high position that is not easily reached. For example, place a ball on top of a high shelf. Tell students that you have a problem—you can’t reach the item on the high shelf. Ask students to help you figure out how you can reach the item. What if their ideas didn’t work? What would their next steps be? Tell students that today they will be thinking about different ways to solve problems.

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: How do we design things that solve problems?

2. Read together: “Super Solver!”

Student Book



Ch. 9

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 9 on page 50. Point out that the bottom edges of the pages of this chapter are all green. Tell students that the title of this chapter is “Super Solver!” and tell them to pay special attention to the different ways that the girl tries to solve her problem as you read.

Ask students to look at the images as you read aloud. Talk about what they notice about the different inventions around her. Guide students to discuss what they think the different inventions do and where they came from.

CHAPTER
9

Super Solver!

Inventor Kid is here to save the day!

There's no problem too big for me to solve!



Oh no!

My toy car keeps getting stuck under my bed!



50

Tell students that a **problem** is something that people want to change or improve.

LITERAL—What's the problem?

» The toy car keeps getting stuck under the bed.

INFERENTIAL—What would you do to solve the problem?

» I might use a broom handle to reach the car. Or I would ask someone for help.

Point out that Inventor Kid likes a challenge. She wants to invent a **solution**! Start a chart on the board in which you will record the process Inventor Kid goes through during the story. For this step, write, "Problem: Toy car is stuck."

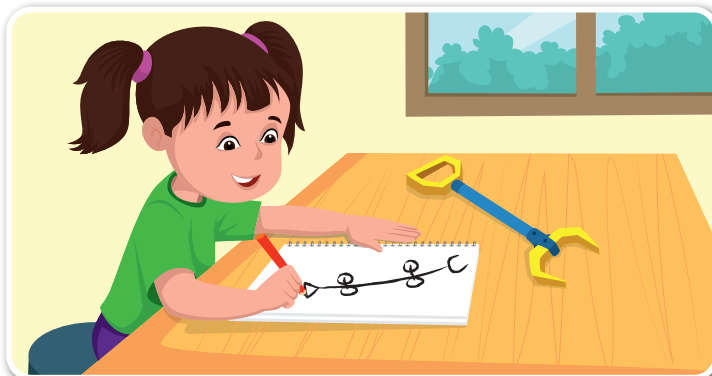
Page 51

Ask students to look at the images as you read aloud. Talk about why they think Inventor Kid is using a sketchbook.

I made this Handy Helper to pick things up.
Could I use it to save my car?



I might need to change it a bit.
If I add wheels and make it longer, it just might work!



51

LITERAL—Inventor Kid has needed to solve a problem before. What was it?
How did she solve it?

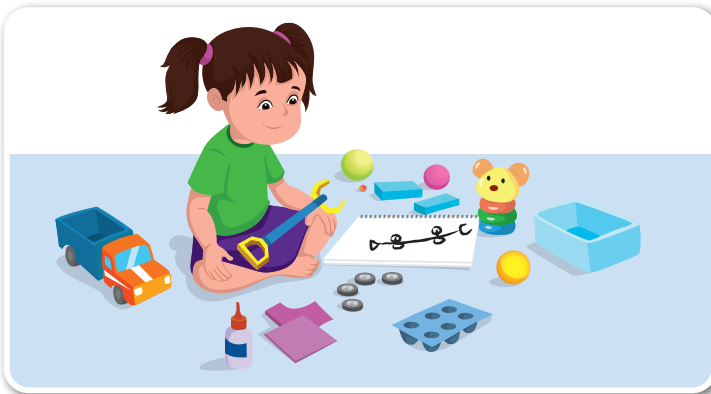
» She needed to pick things up, so she made a Handy Helper.

LITERAL—What is Inventor Kid going to do now?

» She is going to change the Handy Helper by adding wheels and making it longer.

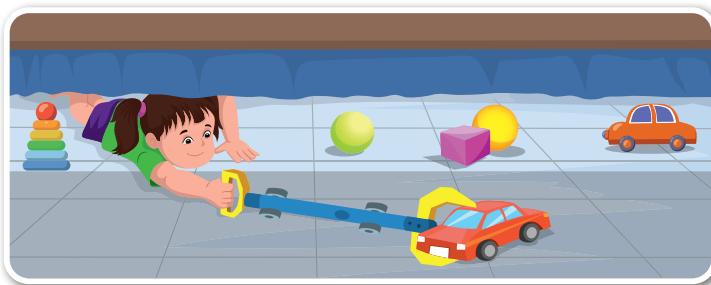
Ask students to look at the images as you read aloud. Talk about what they notice about the different materials that Inventor Kid has out. Guide students to discuss why they think there are so many different materials out.

Time to transform my Handy Helper into a Toy Rescuer!



It works!

This Toy Rescuer is a solution for the car stuck under my bed.



52

INFERENTIAL—What is a solution?

» A solution is an answer to a problem or something that fixes a problem.

INFERENTIAL—How do you think Inventor Kid went about making her new creation?

» I think she probably used different materials to try out different things.

INFERENTIAL—How did Inventor Kid know her new invention, the Toy Rescuer, would solve her problem?

» She tested it.

Ask students to look at the images as you read aloud. Talk about what they notice about the supplies and tools Inventor Kid is using. Ask students to think about why she has these different supplies.

My Reach-O-Matic can reach high places.
I wonder if it can also reach far underneath my bed.



By making it shorter and adding a claw, it might just do the trick!



53

LITERAL—Why is Inventor Kid making another invention?

» She is making another invention to see if it could also be a solution.

LITERAL—Look at the second image. Describe Inventor Kid's process. (Why is she not simply changing the Reach-O-Matic?)

» Inventor Kid is sketching her idea and making plans first before testing her invention.

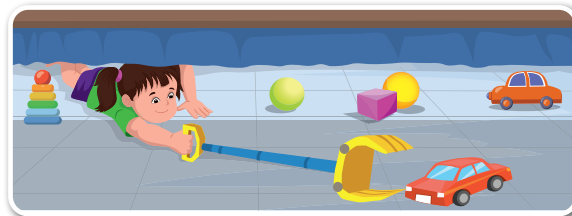
Point out that Inventor Kid went through certain steps. First, she came up with an idea. Then, she drew a sketch of her idea and made a plan.

Ask students to look at the images as you read aloud. Have them compare the images with the pictures on the previous page. Discuss how they are the same or different.

Let's try this new and improved Reach-O-Matic to solve the problem.



Oops! This version of the Reach-O-Matic didn't work to rescue the car.



That's OK. Sometimes, inventions don't work as planned. Time to think of another solution!



54

After looking at the second image, ask students the following question:

INFERENTIAL—How do you think Inventor Kid is feeling? Do you think adult scientists feel the same?

- » Sample answers: I think she is feeling frustrated but excited. I think adult scientists feel the same because they like solving problems.

After looking at the third image, ask students the following question:

INFERENTIAL—Now how do you think Inventor Kid is feeling?

- » She seems determined.

LITERAL—What did Inventor Kid learn about the Reach-O-Matic?

- » She learned that it didn't reach because it wasn't long enough and that she would have to think of another solution.

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

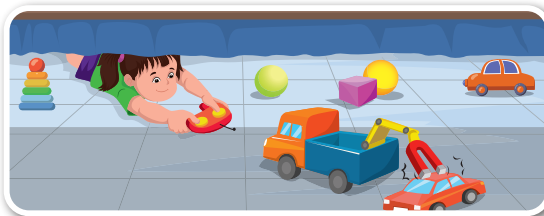
My remote-controlled truck zips around.
Could it solve my toy car problem?



Maybe if I add a magnetic attachment, the truck could save my toy car.



Hooray! The changes to my remote-controlled truck worked, too!
Inventor Kid saves the day!



Main Science Idea

People can design inventions to solve problems.

55

EVALUATIVE—What is the toy car problem?

- » that the car keeps getting stuck under the bed

INFERENTIAL—Review the chart. How many possible solutions worked? Why did Inventor Kid want more than one solution?

- » Two solutions worked. She might have wanted more than one solution in case one broke.

3. Check for understanding.

Activity Page



AP 9

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. Review the reading, and remind students that they can design solutions to problems.

Guide students through Activity Page 9, then discuss their invention plans. An invention that solves the problem needs to help a person with an itchy back both reach and scratch the itch.

See the Answer Key for sample or correct answers.

LESSON 10

Tulip Mystery

AT A GLANCE

Lesson Question

What makes evidence good?

Learning Objectives

- ✓ Select the more robust evidence for provided claims.
- ✓ Differentiate relevant from irrelevant details in an explanation.
- ✓ Differentiate verifiable information from unverifiable opinions in a provided scenario.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- detective activity

Main Science Idea

The strength of a claim depends on whether it is supported by good, strong evidence. If strong evidence does not support a claim, it is the claim that must change.

NGSS and CCSS References

SEP7. Engaging in Argument from Evidence:

In science, argument based on evidence is essential to identifying the best explanation for a natural phenomenon. Students and scientists are expected to use argumentation to listen, compare, and evaluate competing ideas and methods based on evidence.

RI.1.3. Key Ideas and Details: With prompting and support, describe the connection between two individuals, events, ideas or pieces of information.

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.

claim

evidence

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.

observation

opinion

Instructional Resources

Student Book



Ch. 10

Student Book, Chapter 10
“Tulip Mystery”

Activity Page



AP 10

Activity Page
Cookie Mystery (AP 10)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing
- image of a messy room
- cutouts for each student for Activity Page 10 (optional)

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 10 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Online Resources



Show students an image of a messy room. Ask students what they think happened and why. As they are sharing, restate their ideas using the words *claim* and *evidence*.

(See the Online Resources Guide for a link to a recommended video.

www.coreknowledge.org/cksci-online-resources)

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: What makes evidence good?

2. Read together: “Tulip Mystery.”

Student Book



Ch. 10

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 10 on page 56. Point out that the bottom edges of the pages of this chapter are all light blue. Tell students that the title of this chapter is “Tulip Mystery,” and tell them to pay special attention to the different things Kai thinks about as you read.

Read Aloud Support

Page 56

Ask students to look at the image as you read aloud. Talk about what they notice about the garden. Ask students what they think the garden might have looked like before and what might have happened.



LITERAL—What does Kai think happened to his tulips?

» He thinks that bugs ate the tulips.

Talk to students about the difference between opinion and fact. Opinions are ideas that we have about things. Facts are things that are definitely true for everyone.

INFERENTIAL—Why are facts important in science?

» Facts are important because they help us figure out what is true or not true.

LITERAL—Ask students to help you keep a list of **claims** and **evidence** on the board. Write or make simple drawings. Add Kai's claim to the list, and have students examine the picture and try to explain why Kai thinks bugs ate the tulips.

Page 57

Ask students to look at the image as you read aloud. Talk about what they think Kai and his friend may be looking for.



EVALUATIVE—What is a claim?

- » It is an idea, explanation, or statement about why something happened.

Call attention to Kai's idea that bugs ate the tulips. In science, we make claims when we are trying to explain or describe how or why something happened.

LITERAL—What evidence do they have?

- » There are holes where the tulip bulbs had been planted.

EVALUATIVE—Why does Kai say the evidence doesn't support his claim?

- » He says this because he doesn't think bugs could create large holes or carry away entire tulip bulbs.

Point out that evidence is still good evidence if it is a valid observation that is true. If true information doesn't support a claim, it is the claim that has to change. Add Kai and Maya's evidence and observations to the list. Optionally, draw a line through the claim about bugs.

Page 58

Ask students to look at the image as you read aloud. Talk about what they notice about what Kai and Maya are observing.

Kai made a new claim.

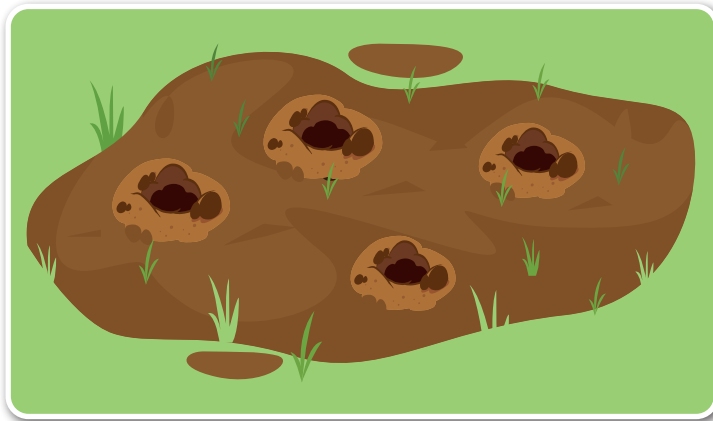
"I think rabbits are eating my tulips!"

Maya asked, "What evidence do you have?"

Kai pointed at the holes in the soil.

"Look at these holes!" he replied.

"Everyone knows rabbits love to nibble on things in gardens. They must have dug up my tulip bulbs!"



58

Before reading, ask students:

EVALUATIVE—Make a claim about what happened to the tulips. Explain your idea.

- » Sample answer: I think that a dog is eating the tulips. I think this because dogs dig holes and there are holes in the ground.

LITERAL—Why does Kai think that rabbits are eating the tulips?

- » He thinks this because rabbits are known to eat things in gardens and dig things up.

EVALUATIVE—Compare Kai’s claim to your own. Which one is better supported by the evidence?

- » Sample answer: I think dogs dug up the garden, and Kai thinks that rabbits did. I think my claim is better supported by the evidence because dogs are really good at digging holes.

Add the new claim about rabbits to the list.

Page 59

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



LITERAL—What new evidence did they find?

- » They found soil on top of the fence with some tulip stems.

EVALUATIVE—Does the evidence support the claim that a rabbit ate the tulips? Why or why not?

- » The evidence does not support the claim. This is because rabbit paws aren’t the right shape to climb fences, so rabbits can’t climb fences, and something climbed to the top of the fence with the tulip bulbs.

INFERENTIAL—Could you make a claim supported by evidence right now? What other evidence could you look for?

- » I could not make a claim. All I could say is that rabbits didn't do it. I would look for evidence that shows what took the tulip bulbs.

Add the new evidence and their observations to the list. Optionally, draw a line through the claim about rabbits.

Page 60

Ask students to look at the image as you read aloud. Talk about how Kai and Maya are thinking about the evidence they have collected. Ask them what they think the light bulb means.



Kai and Maya thought carefully about all the evidence. "Hmm," Maya said. "What other creatures around here can climb?"

Kai exclaimed, "I've seen squirrels climb really well!"

A spark lit up Maya's eyes.

"You're right! Think about squirrel paws.

They are built for climbing *and* digging!"

INFERENTIAL—What new claim do you think Kai is going to make?

- » I think Kai is going to claim the squirrels took the tulips.

LITERAL—What new evidence supports his new claim?

- » Squirrel paws are built for climbing and digging.

Add the new claim and evidence about squirrels to the list.

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

Kai made one more claim about his backyard mystery.

“Squirrels are eating my tulips!”

Kai and Maya spotted some squirrels playing nearby.

All the evidence put together supported Kai’s claim this time.

Squirrels had been the problem all along!



Main Science Idea

Good evidence comes from facts. Strong evidence can help us see when we are wrong and make us change our minds about things.

61

Review the list of evidence with students.

Have students turn to a neighbor and pair-share ideas about whether or not the evidence supports Kai’s claim that squirrels took the tulips.

INFERENTIAL—Do you agree with Kai’s claim? Why or why not?

- » Yes, I think that squirrels took the tulips. I think this because he saw holes in the ground and saw that something climbed the fence. Squirrels can climb and dig but rabbits cannot.

3. Check for understanding.

Activity Page



AP 10

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. Remind students about what makes evidence good or useful.

Distribute Activity Page 10. Tell students you have gotten statements from different eyewitnesses about a missing cookie. It is their job to think about the evidence and make a claim about who took the last cookie. Read each clue one at a time, and give students time to refer to the pictures of the suspects and circle names for each clue.

See the Answer Key for sample or correct answers.

Science Information

AT A GLANCE

Lesson Question

How can we find information in different places in science material?

Learning Objectives

- ✓ Answer questions using information from text features, including headings, diagrams, tables, icons, and definitions.
- ✓ Identify nonprint media that can serve as sources of scientific information.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- library field trip

Main Science Idea

Learning about science often includes reading, looking at pictures, and putting together information from different places.

NGSS and CCSS References

SEP8. Obtaining, Evaluating, and Communicating Information: Information can come in a variety of forms—tables, diagrams, graphs, models, as well as orally or written. Scientists obtain information which they use to evaluate claims and in turn communicate their own scientific explanations.

RS.1.5. Craft and Structure: Know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) to locate key facts or information 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.

diagram

resource

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.

caption **header** **information**

Instructional Resources

Student Book



Ch. 11

Student Book, Chapter 11
"Science Information"

Activity Page



AP 11

Activity Page
Finding Information (AP 11)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing
- Arrange with librarian for a class visit to the library, or prepare informational resources for the classroom.

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 11 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Online Resources



Watch the short video titled "How to Make a Rainbow." After students watch, hold a short discussion about the things the presenter/teacher did to help them learn. For example, she talked about rainbows, showed pictures, and had an activity. Ask students to describe things that helped them learn and where else they might go in order to find out more about rainbows. In this chapter, they will follow a fellow student who is hoping to learn more about rainbows, too. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: How can we find information in different places in science material?

2. Read together: “Science Information.”

Student Book



Ch. 11

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 11 on page 62. Point out that the bottom edges of the pages of this chapter are all red. Tell students that the title of this chapter is “Science Information,” and tell them to pay special attention to the different places the student finds scientific information as you read.

Read Aloud Support

Page 62

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

CHAPTER
11

Science Information

Max is a boy who loves science.
He also loves to visit the school library.
He spots a rainbow poster on the library wall.
April has arrived.
Rainy days bring colorful surprises . . . like rainbows!
Ms. Parker, the librarian, invites Max to a special learning station all about rainbows.

62

INFERENTIAL—What other things might Max learn about at the library? How would he learn these new things?

- » He could learn about lots of different topics, like animals that live nearby or the weather. He could use computers, read books, or talk to librarians there.

LITERAL—Where in the library can Max find information about rainbows?

- » He saw a rainbow poster, and there is a learning station about rainbows there.

Point out that the poster and learning station can help Max learn more about rainbows. They are **resources** for learning about rainbows.

SUPPORT—Spend a few moments looking around the classroom. Have students point out different resources that may be present in the classroom such as the teacher, a computer, textbooks and workbooks, and posters.

Page 63

Ask students to look at the image as you read aloud. Talk about what they notice about the image. Ask students to pair-share with a neighbor about what they know about rainbows. Ask a few to share how they learned this information.

Max gets a close look at the poster.
It shows a rainbow stretching from the trees to the sky.
He sees that the colors are next to one another.
Max reads the poster's caption to learn about rainbows.



A rainbow is a beautiful and colorful arch that appears in the sky after it rains. It happens when light from the sun shines through and bounces off raindrops in the air. Rainbows have different colors, including red, orange, yellow, green, blue, indigo, and violet.

LITERAL—Describe the parts of the poster that help Max learn.

» the picture, the title, and the writing

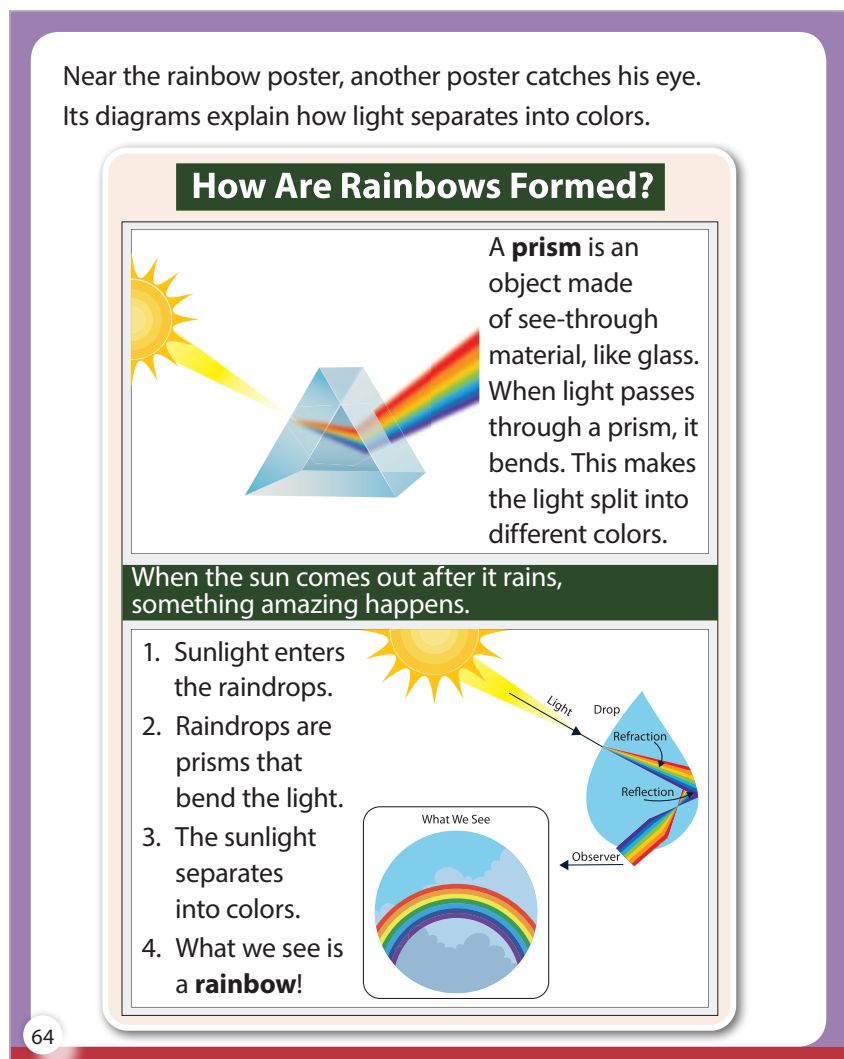
Call attention to the different parts of the poster. Point out the picture, the writing (use the word *caption*), and the title (*header*).

LITERAL—What did Max learn about rainbows from the poster?

» Max learned how rainbows are formed and the colors of the rainbow.

Page 64

Ask students to look at the image as you read aloud. Talk about what they notice about the new poster and its different parts.



Before reading the text, ask students to answer the following question:

LITERAL—What is this poster about? How do you know?

» It is about how rainbows are formed. I know this because of the header.

Point out the header, bold words, and **diagram**. These are parts of the poster that help tell us important information.

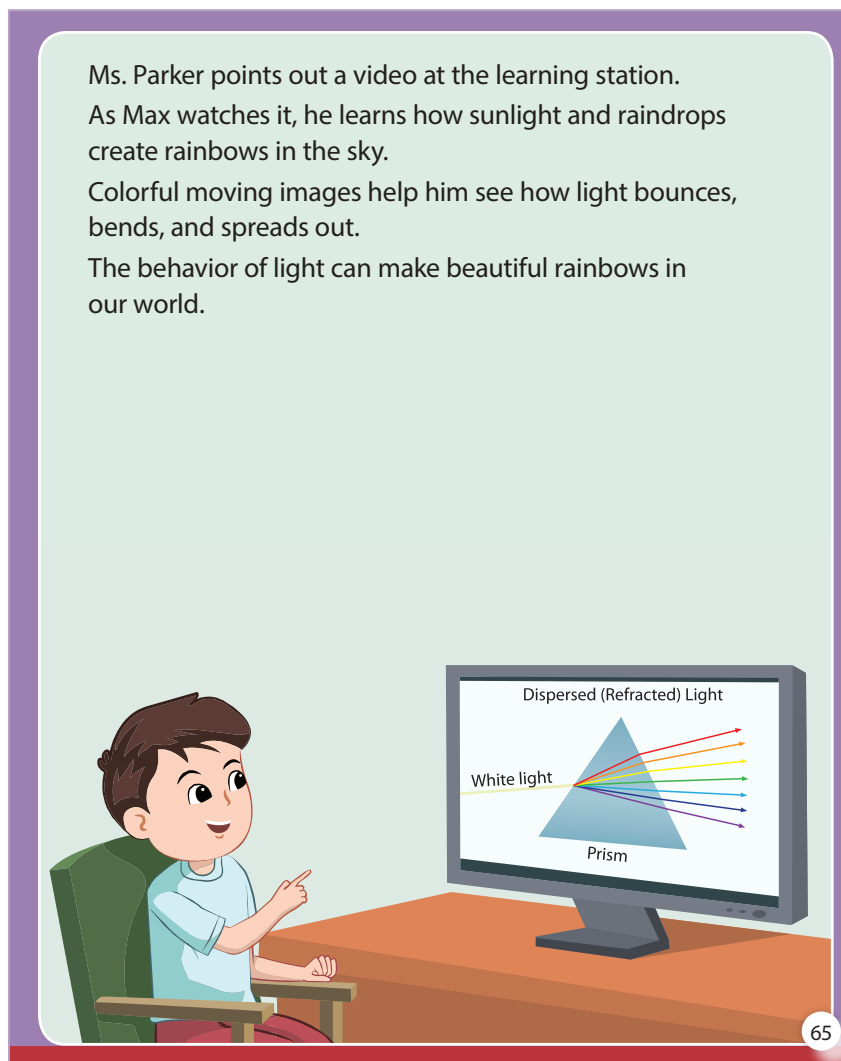
LITERAL—What did Max learn about the formation of rainbows after looking at this picture?

» He learned what a prism is and the steps to how a rainbow is formed.

ALERT—Remind students that the purpose of this chapter is not the science content itself (i.e., how rainbows are made). Instead, it is how we can use print materials like posters to learn about science.

Page 65

Ask students to look at the image as you read aloud. Talk about what they notice about the video Max is now watching. Ask students to describe how and what they have learned from videos before.



LITERAL—What is Max learning about while watching the video?

» He is learning about rainbows and how light bends to create colors.

INFERENTIAL—What are some other ways that Max might find out more about rainbows while at the library?

» He can talk to someone, read books, or look up information on a computer.

Ask students to look at the image as you read aloud. Talk about what they notice about what is happening in the image. How do they think Max is learning now?

Max still has one question.

He knows he can ask Ms. Parker.

"Why does a rainbow make a curved shape instead of a straight line?"

Ms. Parker smiles.

"That's a great question, Max!" she replies.

"The sun hits the water droplets in the air at different angles, from low in the air to high in the air."



LITERAL—How is Max learning about rainbows now?

» He is talking to Ms. Parker about them.

LITERAL—When have you talked to someone and learned something? Whom did you talk to, and what did you learn?

» Sample answers: I talked to teachers, librarians, friends or other adults. I learned about how to play soccer, how to make a sandwich, how to swim.

INFERENTIAL—Study the picture. How else can Max learn while at the library?

» He can read books and use the other resources.

Ask students to look at the image as you read aloud. Talk about what Max might be thinking about.

Max got details about rainbows from different places today.

- He learned from posters with words and photos.
- The posters had titles and drawings, too.
- Max got information from a video.
- He listened to the narrator speaking in the video.
- He also got information from Ms. Parker.

Max put all the pieces of information together.

Now he understands much more about rainbows than he did before!



Main Science Idea

Information can come from printed words, pictures, and voices that we hear. Pictures can be diagrams, photos, or icons. We put all the information together to understand new things.

67

Ask students the following question:

EVALUATIVE—Do you think that Max can be a resource on rainbows? Why or why not?

- » Yes. He has learned a lot about rainbows in different ways. He can put the information together to better understand rainbows and now can teach other people.

3. Check for understanding.

Activity Page



AP 11

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. You might choose to schedule a library visit to encourage students to find features such as titles, headers, illustrations, and labels in a variety of materials.

Wrap up with Activity Page 11.

See the Answer Key for sample or correct answers.

Learning from Patterns

AT A GLANCE

Lesson Question

What can we learn from observing patterns?

Learning Objective

- ✓ Draw useful conclusions from observation of provided patterns.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- patterns scavenger hunt

Main Science Idea

Observing patterns and noting sequences within a pattern leads to making a prediction about something.

NGSS and CCSS References

CCC1. Patterns: Patterns can be observed, used to describe phenomena, and used as evidence in scientific explanations. Patterns help connect experiences with phenomena.

RI.1.7. Integration of Knowledge and Ideas: Use the illustrations and details in a text to describe its key ideas.

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.

pattern **prediction**

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.

observation

Instructional Resources

Student Book



Ch. 12

Student Book, Chapter 12
“Learning from Patterns”

Activity Page



AP 12

Activity Page
Spotting Patterns (AP 12)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 12 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Online Resources



Watch the short time-lapse videos of a year in a forest and day-night over a farm. At the end of each video, ask students to think about what might happen later. What might happen the next day or next year? How do they know? (See the Online Resources Guide for a link to the recommended videos. www.coreknowledge.org/cksci-online-resources)

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: What can we learn from observing patterns?

2. Read together: “Learning from Patterns.”

Student Book



Ch. 12

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 12 on page 68. Point out that the bottom edges of the pages of this chapter are all dark blue. Tell students that the title of this chapter is “Learning from Patterns,” and tell them to pay special attention to how things repeat as you read.

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

CHAPTER
12

Learning from Patterns

Have you ever noticed the spots on a ladybug's back? The spots are arranged in a pattern on the bug's body. One side of the bug's body is a mirror image of the other. That's a pattern.



When things repeat or happen in the same way over and over again, that's a pattern. What repeats in this pattern?

●
■
▲
●
■
▲

68

LITERAL—What is a **pattern**?

» A pattern is something that repeats the same way over and over again.

Have students turn to a neighbor and pair-share their ideas about the following questions:

EVALUATIVE—Look at the picture with the shapes. What repeats in the pattern?

» The pattern that repeats is circle, square, then triangle.

INFERENTIAL—What other patterns can you think of? How do you know they are patterns?

» Possible answer: Day and night are a pattern, and so is the way I make my bed. I know these are patterns because they happen the same way every time.

Ask students to look at the images as you read aloud. Have them decide whether or not these are examples of patterns. Tell students to explain their answers.

Patterns can be found all over nature.
You can find patterns by looking at plants and animals. You can find some patterns by listening.

Parts arranged in circles, around and around

Dark stripe then light stripe, over and over

Yellow outlines around brown spots, from bottom to top

TAP, TAP, TAP, TAP, TAP!!!

CROAK! (Then a quiet pause) CROAK! (Then quiet)

When we notice a pattern, we can figure out what will come next. Patterns helps scientists understand things better and make predictions.

Have students review the images as you restate the sentence “When we notice a pattern, we can figure out what will come next.”

EVALUATIVE—What might come next in each image (in another flower, in another giraffe, or the next time the woodpecker pecks)?

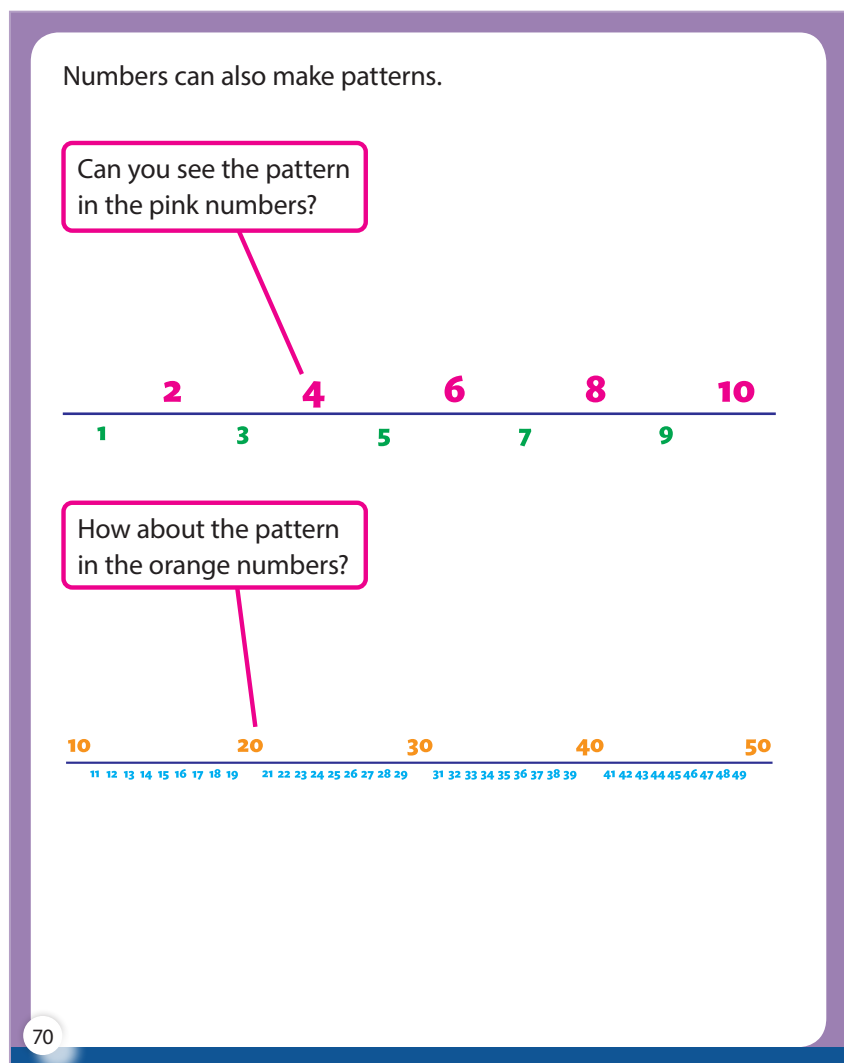
- » I think the next flower will have lots of circles, the next giraffe will have brown spots, and the woodpecker will go “TAP, TAP, TAP, TAP, TAP” again.

Point out that when they are thinking about and saying what they think might come next, they are making **predictions**.

LITERAL—Why is noticing patterns important to scientists?

- » Patterns can help them understand things better and make predictions.

Ask students to look at the image as you read aloud. Talk about if they notice a pattern in the image.



Ask students to respond to and expand on the prompts in the text.

LITERAL—What pattern do you see in the pink numbers?

» I see that it skip counts by 2.

LITERAL—What pattern do you see in the orange numbers?

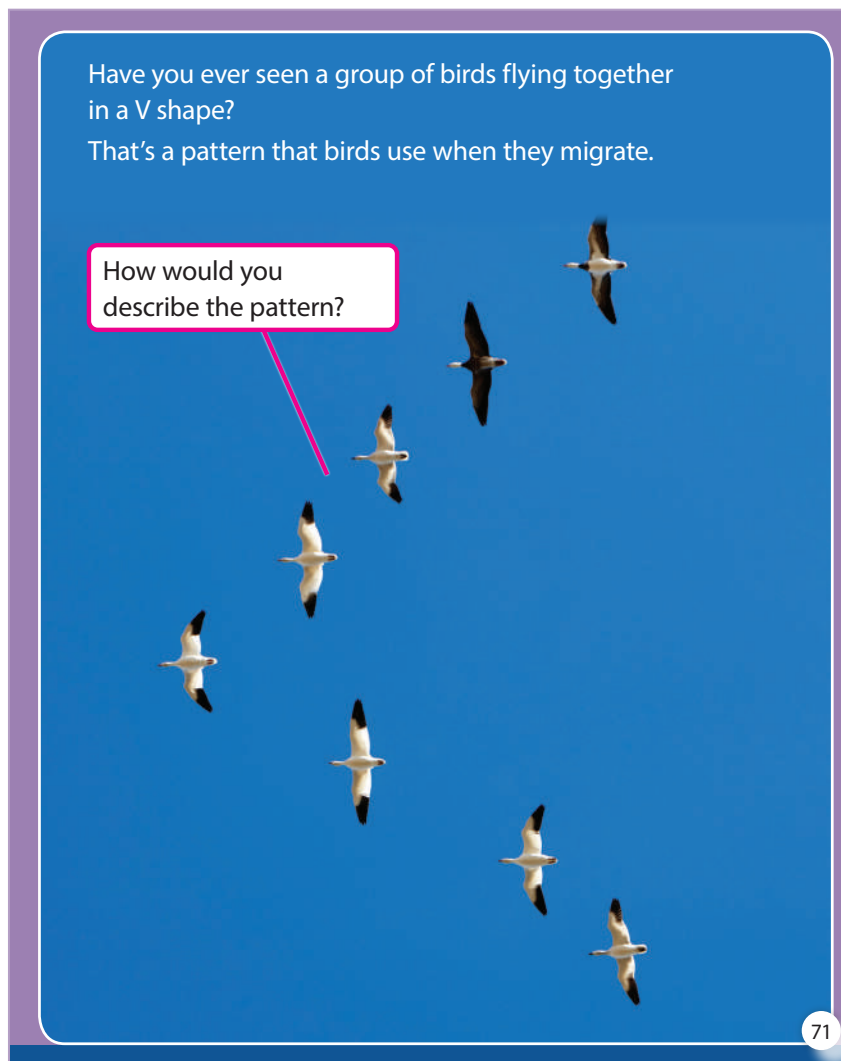
» I see that it skip counts by 10.

EVALUATE—What other patterns can you come up with by using a number line?

» Possible answer: You can skip count by 5.

SUPPORT—There are many patterns in numbers! Project or hand out hundreds boards for students to explore for patterns. For example, columns always have the same number in the ones spot.

Ask students to look at the image as you read aloud. Talk about what they notice about the shape the birds are flying in.



Pair-share with a partner about the following question:

LITERAL—What are some different ways you can describe the pattern of the birds flying?

- » I see a V shape. I see that the birds in the back are farther from the center of the V.

Online Resources



EXTEND—Students may be interested in why this pattern helps birds when they migrate. Help students learn more about migration by watching videos. (See the Online Resources Guide for a link to the recommended videos.)

www.coreknowledge.org/cksci-online-resources

INFERENTIAL—Migration is when animals leave their current home and move to another place. What other patterns in animal behavior can you think of?

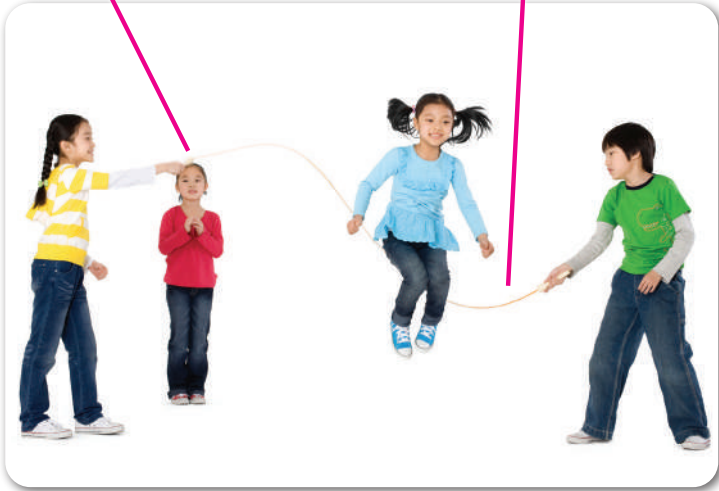
- » One example is the time of day that animals eat and sleep. Some animals are awake at night and sleep during the day. Some animals howl when they are hunting.

Ask students to look at the image as you read aloud. Have students talk about any patterns they notice when they imagine themselves jumping rope.

Humans follow patterns, too.

The watchers keep the rhythm.
CLAP, CLAP, CLAP!!!

The jump rope makes a sound each time it hits the ground.
SNAP, SNAP, SNAP!!!



How does the pattern help the jumper?
Can you think of a pattern that helps you do something?

72

Ask students the following questions:

LITERAL—What are the patterns described in the text?

- » the sound of the jump rope hitting the ground and the clapping of the people watching

EVALUATIVE—How do these patterns help you?

- » They help me know what to expect (make predictions) and how something works.

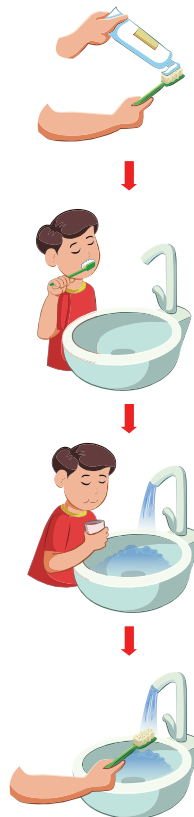
Ask students to look at the image as you read aloud. Talk about what they notice about the way they carry out the familiar practice of brushing their teeth.

Think about an activity you do every day,
like brushing your teeth.

You follow a pattern of steps.

The steps happen in the same order every
time you brush.

1. What do you do first?
2. What do you do next?
3. What do you do after that?
4. How do you finish the task?



Main Science Idea

Noticing and studying patterns can help you figure things out.

73

LITERAL—What pattern do you see in the routine??

- » The pattern shows how to brush your teeth. The steps are in order from beginning to end.

EVALUATIVE—Why are knowing and using patterns helpful to us?

- » They are helpful because they help us know what to expect (predictions) and what to do next.

3. Check for understanding.

Activity Page



AP 12

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms.

Use Activity Page 12 to assess students' ability to identify patterns. This can be done as a whole-class activity or as an individual activity.

See the Answer Key for sample or correct answers.

Demi's Difficult Day

AT A GLANCE

Lesson Question

How can understanding causes and effects help with solving problems?

Learning Objectives

- ✓ Explain how identifying the causes of given problems contributes to solving the problems.
- ✓ Evaluate scenarios to spot likely problem outcomes and propose measures to prevent the problem outcomes.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration

Main Science Idea

Understanding causes and effects of a phenomenon lets people understand ways to solve a problem.

NGSS and CCSS References

CCC2. Cause and Effect: Scientific Investigations aim to determine causes of effects (scientific phenomena). Searching for the causes is often the impetus for scientific exploration.

RI.1.1. Key Ideas and Details: 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

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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.

cause effect problem solution

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.

observation

Instructional Resources

Student Book



Ch. 13

Student Book, Chapter 13
“Demi’s Difficult Day”

Activity Page



AP 13

Activity Page
Cause, Effect, Problem, and
Solution (AP 13)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 13 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Online Resources



Have students watch the video on the Apollo 13 mission. Hold a discussion with students, focusing on the different problems that the astronauts faced and the solutions that they came up with. Tell students that in this chapter, they will be thinking like scientists about problems, what caused them, and how to solve these problems and prevent them from happening again. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: How can understanding causes and effects help with solving problems?

2. Read together: “Demi’s Difficult Day.”

Student Book



Ch. 13

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 13 on page 74. Point out that the bottom edges of the pages of this chapter are all dark purple. Tell students that the

title of this chapter is “Demi’s Difficult Day,” and tell them to pay special attention to the different problems as you read.

Read Aloud Support

Page 74

Ask students to look at the image as you read aloud. Talk about what they notice about the girl’s expression. How might she be feeling? Why?

CHAPTER 13

Demi’s Difficult Day

Demi’s bathtub won’t drain.
What causes this problem?
Something must be clogging the drain.
Demi is a curious kid.
She loves to figure things out.
Demi needs to find the cause so she can fix it.
She reaches her hand into the bathwater.
A sponge toy is stuck in the drain.
That’s the cause of the problem!
Demi pulls out the toy, and the water drains.



74

LITERAL—What was the **problem**? What was the **cause** of the problem?

- » The problem was that the bathtub wouldn’t drain because a sponge toy was stuck in the drain.

LITERAL—How did Demi figure out what was causing the problem?

- » She reached into the bathwater and looked around.

LITERAL—What was the **solution** to her problem (how did she solve it)?

- » She pulled out the toy, and water went down the drain.

Emphasize how Demi had a *problem*, identified the *cause*, and then found a *solution*.

Ask students to look at the image as you read aloud. Talk about what they notice about Demi. Why might she be upset?

Oh no!

Next, Demi sees milk has spilled all over the table and floor.

It's easy enough to clean up the milk.

But Demi is already thinking about the cause of the spill.

What made it happen?

The table tilts when she leans on it.

The wobbly table is the cause of the spill.



INFERENTIAL—How would you describe a problem to someone else?

- » I would tell someone that a problem is something that needs to be fixed or solved.

LITERAL—How is Demi going to solve her spilled milk problem?

- » She is going to clean up the milk.

Point out that this is a solution; it fixes the problem.

LITERAL—What was the cause of the spilled milk problem?

- » The table was wobbly.

Call attention to the difference in meaning between *problem*, *solution*, and *cause*.

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

Demi's bike has a flat tire.
There are so many problems to solve today!
What is the cause of the flat tire?
The tire has a nail in it.
This problem is a little harder to fix.
Demi will need the help of a grown-up.
But she knows what caused the problem.



LITERAL—Demi has another problem! What is it?

» Her bike has a flat tire.

LITERAL—What caused it?

» The tire has a nail in it. The nail made the tire go flat.

INFERENTIAL—Why is it important to know the cause of a problem?

» Now Demi knows how to fix the problem (the flat tire) and keep it from happening again.

Ask students to look at the image as you read aloud. Talk about what they notice about what Demi is doing. Does it help her solve her flat tire problem?

Demi is experiencing causes and effects today!
 Knowing the causes of things can be helpful.
 Spotting something that could cause a problem can help us keep the effect from happening.
 Demi notices nails on the driveway.
 Nails caused her flat bike tire!
 She uses a magnet to collect the nails before Mom gets home.
 Now Mom's car won't get a flat tire.



77

INFERENTIAL—What is a cause? What is an **effect**?

- » A cause explains why something happens. An effect is something that happens as a result of the cause. It is a description of what happened.

EVALUATIVE—Why is spotting a cause before an effect happens helpful?

- » It is helpful because you can keep bad things from happening or tell if the effect will be good.

INFERENTIAL—Demi saw a possible cause and a possible effect. Can you think of a time when you *wanted* an effect to happen? How could you cause it to happen?

- » Sample answer: My mom said I could watch TV if I cleaned my room. So, I cleaned my room (the cause) so I could watch TV (the effect).

Ask students to look at the image as you read aloud. Talk about what they notice about Demi's expression. Why do you think she's feeling this way?

Demi thinks about other difficult parts of her day.
She knows what caused her problems.
Now she can change the outcomes for tomorrow.
The next time Demi takes a bath, she will take her toys out of the tub.
That way, the drain won't get plugged.



LITERAL—What were the difficult parts of her day?

- » The tub would not drain, the milk spilled, and her bike had a flat tire.

EVALUATIVE—How could she avoid the spilled milk problem or flat bike tire problem in the future?

- » She needs to know the causes of them. She knows the table is wobbly, so she shouldn't put milk on it. She knows that if she sees nails on the ground, then she should avoid them while riding her bike.

EVALUATIVE—Why is knowing the possible effects helpful?

- » It can help us avoid or get possible effects.

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

The next time Demi puts a glass on the wobbly table, she won't put it near the edge.

Better yet, until she can figure out the cause of the wobble, she will put her glass on the counter where it won't spill.

Now to investigate the wobbly table!

- What is the cause?
- What is the effect?
- How is that a problem?

How can knowing the cause of the problem help Demi fix it?



Main Science Idea

Understanding causes and their effects can help with solving problems.

79

Suppose that after investigating, Demi found that the tip of one of the table legs had fallen off.

EVALUATIVE—Identify the cause, effect, problem, and possible solution.

- » The cause is the broken table leg. The effect is the wobbly table. The problem is the spilled milk. The solution is to fix the table leg.

3. Check for understanding.

Activity Page



AP 13

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. Facilitate Activity Page 13. It is helpful to walk the students through the first line, which is completed for them. Then do the second line together.

See the Answer Key for sample or correct answers.

Counting Quantities

AT A GLANCE

Lesson Question

When is counting quantities useful?

Learning Objectives

- ✓ Evaluate the importance of knowing a specific quantity of something.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- ranking exercise

Main Science Idea

Knowing quantities in science is helpful. It is not always important to know the exact numbers of things, though.

NGSS and CCSS References

CCC3. Scale, Proportion, and Quantity:

Scale, proportion, and quantity are essential considerations when deciding how to model a phenomenon. Mathematics is essential in both science and engineering.

RI.K.1. Key Ideas and Details: With prompting and support, ask and answer questions about key details in a text. (Also **SEP3**, **RI.K.10**, **L.1.4.A**, and **L.K.1.d**)

CCSS.Math.Content.1.NBT.A.1. Extend the counting sequence.

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.

amount **quantity** **useful**

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.

count **exact**

Instructional Resources

Student Book



Ch. 14

Student Book, Chapter 14
"Counting Quantities"

Activity Page



AP 14

Activity Page
Quantities (AP 14)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 14 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Ask students to share anything they counted today. Some may talk about counting the number of carrots they got in their lunch or counting the number of pieces of paper each student received. Talk about why sometimes it is important to know the exact amount of something, for example, to make sure that everyone gets the same amount.

Online Resources



Show students a video of the nursery rhyme "Five Little Ducks." Then discuss why sometimes it is really important to be able to count. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: When is counting quantities useful?

2. Read together: "Counting Quantities."

Student Book



Ch. 14

While some advanced students may be able to read words on a given page of the Student Book, as a 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 14 on page 80. Point out that the bottom edges of the pages of this chapter are all orange. Tell students that the title of this chapter is "Counting Quantities," and tell them to pay special attention to how and why things are counted.

Ask students to look at the images as you read aloud. Ask them to think about times they have seen different numbers of wild animals.

CHAPTER
14

Counting Quantities

Counting is something we do every day.
The number of something is its quantity.
You can compare quantities.



How many prairie dogs do you count? Are there more prairie dogs or alligators?

80

INFERENTIAL—Why might it be important to know how many prairie dogs and alligators there are?

» If one is missing, you know how many are left.

EVALUATIVE—Is it always important to know how many of something there are?

» No, it might not matter exactly how many things there are.

SUPPORT—Talk about the words **quantity** and **amount**. Count the number of students in the room, and explain that the total number is the quantity. Explain that the words *quantity* and *amount* mean basically the same thing, the total number. *Amount* is often used with uncountable nouns, such as paper or water. *Quantity* is more often used with countable nouns, such as pieces of paper or cups of water.

Ask students to look at the pictures as you read aloud. Ask them to think about when counting is **useful** and when it is not.

Counting things can be useful.

A farmer counts the baby chicks.

She needs to know how many hatched.

There are two baby chicks!

All the chicks need to eat.

Counting chicks tells the farmer how much food to buy.

Counting helps the farmer, and the chicks get fed!



Not everything needs to be counted, though.

Counting how many spots are on the puppies doesn't matter too much.

But you can notice one puppy has more spots than another. It can help you tell them apart.

81

INFERENTIAL—Describe a time when counting was very important to you.

- » Answers will vary but may include sharing to make sure something is fairly distributed or keeping score in a game.

INFERENTIAL—Describe a time when counting was not very important.

- » It is not important to know how many blades of grass or insects there are.

SUPPORT—Discuss common examples of times when it is important to count something. For example, sometimes it is important to find out how many plants need to be planted or how many birds are showing signs of illness. Reinforce the idea that counting provides important data for studying a particular problem or issue.

Ask students to look at the images as you read aloud. Ask them to think about when it is important to know exact quantities.



A young baker makes cookies.
 She must count how many cups of flour to add to the bowl.
 She must use the correct amount of flour.
 Adding more or less of an ingredient affects how a food turns out.
 Quantities matter in baking recipes.

A scientist who is mixing chemicals must count.
 The quantity of one chemical must be exact.
 The quantity of another must be exact, too.
 Counting is not only helpful, but it also can be necessary.



82

LITERAL—Explain why exact amounts are necessary in the examples on the page.

- » The recipe or experiment won't turn out right if the correct quantities are not used.

INFERENTIAL—Describe a time when you had to measure ingredients.

- » Answers will vary but likely will involve following a recipe.

Know the Standards

TEACHER DEVELOPMENT

CCC3. Scale, Proportion, and Quantity Crosscutting concepts apply across all domains of science and in other disciplines as well. Mathematics—including scale, proportion, and quantity—is essential in most fields, such as science, engineering, social studies, physical education, and health. In this lesson, students encounter different examples of when knowing quantities is important for scientific understanding and inquiry.

Ask students to look at the image as you read aloud. Ask them to think about how much water a plant needs.

To care for a plant, you must figure out how much water it needs.

You can count the number of days that you water a plant in a week.

You can keep track of the amount of water you pour over the plant.

This will help you make sure the plant gets enough water and not too much.



You could also count how many leaves grow on your plant. But is knowing that quantity useful for keeping the plant alive?

83

INFERENTIAL—Is it important to measure an exact amount of water to help a plant grow?

» No, you just want to make sure the soil is wet and the plant is healthy.

INFERENTIAL—What would happen if the plant got too much or not enough water?

» It would not grow or be healthy and might die.

EVALUATIVE—Do all plants need the same amount of water?

» No, it depends on how dry the room is and what type of plant it is.

Ask students to look at the image as you read aloud. Have them think about why it might be important to know the exact number of certain animals.

Scientists pay attention to quantities.
They count and measure everything they study.
Elephants are an endangered species.
That means the number of living elephants is getting too low.
There could end up being no elephants at all.
Keeping track of the number of elephants is important.
It lets scientists know if things people do to protect elephants are helping.
It's hard to know the exact quantity of elephants, though.
They move around over vast areas



84

LITERAL—Why are scientists counting the number of elephants on this page?

- » The elephants are endangered, so the scientists want to know if the population is growing, getting smaller, or staying the same.

INFERENTIAL—Why can it be difficult to count wild animals?

- » If animals move around, you have to make sure that you are not counting the same animals twice.

CHALLENGE—Challenge students to make a list of endangered animals and present their findings to the class. Explain that counting animals is a way of determining that a species is endangered.

Ask students to look at the image as you read aloud. Have them think about all the ways scientists are counting.

This is an elephant nursery.
 The keepers care for orphaned elephants.
 The keepers count the elephants.
 They know exactly how many young elephants they need to feed.
 They know exactly how much food they feed each one.
 They keep track of how much the elephants grow.
 When the elephants have grown enough, they can survive on their own.
 They will go into the wild again.
 Saving the lives of elephants involves knowing how to count.



Main Science Idea

Knowing quantities in science is helpful. It is not always important to know the exact numbers of things, though.

85

LITERAL—What do the scientists count in this example?

- » the number of elephants, how much food they need, how much the elephants are growing

3. Check for understanding.

Activity Page



AP 14

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. Knowing quantities in science is helpful. It is not always important to know the exact numbers of things, though.

After students complete Activity Page 14, discuss examples they can offer about times when counting an exact quantity matters and when exact quantities are unimportant.

See the Answer Key for sample or correct answers.

Systems Art Show

AT A GLANCE

Lesson Question

What are some examples of systems?

Learning Objectives

- ✓ Identify parts of provided system examples.
- ✓ Describe roles given parts play in the working of given system examples.
- ✓ Summarize causes and effects within given system examples.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- identification exercise

Main Science Idea

Things that work together and affect each other form a system. There are many kinds of systems.

NGSS and CCSS References

CCC4. Systems and System Models: Systems and system models are used by scientists and engineers to investigate natural and designed systems.

RI.K.1. Key Ideas and Details: With prompting and support, ask and answer questions about key details in a text. (Also **RI.K.10**, **L.1.4.A**, and **L.K.1.d**)

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parts **system**

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.

aquarium

terrarium

Instructional Resources

Student Book



Ch. 15

Student Book, Chapter 15
"Systems Art Show"

Activity Page



AP 15

Activity Page
System Parts (AP 15)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 15 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Online Resources



Show students a video about a bird habitat, such as that of bald eagles. Then discuss what a bald eagle needs to survive, including trees, water, and food. Explain that bald eagles are part of a system in nature, a group of things that work together to perform a function. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: What are some examples of systems?

2. Read together: "Systems Art Show."

Student Book



Ch. 15

While some advanced students may be able to read words on a given page of the Student Book, as a 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.

Know the Science

TEACHER DEVELOPMENT

Systems can be both natural and designed. The chapter exposes students to examples of both.

Guide students to open their books to Chapter 15 on page 86. Point out that the top edges of the pages of this chapter are all green. Tell students that the title of this chapter is “Systems Art Show,” and tell them to pay special attention to how the parts work together in each system.

Read Aloud Support

Page 86

Ask students to look at the image as you read aloud. Ask them to think about what the word **system** means.

CHAPTER
15

Systems Art Show

STUDENT ART SHOW

WELCOME to the student art show!
You can see pictures that students worked on during the year.

The theme of this year’s art show is systems. Each picture in the gallery is about a system. What is a system? A system is a set of parts that work together. The parts affect each other.

ENJOY THE SHOW!

See what systems and their parts you can find along the way!



86

LITERAL—What does the word *system* mean?

» a group of parts that work together

INFERENTIAL—What kinds of systems can you think of?

» Possible answers: a heating system, a plumbing system, a computer system, weather system

INFERENTIAL—Why would a school have an art show about systems?

- » to learn about systems, to have a topic for artwork, to show what students learned about systems

SUPPORT—Talk about the word *system*, which is a group of things that work together. Talk about a familiar board game, and together identify the **parts** of the game, such as game board, cards, spinner, and pawns.

Page 87

Ask students to look at the picture as you read aloud. Ask them to think about plant systems.



Theo Milbury

Blooms

Crayons on Paper

This drawing shows a plant with its flower. The artist drew a stem, a leaf, and petals. The stem sends water from the roots to the rest of the plant. The leaves help the plant make food. Petals on the flower attract bees to spread pollen around. This helps plants make seeds to grow new plants. These parts work together as a system. They help the flower grow and survive.

87

LITERAL—What are the parts of a plant system?

- » stem, leaf, petals, flowers, pollen, water, roots, seeds, bees

LITERAL—How do the parts work together?

- » The roots absorb water and send it to the stem. That water supplies the leaves that make food and flowers. The flowers attract bees to help make seeds that help the plant make new plants.

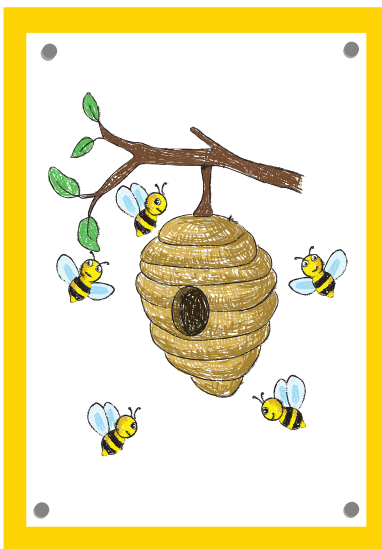
INFERENTIAL—Are all plants examples of systems?

» yes, although they may have different parts

EXTEND—Discuss how plants are their own system but are also part of a larger system. For example, a tree has parts that work together to keep it alive, but it is also part of a system for birds that build nests in trees and insects that live in trees.

Page 88

Ask students to look at the image as you read aloud. Ask them to think about the different parts of a system involving honeybees.



Vanessa Valquez

Hive City

Colored Pencils on Paper

Buzz, buzz, buzz. The bees in this picture are very busy. They are working in a beehive! A beehive is where bees live and work. Each bee plays an important part in the system. Some bees collect pollen to bring back to the hive. Other bees protect the hive and guard the queen.

The queen bee lays eggs and makes new bees. All these bees work together. It's a system

88

LITERAL—What are the parts of a beehive system?

» worker bees, plant pollen, queen, hive

Know the Standards

TEACHER DEVELOPMENT

CCC4. Systems and System Models Objects and organisms can be described in terms of their parts, and systems in the natural and designed worlds have parts that work together. In this lesson, students explore examples of different systems of plants and animals, as well as the solar system.

INFERENTIAL—What are the parts of the beehive system that are outside the hive?

» flowers, water

EVALUATIVE—What is the most important part of the beehive system?

» All the parts are important. Without one of the parts, the hive would not survive.

Page 89

Ask students to look at the image as you read aloud. Ask them to think about the parts of this system.



Luca Helman

Far Out

Crayons on Paper

The solar system has eight planets. Some of them have moons. The planets move around the sun. Gravity keeps the planets and moons in place.

89

LITERAL—What are the parts of the solar system?

» planets, their moons, and the sun

INFERENTIAL—How do the parts of the solar system work together?

» Gravity holds the planets in their paths around the sun.

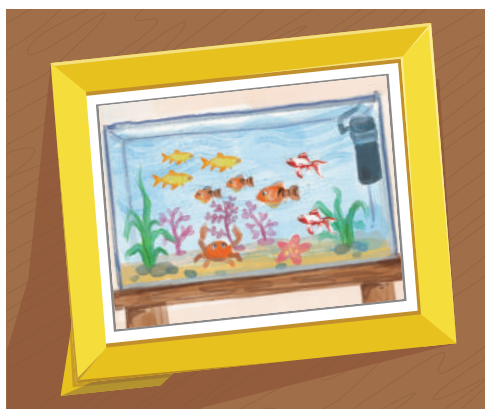
EVALUATIVE—What is the most important part of the solar system?

» the sun because all the other parts move around it

EXTEND—Explore different human-made systems, from a light bulb, to a telephone system, to a system of roads and bridges. Reinforce the idea that each system is composed of different parts that work together to perform a function.

Page 90

Ask students to look at the image as you read aloud. Have them think about how the parts of the system work together.



Story Miraldi

See the Sea

Watercolor

This artist drew an aquarium. An aquarium is an underwater system designed by humans. It has parts that provide all the things aquatic animals need to live. These parts are meant to be like their natural habitats. The main part of an aquarium is water. Rocks or sand at the bottom of the aquarium give animals a place to rest or walk, just like in an ocean. Pretend plants and other objects give animals places to hide. Some aquariums have machines that keep the water at a good temperature. They are designed to imitate how the sun heats water in nature. Finally, fish, starfish, and all the creatures in the tank are part of an aquarium.

90

LITERAL—What are the parts of the aquarium system?

» water, rocks, sand, plants, fish, container

INFERENTIAL—How is an aquarium different from living in a pond or lake?

» The fish don't have to find food, and they are safe from animals that try to eat them.

INFERENTIAL—How are humans part of the aquarium system?

» Humans created the container and put in the water, rocks, plants, and fish. They keep the aquarium clean and at the right temperature and provide food.

Ask students to think about how the parts of a terrarium work together to keep the living things alive.



Dina Horowitz

Jars of Green

Colored Pencils on Paper

A terrarium is like a self-contained garden. It is a system with living and nonliving parts. A terrarium is a closed container with soil, plants, and air in it. Water moves from the air to the soil and back again.

Main Science Idea

Things that work together and affect each other form a system. There are many kinds of systems.

91

INFERENTIAL—How is a terrarium different from an aquarium?

- » An aquarium is an underwater system. A terrarium is an enclosed ecosystem that survives in air.

INFERENTIAL—What parts do the terrarium and aquarium have in common?

- » Both need water.

3. Check for understanding.

Activity Page



AP 15

Online Resources



Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. Things that work together and affect each other form a system. There are many kinds of systems. Show a video about robin ecosystems. Use the activity page to assess students' ability to identify parts of a system. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

Have students complete Activity Page 15.

See the Answer Key for sample or correct answers.

Fascinating Fasteners

AT A GLANCE

Lesson Question

Where can we find the same small parts used in many larger objects?

Learning Objective

- ✓ Recognize and describe the versatility of fasteners (screws, nuts and bolts, rivets, nails).

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- select the best fastener

Main Science Idea

One design for fastening materials together can be used in many different objects.

NGSS and CCSS References

CCC5. Energy and Matter: 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. A given energy input results in a more useful energy output.

RI.K.1. Key Ideas and Details: With prompting and support, ask and answer questions about key details in a text. (Also **RI.K.10**, **L.1.4.A**, and **L.K.1.d**)

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

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fastener **system**

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.

bolts **nails** **nuts** **rivets** **screws**

Instructional Resources

Student Book



Ch. 16

Student Book, Chapter 16
“Fascinating Fasteners”

Activity Page



AP 16

Activity Page
Fast Fasteners (AP 16)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 16 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Online Resources



Show students a video about a simple machine, the screw. Then discuss all the different ways students have seen screws being used, such as closing the battery compartment in a toy, holding two pieces of wood together, and keeping a shelf attached to a wall. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: Where can we find the same small parts used in many larger objects?

2. Read together: “Fascinating Fasteners.”

Student Book

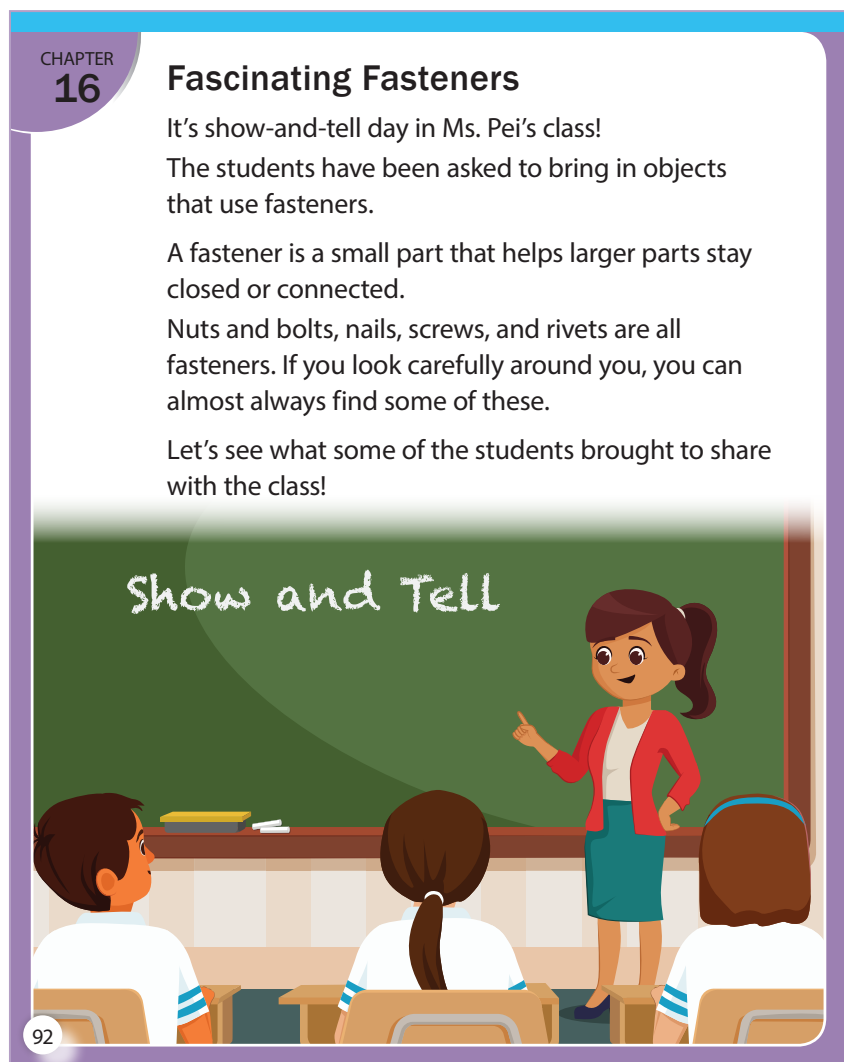


Ch. 16

While some advanced students may be able to read words on a given page of the Student Book, as a 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 16 on page 92. Point out that the top edges of the pages of this chapter are all light blue. Tell students that the title of this chapter is “Fascinating Fasteners” and that it is about small parts that hold other parts together.

Ask students to look at the image as you read aloud. Ask them to think about what a **fastener** is and how it works.



LITERAL—What does the word *fastener* mean?

» a small part that holds two things together

INFERENTIAL—What kinds of fasteners can you think of?

» Possible answers: tape, hook-and-loop tape, glue

INFERENTIAL—Look around the room. What kind of metal hardware acts as a fastener?

» nuts and bolts, nails, screws, and rivets

INFERENTIAL—How is the fastener part of the **system**?

» Sample answer: Screws may hold hooks to the wall that support a bulletin board. Nails may hold table or chair legs together.

Ask students to look at the pictures as you read aloud. Ask them to think about how nails hold two things together.

Ricardo is sharing a wooden birdhouse with the class.
Several flat pieces of wood are held together with nails.
Nails are pointy metal fasteners.
They are hammered into place.
Usually, nails are used to hold together wood parts.
Many objects are built with nails.



Emily brought in a picture frame to share.
The corners of the picture frame are held together with tiny nails.
They are smaller than the nails holding Ricardo's birdhouse together.



93

LITERAL—What is a nail?

- » a metal fastener you can hammer into two pieces to hold them together

INFERENTIAL—What nails can you find in the classroom?

- » Nails might be found in wooden chairs, tables, or bookshelves.

INFERENTIAL—What are the disadvantages of using nails to fasten things together?

- » The nail may not be long enough. If a pressure such as gravity pulls against the nail, it can stop holding.

CHALLENGE—Challenge students to bring in and present systems that are held together by nails, such as a wooden dollhouse or a wooden box. Have students explain how the nails work as part of the system.

Ask students to look at the images as you read aloud. Ask them to think about how screws hold two things together.

Olga brought in a plastic flashlight to show the class.

The outer parts of the flashlight are held together by screws.

Bennett is sharing his eyeglasses.

Eyeglasses use tiny screws to connect the parts of their frames.

Screws are commonly found holding bigger parts together.

They can be used with wooden, plastic, or metal materials.

They twist into the parts instead of being banged in like nails.



94

INFERENTIAL—What are the advantages of using a screw over a nail?

- » It can be used with wood, metal, or plastic, and it can hold things more firmly because the grooves are stronger than the smooth sides of a nail.

EVALUATIVE—Which is better, a screw or a nail?

- » It depends on the task. Sometimes nails are better, and sometimes screws are better.

Know the Standards

TEACHER DEVELOPMENT

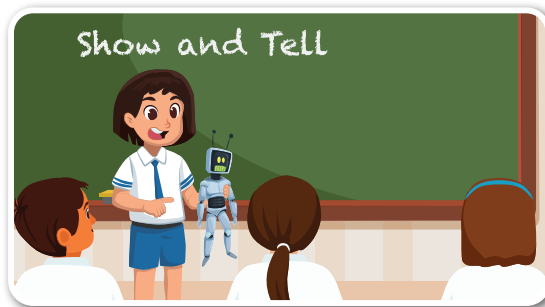
CCC5. Energy and Matter As students learn that familiar objects are made of common parts that can be used in different objects, they are building background understanding that will help them conceptualize later that all systems are made up of matter and energy changing in cycles through those systems.

Ask students to look at the images as you read aloud. Ask them to think about how screws are parts in a system.

Felix is showing the class his guitar.
Some of its parts are held together with small screws.
Now he plays the class a song!
Strum, strum, strum.



Coop brought her metal robot toy to show to the class.
The metal body parts are connected by screws.
They attach the head, arms, and legs to the robot's torso.



95

LITERAL—How are screws different from each other?

- » Some are very small, like the ones in eyeglasses. Others are much bigger, like those that hold a table together.

INFERENTIAL—How are screws the same as each other?

- » They all have the shape of a grooved rod. They have a pointy end and gradually get thicker toward the top. The head of the screw has a groove so you can use a tool to twist it into the materials you are trying to hold together.

INFERENTIAL—How can a screw work in a metal or plastic system?

- » It works in the same way as it does with wood. It digs grooves into the sides of the material so the only way to get it out is to unscrew it.

Ask students to look at the images as you read aloud. Have them think about how a rivet is the same as and different from a nail and a screw.

Penny is sharing her toy car.

The underside of the car uses rivets to hold the outer parts together.

Rivets are small metal fasteners, too.

They are often used in cars, planes, rockets, ships, and buildings.

But they can also be used in smaller objects, too.

A rivet is like a nail that isn't pointy.

It's thin shape gets smashed to hold it in place and fasten materials together.



96

LITERAL—How is a rivet like a screw and a nail?

- » It fastens two pieces together. It is like a nail without a pointy end.

INFERENTIAL—How does a rivet hold materials together?

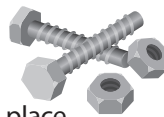
- » Rivets are pounded into place, and then one side is smashed so it stays in place.

INFERENTIAL—What are the disadvantages of using rivets?

- » They are difficult to remove without destroying the materials because you can't unscrew them or pull them out.

Ask students to look at the images as you read aloud. Have them think about how a bolt and nut are like rivets, nails, and screws.

Theo rode his bicycle to school.
He shows it to the class.
Nuts and bolts hold the handlebars and pedals in place.
They connect parts to the bike's frame.
Sonja shows the class her skateboard.
The wheels are attached to the board using nuts and bolts.
A bolt is like a screw without a pointy end.
The nut is the part that twists onto the thin shaft.



You can probably find these types of fasteners in the room you are in right now.
Give it a try!

Main Science Idea

One design for fastening materials together can be used in many different objects.

97

LITERAL—How is a nut-and-bolt fastener different from a screw?

- » It has two parts. The bolt does not have a pointy end and is not thicker on one end than the other.

INFERENTIAL—What are the advantages of using nuts and bolts over nails, rivets, or screws?

- » You can use them with lots of different materials. They are very strong but can be easily removed.

3. Check for understanding.

Activity Page



AP 16

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. One design for fastening materials together can be used in many different objects. Have students complete Activity Page 16. After students complete the page, discuss why they chose each type of fastener for each system.

See the Answer Key for sample or correct answers.

The Right Material for the Job

AT A GLANCE

Lesson Question

How well do different materials hold their shapes?

Learning Objective

- ✓ Describe the contrast among liquid, semi-solid (gels and pastes), and solid materials.
- ✓ Describe the contrast among soft and hard solid materials.
- ✓ Describe the contrast among rigid, flexible, and elastic materials.
- ✓ Describe the contrast among strong and fragile solid materials (those that are brittle or tear easily).

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- classification exercise

Main Science Idea

Describing materials can help you decide how they can be useful.

NGSS and CCSS References

CCC6. Structure and Function: 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.

RI.K.1. Key Ideas and Details: With prompting and support, ask and answer questions about key details in a text. (Also **RI.K.10**, **L.1.4.A**, and **L.K.1.d**)

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

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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.

flexible **liquid** **material** **solid**

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.

cardboard **diorama** **fabric**

Instructional Resources

Student Book



Ch. 17

Student Book, Chapter 17
“The Right Material for the Job”

Activity Page



AP 17

Activity Page
Types of Materials (AP 17)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 17 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Online Resources



Show students a video about building a diorama. Then discuss the different materials that were used to make the diorama, including glue, plastic animals, cardboard, and yarn. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: How well do different materials hold their shapes?

2. Read together: “The Right Material for the Job.”

Student Book



Ch. 17

While some advanced students may be able to read words on a given page of the Student Book, as a 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 17 on page 98. Point out that the top edges of the pages of this chapter are all red. Tell students that the title of this chapter is “The Right Material for the Job” and that it is about how different materials have different properties that make them useful for different purposes.

Read Aloud Support

Page 98

Ask students to look at the image as you read aloud. Ask them to think about different kinds of craft **materials** they have used to make things.



CHAPTER 17

The Right Material for the Job

Diego enjoys building things.

Today he needs to design a space diorama for school.

He looks through his craft closet for materials.

Material is what an object is made of.

Diego's closet is filled with all kinds of materials!

He is excited to pick out the best ones to use for his space diorama.

LITERAL—What does the word *material* mean?

» what an object is made of

INFERENTIAL—What kinds of materials have you used to make things?

» Possible answers: paper, tape, cardboard, noodles, paints, plastic cups, metal cans, glue, wood, clay

INFERENTIAL—What kinds of things have you made out of different materials?

» Possible answers: painting, clay bowl, tin can coin collector

SUPPORT—Discuss the word *material*, which is what an object is made of. Hold up or point to different objects, such as a book, a pencil, an apple, the door, and a desk, and ask what material each is made of. Reinforce the idea that *everything* is made of materials, even food, air, and plants.

Page 99

Ask students to look at the pictures as you read aloud. Ask them to think about the properties of **liquids**.

Diego takes out his liquid materials first.
Liquid does not hold its shape.
A liquid will fill the space in a container.
It will take the shape of the container.
A few liquids can be used for his diorama.
He can use liquid glue to stick other materials together and hold things in place.



Liquid paint will be good for painting the planets, moons, and space scenery.
When these materials dry, they won't be liquids anymore.
As water evaporates from the liquid, a solid will remain.



99

LITERAL—What is a liquid?

- » a material that takes the shape of a container

INFERENTIAL—What types of liquids do students use?

- » Sample answers: milk, paint, hand sanitizer, water, soda, glue

INFERENTIAL—How can a liquid become a **solid**?

- » If it dries, it can harden and keep its own shape the way glue and paint do. Liquids can also become solid when they freeze.

CHALLENGE—Challenge students to design a diorama based on a space theme. They might be interested in a diorama of planets, moons, rockets, stars, or the sun. Have them select materials and present their designs to the class.

Page 100

Ask students to look at the image as you read aloud. Ask them to think about materials they can make into different shapes.

Diego sorts through his clay. Clay is tacky and thick. It can be shaped and molded to add thickness to the diorama's landscape.

He decides he will use clay to make textured surfaces like rocky terrain on the moon or the crust of planets.



100

INFERENTIAL—Why is clay a good choice to use to make mountains?

» You can push and pull it into different shapes.

INFERENTIAL—How is clay different from a liquid?

» Even though it can be shaped into something else, it keeps its shape.

Know the Standards

TEACHER DEVELOPMENT

CCC6. Structure and Function In Grades K–2, students observe that the shape and stability of structures of natural and designed objects are related to their function(s). In this lesson, students explore different solid and liquid materials that can be used to make things.

INFERENTIAL—What are other materials Diego could use to make mountains?

- » Sample answer: He could make them out of paper cups and paint them or cover them with other materials to look like mountains, or he could make them out of foam blocks.

Page 101

Ask students to look at the images as you read aloud. Ask them to think about how they can change the shape or look of solid materials.

Diego has a lot of solid materials. Solid materials hold their shapes. He can use them in many ways for his diorama.

Cardboard is hard and sturdy. Diego can use it to make the bottom of the diorama. Paper wouldn't be as good of a choice because paper folds and flops too much.

He will also use cardboard tubes to make a rocket ship.



Foam balls can be painted to look like planets and moons. They are of different sizes.



101

LITERAL—What is a solid?

- » a material that keeps its shape

INFERENTIAL—What are examples of solid materials students use to make things?

- » Possible answers: cardboard, paper, foam balls or bricks, wood

INFERENTIAL—How can you change the shape of a solid material?

- » You can cut it, fold it, or melt it.

INFERENTIAL—How can you change the look of a solid material?

- » You can paint it or cover it with paper or other material.

Ask students to look at the image as you read aloud. Have them think about the properties of **flexible** materials like fabric.

Diego has a box filled with scraps of fabric. Fabric is soft, even though it is a solid. It can be twisted, folded, cut, stitched, and glued!

Diego thinks he can use gold fabric to cover his rocket ship. Then he can cut strips of orange fabric to use as the fire on his rocket's engine.



102

LITERAL—How is fabric different from other solids like foam bricks?

- » It is flexible and can be twisted, folded, cut, stitched, and glued.

INFERENTIAL—How have you used or seen fabrics used?

- » Sample answers: for clothes, tablecloths, curtains, towels, and sheets

INFERENTIAL—What makes fabrics useful materials?

- » You can sew them into different things. They are flexible and can be colorful. They can be washed.

SUPPORT—Discuss the word *flexible*, which means able to be bent without breaking. Talk about materials that are flexible, including soft plastic water bottles, fabric, string, plastic wrap, paper, and curtains. Reinforce the idea that flexible materials are the best for certain functions, such as clothing and tying things, but that solid materials are best for other functions that require stability.

Ask students to look at the images as you read aloud. Have them think about how they can describe wires and elastic bands.

Diego pulls out a box of wires and rubber bands.

Wires are lightweight and flexible. Diego can use them to make antennae on satellites and connector parts for his rocket ship.



Elastic rubber bands stretch and return to their original size. Diego decides to use elastic to make the astronauts in his diorama look like they are bouncing in space.

With all of these materials, Diego feels ready to start building his diorama!

Main Science Idea

Describing materials can help you decide how they can be useful.

103

LITERAL—How are wires and elastic bands the same and different?

- » They are both narrow and lightweight, and they can be colorful and easily bent. Elastic bands can stretch, but wire cannot.

3. Check for understanding.

Activity Page



AP 17

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. Describing materials can help you decide how they can be useful. Use the activity page to assess students' ability to distinguish between liquid and solid materials.

After students complete Activity Page 17, discuss the difference between liquids and solids, including flexible solids like clay, wire, yarn, paper, and fabric. Those materials keep their shape even though they are flexible.

See the Answer Key for sample or correct answers.

Things That Change

AT A GLANCE

Lesson Question

What are many different types of changes?

Learning Objectives

- ✓ Classify observed phenomena as examples of things that change or things that do not.
- ✓ Describe a change in a natural system.
- ✓ Describe a change in a human-designed system.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- classification exercise

Main Science Idea

Many things are changing all the time.

NGSS and CCSS References

CCC7. Stability and Change: 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.

RI.K.1. Key Ideas and Details: With prompting and support, ask and answer questions about key details in a text. (Also **RI.K.10**, **L.1.4.A**, and **L.K.1.d**)

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

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change **stable**

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.

notice **same** **traits**

Instructional Resources

Student Book



Ch. 18

Student Book, Chapter 18
“Things That Change”

Activity Page



AP 18

Activity Page
Change or No Change (AP 18)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 18 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Online Resources



Show students a time-lapse video of plant growth. Then discuss the changes that the plant goes through to introduce the idea of change. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: What are many different types of changes?

2. Read together: “Things That Change.”

Student Book



Ch. 18

While some advanced students may be able to read words on a given page of the Student Book, as a 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 18 on page 104. Point out that the top edges of the pages of this chapter are all dark blue. Tell students that the title of this chapter is “Things That Change” and that it is about how some things become different over time while others do not.

Ask students to look at the images as you read aloud. Ask them to think about how they themselves have changed over time.

CHAPTER
18

Things That Change

Some things in nature change, and other things stay the same.

When something changes, it means that it becomes different.

You are taller now than you were when you were born.

Your height changed as you got older.



The height of the hills around where you live won't naturally change much in your lifetime.

Things that stay the same are stable.

Hills are most often very stable.

104

LITERAL—What does the word **change** mean?

» Something becomes different.

INFERENTIAL—What kinds of changes have you gone through?

» growing taller, losing teeth, growing and cutting hair

INFERENTIAL—How have you stayed the same?

» eye color, still have two arms and two legs

SUPPORT—Discuss the word **stable**, which means enduring or not changing. Discuss what kinds of things seem to be stable or stay the same: big trees, buildings, mountains, roads, rivers. Introduce the idea that even when things are stable, they may be slowly changing. For example, trees are growing, a river may flood or change course, and a building may get painted.

Ask students to look at the pictures as you read aloud. Ask them to think about things that are fast and things that are slow.

Everything in motion has speed.

Some motion seems very fast.

Some motion is very slow.

The runner and the tortoise can change speeds, too.

They can go faster or slower.



105

LITERAL—What is the difference between fast and slow?

- » An object going fast covers more distance than an object moving slowly in the same amount of time.

INFERENTIAL—In the pictures, what is moving fast, and what is moving slowly?

- » The human is running fast. The tortoise is moving more slowly.

INFERENTIAL—What are things that don't seem to be changing at all in the picture?

- » the running track, the ground, the color of the runner's clothes

CHALLENGE—Tell, show a video of, or, read the fable of the tortoise and the hare. Challenge students to make up a story of fast changes, like a flood, and slow and steady changes, like the growth of a tree. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)



Ask students to look at the images as you read aloud. Have them think about gradual changes.

This sandcastle at the beach was far away from the ocean water at the beginning of the day. After a few hours, the waves started washing the sandcastle away.



What quickly changed?

The tide came in.

The ocean always has waves.

In repeating cycles, the waves move higher onto the shore.

The tide changed.

And the castle changed, too.

106

INFERENTIAL—What are examples of fast changes you have seen?

- » Sample answers: a bulldozer digging a big hole, a tree being cut down, a car crash, falling and scraping a knee

INFERENTIAL—What are some slow changes you have seen?

- » Sample answers: clouds moving, clock moving, sun going down

INFERENTIAL—How do things people make change?

- » Possible answer: The sandcastle changes when the tide comes in and washes over it. A building also changes over time as the paint starts to peel or animals like mice or insects chew holes in it.

Know the Standards

TEACHER DEVELOPMENT

CCC7. Stability and Change In Grades K–2, students observe that some things stay the same while other things change and that things may change slowly or rapidly. In this lesson, students explore many different types of fast and slow changes that occur.

Ask students to look at the images as you read aloud. Ask them to think about changes that occur as plants and animals grow.

This adult orangutan didn't always look this way.



When it was a baby, it was also much smaller. Its muscles were small. It didn't have too much hair. These are some of the physical traits that changed.

There are also traits that stayed the same. The overall structure of the legs and arms never changed. Some things change a lot. Some things change less.

107

LITERAL—How did the orangutan change as it grew?

- » As a baby, it was smaller and didn't have much hair or muscles. As it grew, the color changed, it grew bigger, and it grew more hair.

INFERENTIAL—How can you tell you are the same person as your baby picture?

- » My skin color, eyes, nose, and mouth shape are the same.

INFERENTIAL—How do grown-ups change slowly?

- » Their hair turns gray. They get fatter or thinner. Their skin gets more wrinkly.

EVALUATIVE—Are fast changes better than slow changes?

- » No, they are just different. A slow change or a fast change can be good or bad.

Ask students to look at the images as you read aloud. Have them think about things that change and things that stay the same.

People have been growing food for a long time.
We must eat to stay alive.
Our need for food is something that never changes.
People always need to do things to help them eat.
Even the ancient Egyptians grew food to eat.



But things change.
Farming systems have changed to improve how food grows.
Humans developed machines to do work.



108

INFERENTIAL—Why does people's need for food never change?

» If we don't eat, we can't stay alive.

INFERENTIAL—What are some things about plants that never change?

» They need sunlight and water to grow.

INFERENTIAL—What are some thing about plants that change slowly?

» They slowly grow taller, develop leaves and flowers and seeds, and then die away.

INFERENTIAL—How could a plant change quickly?

» if it got picked or an animal ate it or it was crushed by a tire

Ask students to look at the images as you read aloud. Have them think about what causes changes in nature.

Here are a couple more examples of things that change in nature.

Earth's surface is always changing. Some changes happen too slowly to notice. When wind blows sand to the same area over time, it can form sand dunes. The formation of sand dunes is a slow change. But it is fast compared to the time it takes for a mountain to form.



Clouds change in the sky. Their shapes change as they float by. Sometimes the sky is full of clouds. Other times there are no clouds in sight.



Main Science Idea

Many things are changing all the time.

109

LITERAL—How do the sand dunes and clouds change?

- » The sand dunes change shape. The clouds move across the sky and change shape.

INFERENTIAL—What causes sand dunes and clouds to change?

- » weather, including wind and rain, and hot and cold temperatures

3. Check for understanding.

Activity Page



AP 18

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. Many things are changing all the time.

After students complete Activity Page 18, discuss the difference between things that change quickly and things that are more stable. Discuss how over long periods of time, many things that we think are the most stable, like rocks and oceans, are also changing.

See the Answer Key for sample or correct answers.

Invention and Discovery

AT A GLANCE

Lesson Question

How are solutions discovered?

Learning Objective

- ✓ Contrast examples of significant “accidental” discoveries with human-designed solutions achieved through painstaking research.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- differentiation exercise

Main Science Idea

Sometimes people work hard for a long time to solve a problem or invent something new. Sometimes they discover something new unexpectedly while they are working on something else.

NGSS and CCSS References

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. (Also **ED.B** and **ED.C**)

RI.K.1. Key Ideas and Details: With prompting and support, ask and answer questions about key details in a text. (Also **RI.K.10**, **L.1.4.A**, and **L.K.1.d**)

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accidental

discovery

invention

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.

engineer

experiment

penicillin

Instructional Resources

Student Book



Ch. 19

Student Book, Chapter 19
“Invention and Discovery”

Activity Page



AP 19

Activity Page
Discovery or Invention (AP 19)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 19 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Online Resources



Show students a video about a famous discovery, such as Galileo’s discovery that Earth revolves around the sun. Then review what Galileo invented (telescope) and the discoveries he made. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: How are solutions discovered?

2. Read together: “Invention and Discovery.”

Student Book



Ch. 19

While some advanced students may be able to read words on a given page of the Student Book, as a 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 19 on page 110. Point out that the top edges of the pages of this chapter are all dark purple. Tell students that the title of this chapter is “Invention and Discovery” and that it is about different ways that people learn and do new things in science.

Ask students to look at the image as you read aloud. Ask them to think about when they have discovered something new.

CHAPTER
19

Invention and Discovery



Step right up! Welcome to the Inventor's Fair!

Today you can learn about some scientists, engineers, and inventors.

You can learn about how they made discoveries.

Some inventors spent many years researching and testing their inventions.

Others made accidental discoveries.

There are different ways to discover things in science.

Enjoy the fair!

110

LITERAL—What does the word **discovery** mean?

- » to see or find out something new

INFERENTIAL—What kinds of discoveries have you made?

- » Sample answers: I found a spot where my dog was hiding treats.
I discovered I really liked cucumber salad.

EVALUATIVE—Are all discoveries good?

- » No, sometimes people discover something bad has happened or discover they don't like something.

SUPPORT—Discuss the difference between a discovery and an **invention**.

A discovery is often made without much work, whereas an invention can take years of experimentation.

Ask students to look at the picture as you read aloud. Ask them to think about times they have been sick and how they got well.

Meet Alexander Fleming.
He's a scientist.
He accidentally discovered a type of mold that is now used as medicine.
It is called penicillin.
It kills some kinds of germs.
It helps people feel better when they are sick.
He was doing an experiment in his lab.
When he checked on his experiment later, he found mold growing.
And nothing else grew around it.
He took a very close look at it.
Was something in the mold killing germs?
That is when he discovered that the mold could be used for medicine.
It was a very surprising, and important, discovery.



111

LITERAL—What did Alexander Fleming discover?

- » He discovered mold growing around his experiment and that nothing else grew around it.

INFERENTIAL—Did Alexander Fleming invent penicillin, or did he discover it?

- » He had been working in a lab, but he *discovered* the reaction to mold that had grown. Then he invented ways to get penicillin to doctors to help people.

INFERENTIAL—Why was the discovery of penicillin an **accidental** discovery?

- » Fleming wasn't looking for it; it just appeared.

Online Resources



EXTEND—Show a video about accidental discoveries. You might bring in a variety of accidental discoveries, such as sticky notes or potato chips, and present each of them to the class. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

Ask students to look at the image as you read aloud. Have them think about how they have used hook-and-loop tape.

Meet George de Mestral and his dog, Milka.

After taking Milka for a walk one day, George noticed burrs stuck to her fur.

He observed the burrs closely.

They had tiny hooks in them.

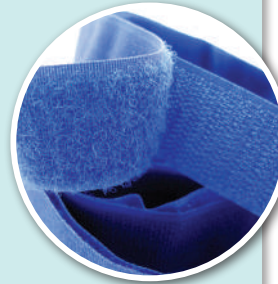
They could hook onto fur and fabric.

This inspired George's invention.

What did he invent?

Hook-and-loop fasteners.

It was a solution to fastening shoes, clothing, and even backpacks.



112

LITERAL—How does hook-and-loop tape work?

- » It works like the burrs that were stuck to the dog's fur. There are little hooks that hook onto clothes and fur.

INFERENTIAL—What is the purpose of burrs?

- » They are seeds that hitchhike on animals and other moving things to spread the seeds to new places.

INFERENTIAL—What is hook-and-loop tape used for?

- » It's used as a closure for coats and shoes and different fabrics so they hold together.

Know the Standards

TEACHER DEVELOPMENT

ED.A. Defining and Delimiting Engineering Problems Identify situations that people want to change as problems that can be solved through engineering.

Ask students to think about the difference between accidental discoveries and inventions.

Meet David Misell.

He's an inventor.

Have you ever tried to see in the dark?

If so, then maybe you've used his invention:
the flashlight!

It took him a long time to invent the flashlight.

First, he had to produce light.

In his day, that wasn't so easy!

Then, he had to research how to direct light waves.

Sometimes his designs failed.

It wasn't easy, but he kept trying.

He came up with many designs until he found the one that worked the best.



113

LITERAL—What was the problem David Misell wanted to solve?

» He wanted to be able to see in the dark and move around.

INFERENTIAL—Was the flashlight an accidental discovery?

» No, he had to research and came up with many designs until he found the one that worked best.

INFERENTIAL—What is the difference between inventions and accidental discoveries?

» It takes a long time and a lot of work to invent something. An accidental discovery is quick, but then it may take time and a lot of inventions to make an accidental discovery available.

Ask students to look at the image as you read aloud. Have them think about discoveries that make a big difference to people.

Meet Stephanie Kwolek.
 She's an engineer.
 She invented an important material called Kevlar.
 Kevlar is a strong, lightweight fiber.
 It is five times stronger than steel but light enough to wear!
 Today we use it in things like body armor and helmets.
 It helps save lives.
 Stephanie discovered Kevlar by accident.
 She was working on an experiment for tires.
 When she mixed certain materials in the lab, she made this strong fiber.
 It was a very happy accident!



114

INFERENTIAL—What problems does Kevlar solve?

- » It is very strong but not heavy, so it lasts a long time and is flexible and can be used for lots of different projects.

INFERENTIAL—In addition to body armor and helmets, how do you think Kevlar could be used?

- » Possible answers: shoes that don't wear out, rugs, sports equipment, coats

INFERENTIAL—How did the invention of Kevlar improve the lives of people?

- » It made things that are safer and last longer.

INFERENTIAL—How does one invention lead to another?

- » Once you know something is possible, like making a strong fabric, you can think of other things to do with it.

Ask students to look at the image as you read aloud. Have them think about how farming affects their lives.

Meet George Washington Carver.
He's a scientist who works with plants.
He spent long years researching different ways to use peanuts.
And he kept discovering more and more along the way.
He discovered something else in his research, too.
It was how to keep farm soil healthy.
He taught farmers how to rotate their crops.
It helped their crops grow better.
His solutions are still used in farming today.



Main Science Idea

Sometimes people work hard for a long time to solve a problem or invent something new. Sometimes they discover something new unexpectedly while they are working on something else.

115

LITERAL—What did George Washington Carver invent?

» different ways to use peanuts, how to keep soil healthy, how to rotate crops

INFERENTIAL—What kinds of things have peanuts in them?

» Sample answers: peanut butter, ice cream, candy bars, peanut oil

3. Check for understanding.

Activity Page



AP 19

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. Sometimes people work hard for a long time to solve a problem or invent something new. Sometimes they discover something new unexpectedly while they are working on something else.

Use Activity Page 19 to assess students' ability to distinguish between inventions and accidental discoveries.

See the Answer Key for sample or correct answers.

How Do They Do That?

AT A GLANCE

Lesson Question

What are engineering and design?

Learning Objectives

- ✓ Define *design* as a verb meaning to document a plan for a solution (and as a noun meaning the recorded plan for a solution).
- ✓ Describe engineers as people who study problems and figure out how to use materials and processes to make solutions.

Instructional Activities

- teacher Read Aloud
- class discussion
- vocabulary exploration
- matching exercise

Main Science Idea

To design something means to make a plan for a solution. Engineers are people who study problems and figure out how to use materials and processes to make solutions.

NGSS and CCSS References

STSE1. Interdependence of Science, Engineering, and Technology: Science and engineering involve the use of tools to observe and measure things. (Also **STSE2**)

RI.K.1. Key Ideas and Details: With prompting and support, ask and answer questions about key details in a text. (Also **RI.K.10**, **L.1.4.A**, and **L.K.1.d**)

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.

design

engineer

solution

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.

light

sound

Instructional Resources

Student Book



Ch. 20

Student Book, Chapter 20
“How Do They Do That?”

Activity Page



AP 20

Activity Page
Problems and Solutions
(AP 20)

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project images/video for whole-class viewing

Advance Preparation: Where page numbers exceed the numbers to which younger students can count, students may be challenged to locate the correct chapter in their Student Books. Before distributing the books to students, it might be helpful to place paper strips as bookmarks or open all books so that the first page of Chapter 20 is visible.

THE CORE LESSON

1. Focus attention on the Lesson Question.

Online Resources



Show students a video about engineering. Then look around the room, and talk about simple things that engineers developed to solve problems, like lights to see, alarms for warning, clocks, and tables and chairs to sit and work. (See the Online Resources Guide for a link to a recommended video. www.coreknowledge.org/cksci-online-resources)

Pose a question for everyone to keep in the back of their minds as the class moves forward to read the chapter: What are engineering and design?

2. Read together: “How Do They Do That?”

Student Book



Ch. 20

While some advanced students may be able to read words on a given page of the Student Book, as a 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 20 on page 116. Point out that the top edges of the pages of this chapter are all orange. Tell students that the title of this chapter is “How Do They Do That?” and that it is about how people make all sorts of things for different purposes.

Ask students to look at the image as you read aloud. Ask them to think about when they have solved a problem.



LITERAL—What do **engineers** do?

- » study problems and look for solutions

INFERENTIAL—What kinds of problems would need to be solved if you were building a movie theater?

- » being able to hear, being able to see, being comfortable

EVALUATIVE—What would happen if the problems were not solved?

- » People would be angry if they couldn't see or hear and would not come back to the theater.

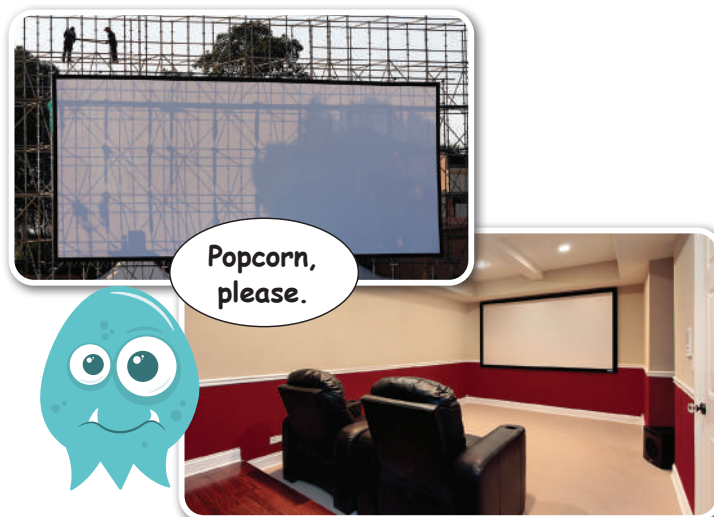
SUPPORT—Discuss the word **solution** as a means of solving a problem. Talk about simple solutions in school, such as taking turns, lining up, and behaving in a safe way.

Ask students to look at the pictures as you read aloud. Ask them to think about times they have been to a theater.

Engineers come up with designs. Designs are the plans for a solution.

Engineers designed, or planned, a way to show movies on big screens. They used special materials for the screen. The screen reflects light. A certain coating makes sure the light is spread evenly. This lets you see the movie no matter where you sit.

Sometimes engineers have to come up with a solution for making a gigantic screen.



Engineers also design screens that can fit in smaller rooms and even in homes.

117

LITERAL—What is a **design**?

» a plan for a solution

INFERENTIAL—What solution would you design to show a video to a few friends?

» I would have just a few friends watch the video on a smartphone to make sure everyone could see and hear, or I would project the video on a TV so more people could see and hear it. If it were a long video, I would make sure there is room to sit down.

CHALLENGE—Challenge students to design a space in the room to watch a movie without disturbing others. It may involve computer screens or phones and headphones. Have them present their designs to the class.

Ask students to look at the images as you read aloud. Have them think about how engineers have designed playgrounds or amusement parks they have gone to.

Some engineers design amusement park rides. They come up with ways for people to have safe but thrilling fun.



Engineers think about speed. They design rides that are safe for going fast or safe for going slow.

Whееее!!!



Engineers think about directions. They design rides that are safe for making twists, turns, or drops.

118

LITERAL—What are problems that engineers have to solve to make a successful amusement park ride?

- » safety, speed, and fun with directional changes

EVALUATIVE—What makes amusement parks and playgrounds fun and exciting?

- » safe rides, happy sounds, plenty of light to see everything

INFERENTIAL—How did engineers solve safety problems at a playground or amusement park you have been to?

- » height or age requirements for certain rides, seat belts, slow rides for small children, soft ground in case of falls

Ask students to look at the image as you read aloud. Ask them to think about how engineers design amusement parks.

When designing amusement park rides, engineers also must think beyond the ride itself.

Engineers think about what material to use. They have to test every part of the roller coaster to make it safe.



119

LITERAL—What makes amusement park rides look fun?

- » the colors, the sounds, how they move

INFERENTIAL—What makes you *not* want to go on a ride?

- » It is too fast or big. It looks as if it could break or I could fall and hurt myself.

INFERENTIAL—How could engineers solve the problems so you would want to ride?

- » make smaller, slower, safer rides for kids like me

EVALUATIVE—How did engineers create the best ride you have ever gone on?

- » Sample answer: They designed a train that moved fast, but not too fast and I could see and hear. I wasn't afraid of getting hurt.

Have students think about how engineers have designed different things around them.

Keeping animals safely in a zoo is a problem.

When designing zoos, math helps engineers figure out how tall to make the enclosures. This way the animals will not escape.

Problem solved!



When designing roads, engineers use math to figure out how wide the roads should be and how to curve the roads so cars can turn one way or another.



120

INFERENTIAL—What problems do engineers have to solve when designing a zoo?

- » Animals must be comfortable but not able to escape, and the crowds should not be able to go in the animal space.

INFERENTIAL—What problems to engineers have to solve when designing a major highway intersection?

- » Drivers should be able to easily find the right road to get where they are going. It should be safe so cars do not crash.

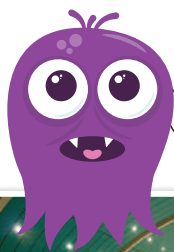
EVALUATIVE—How could engineers solve problems you have getting to and from school?

- » Sample answer: Have the bus stop in front of my house instead of at the end of the street. Design a shelter where people who walk to school can wait until the school is opened on rainy or snowy days.

Ask students to look at the images as you read aloud. Have them think about how engineers design transportation systems.

Engineering uses science. Engineers need to know how things work in the natural world.

If the problem is how to fly safely in bad weather, an engineer can figure out a solution.



Let's travel!



Want to make a train without wheels? That is a problem that needs a solution.

Knowing about magnets helps engineers design superfast trains that glide above their tracks.

Main Science Idea

To design something means to make a plan for a solution. Engineers are people who study problems and figure out how to use materials and processes to make solutions.

121

INFERENTIAL—How do engineers use science to design airplanes?

- » They have to know what makes planes fly and what materials are best to use to build planes out of. They also need to know about the science of weather so planes can fly safely.

3. Check for understanding.

Activity Page



AP 20

Main Science Idea: Reiterate the main idea of the chapter in plain and simple terms. To design something means to make a plan for a solution. Engineers are people who study problems and figure out how to use materials and processes to make solutions.

Use Activity Page 20 to assess students' ability to match conditions that present problems in the natural world and how engineers have used science to design solutions.

See the Answer Key for sample or correct answers.

Teacher Resources

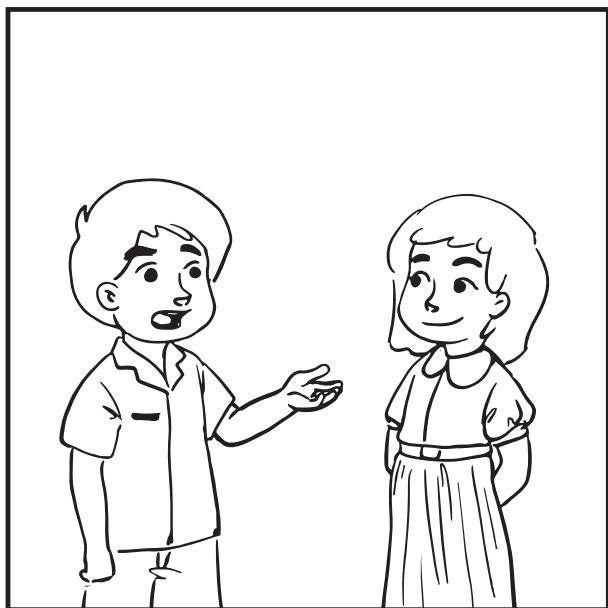
Activity Pages

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What Would You Do?

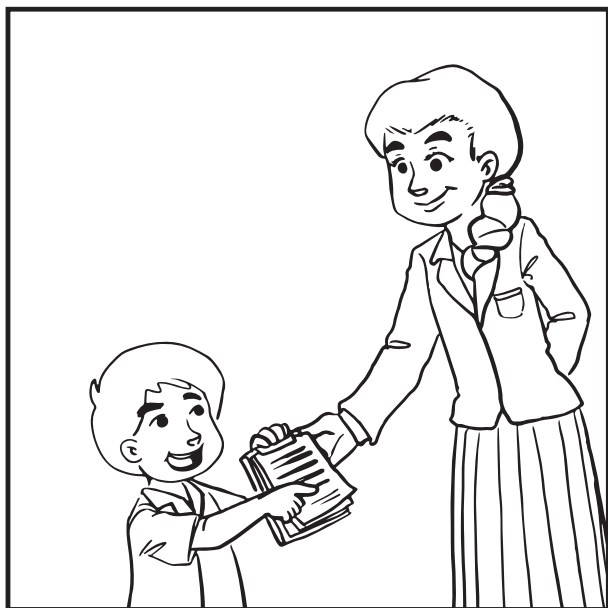
Here are some steps for doing science. Cut them out. Put them in the order you would do them. Glue them on another sheet of paper.



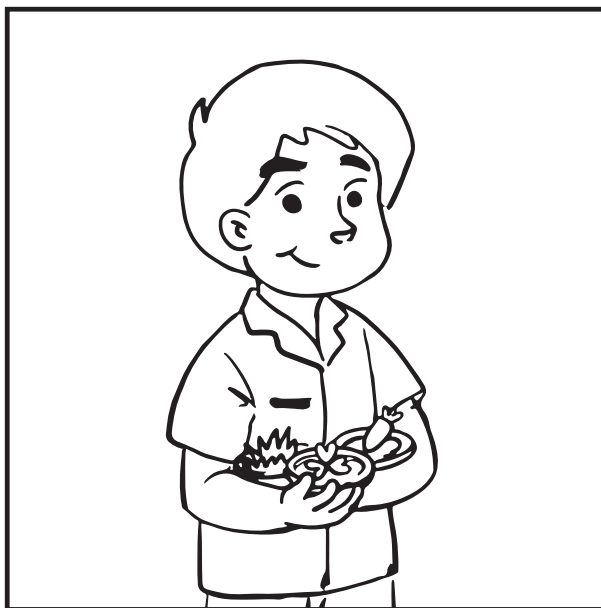
Talk to others about your question.



Be curious. Ask a question.



Compare your results with those of others.



Plan how to answer to your question.

Name _____

Date _____

A Few of My Favorite Things

Classify a few of your favorite things. Write or draw things in nature on the left. Write or draw human-made things on the right.

Things in Nature	Human-Made Things

Name _____

Date _____

Activity Page 3

Use with Lesson 3

Practice Measuring

Choose two objects to measure. Draw your objects. Write their measurements.

1. Draw the object you choose.

Measure how tall it is. Use a ruler.

Write the measurement.

2. Draw the object you choose.

Measure how much it weighs. Use a scale.

Write the measurement.

Questions to Investigate

Science investigations can answer some questions. Other questions cannot be answered by science investigations. Listen to the questions as your teacher reads them aloud. Circle the questions that can be answered by a science investigation.



1. How does the moon look one week after a full moon?

2. Does the full moon look more like a rabbit or a man's face?

3. Are there more hours of daytime or nighttime on July 4?

4. Is it more fun to go to bed before or after the sun sets?

5. What time does the sun rise this week?

6. Do shadows outside always point in the same direction?

7. Who is the best artist in the whole world?

Name _____

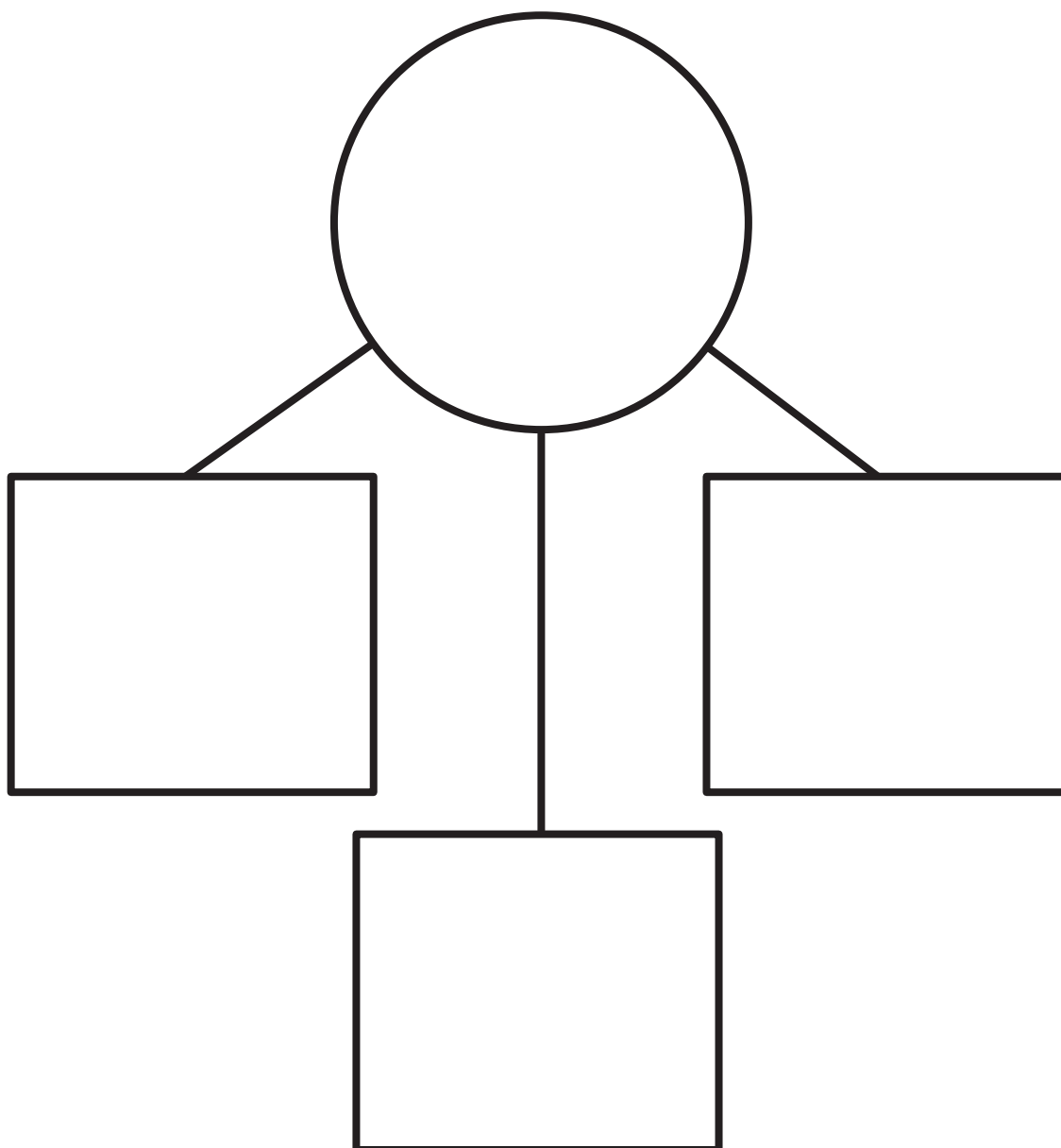
Date _____

Activity Page 5

Use with Lesson 5

Mária Telkes—Connect the Ideas!

Complete the diagram. In the circle, tell how all of Mária Telkes's methods and inventions are connected. In the rectangles, tell what those the inventions do. Use words from the box at the bottom of the page.



ask a question

build a model

cook food

clean drinking water

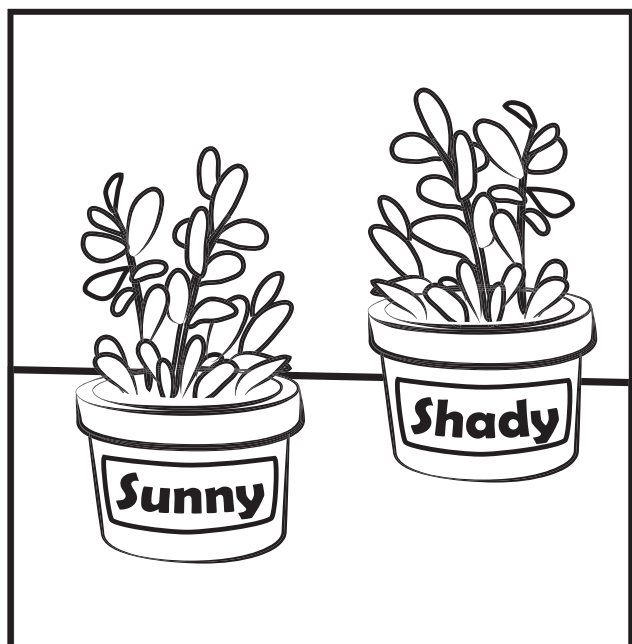
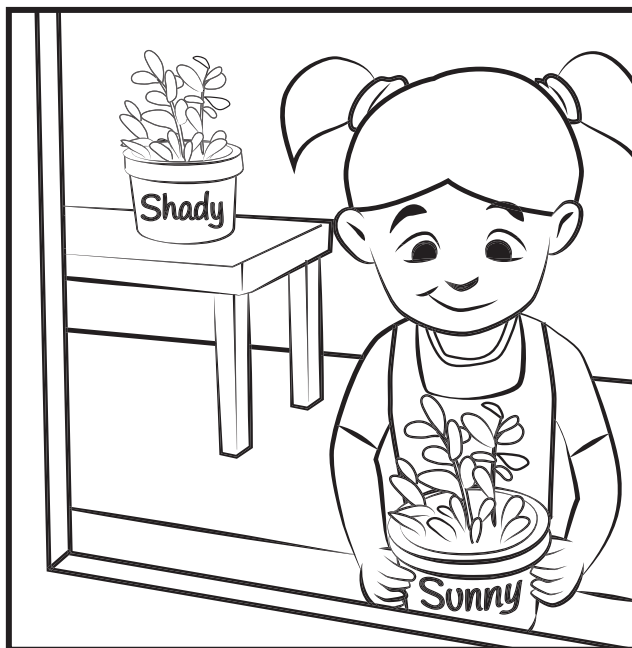
draw a diagram

use sunlight

warm a house

Fix This Mix-Up!

Jen asked, "How much sunlight do jade plants need?" She planned an investigation. She drew each step on a card. Oops! She dropped the cards! Cut out the cards, and put them in the correct order. Number the cards for steps 1 to 4 in order by writing a number on each card.



Name _____

Date _____

Activity Page 7

Use with Lesson 7

My, How You Grow!

Scientists put a tag on Allie the alligator when he hatched. Each year, they find Allie and measure his length. Predict how long Allie will be at the end of his fifth year. Fill in the chart, and answer the question.



	First Year	Second Year	Third Year	Fourth Year	Fifth Year
Inches	10	20	30	40	

How could you find out if your prediction is correct? _____

Name _____

Date _____

Activity Page 8

Use with Lesson 8

Sort It Out

Put the cards that describe *how much* (quantity) in one pile and the cards that cannot be measured (quality) in another pile. Then, describe what you can measure in the measurable pile, and describe the images in the not measurable pile.



Name _____

Date _____

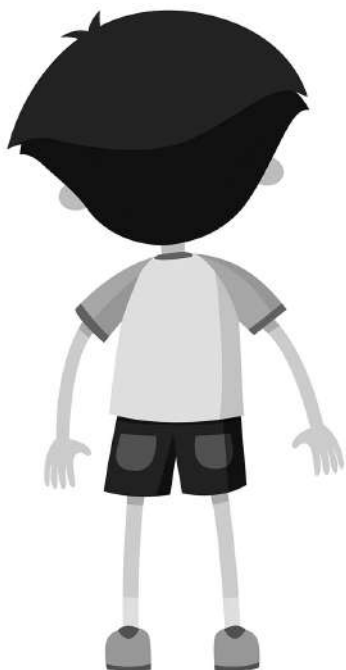
Activity Page 9

Use with Lesson 9

Problem-Solving Invention

It's hard to reach your back when it itches. How can you solve the problem? Invent a back scratcher!

Problem: An itchy back



Design a back scratcher. Draw your invention.

Draw the materials you would use.

Draw your invention being used.

Name _____

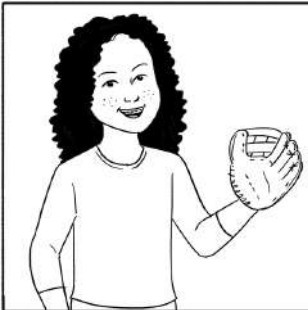
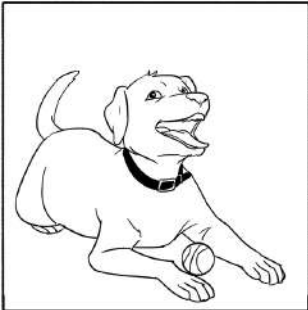
Date _____

Activity Page 10

Use with Lesson 10

Cookie Mystery

You will uncover evidence to make a claim about who ate the last cookie from the plate in the kitchen. Was it Anna, Mary, Dan, or Spot?

Anna	Mary	Dan	Spot
			

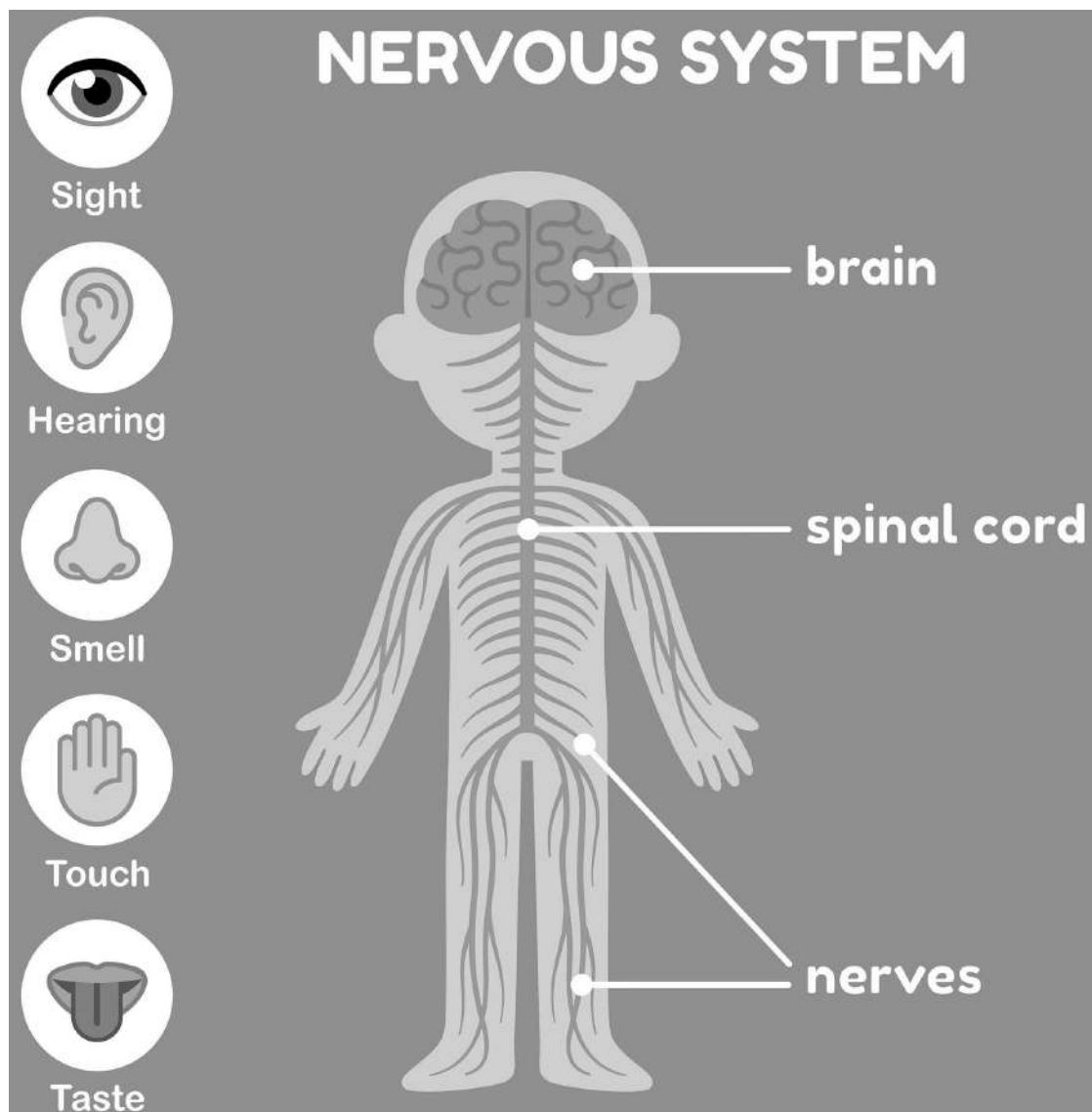
For each, if the clue is true about a suspect, circle their name. First, draw a line through any clues that are not strong evidence. Then review the strong evidence to make a claim about the who stole the last cookie.

Clue				
1. The cookie eater has light hair.	Anna	Mary	Dan	Spot
2. The cookie eater looked hungry.	Anna	Mary	Dan	Spot
3. The cookie eater was happy.	Anna	Mary	Dan	Spot
4. The cookie eater can run really fast.	Anna	Mary	Dan	Spot
5. The cookie eater is smart.	Anna	Mary	Dan	Spot
6. The cookie eater had ball.	Anna	Mary	Dan	Spot
7. The cookie eater was wearing something black.	Anna	Mary	Dan	Spot

MY CLAIM: _____ ate the last cookie.

Finding Information

Look at the poster. Then answer the questions.



What is the poster about?

How many inside body parts are labeled?

What do the circle icons tell you?

Name _____

Date _____

Activity Page 12

Use with Lesson 12

Spotting Patterns

Look for things with patterns. Draw what you find.

Draw a pattern in nature.

Draw a pattern in something made by people.

Draw a pattern in something that you do.

Name _____

Date _____

Activity Page 13

Use with Lesson 13

Cause, Effect, Problem, and Solution

Fill in the blanks. Draw or write possible causes, effects, problems, or solutions. The first one is done for you.

CAUSE	EFFECT	PROBLEM	SOLUTION
pencil falling off table	broken pencil	inability to write	sharpen pencil
loose table leg	wobbly table	spilled milk	
woke up late		breaking school rule	set alarm clock
	playground fall	scraped knee	got a bandage and tied shoes
stormy weather	colder temperature		put on jacket

Name _____

Date _____

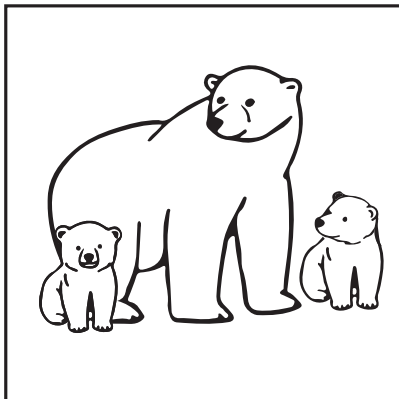
Activity Page 14

Use with Lesson 14

Quantities

Circle the pictures where you can count an exact quantity.

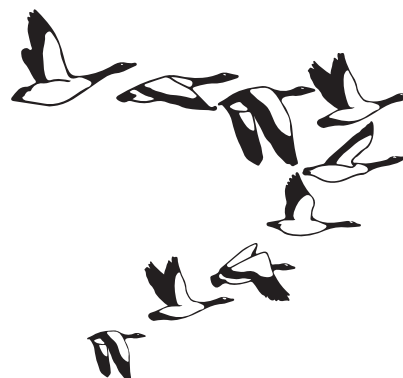
Polar bears



Wildflowers



Geese



Bees



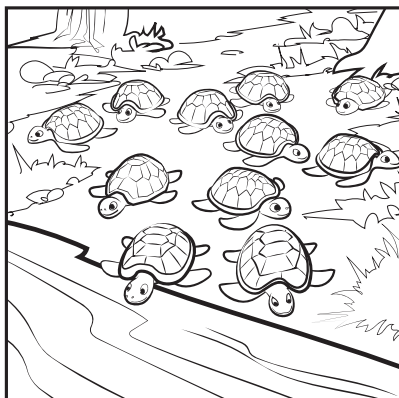
Eggs



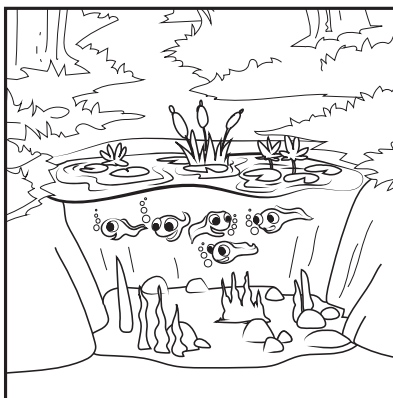
Wolf cubs



Turtles



Tadpoles



Giant redwood trees



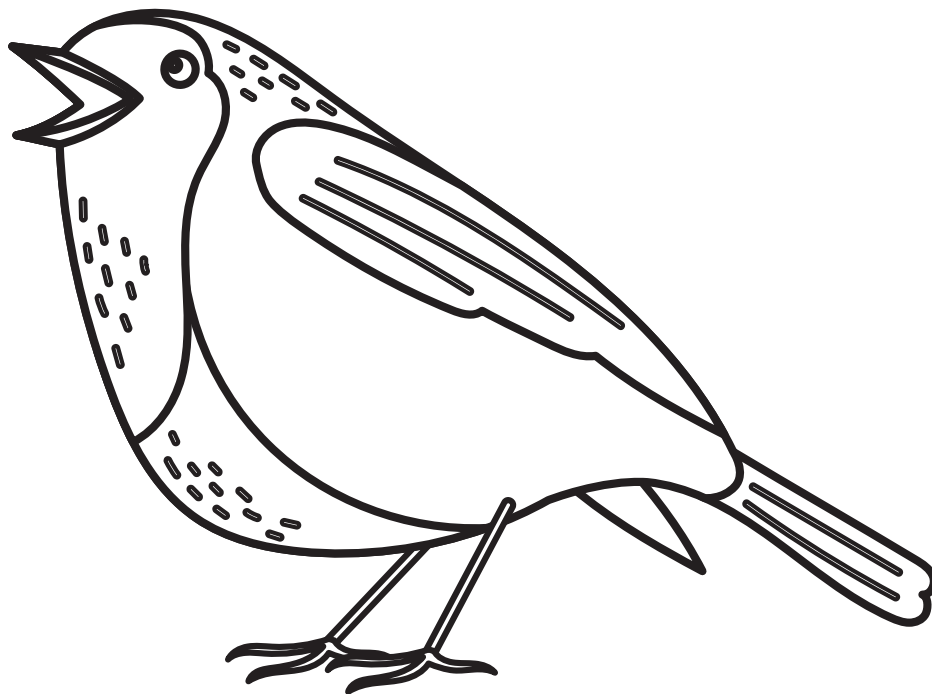
Name _____

Date _____

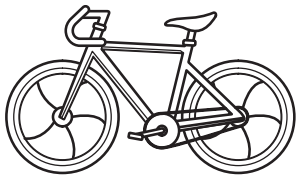
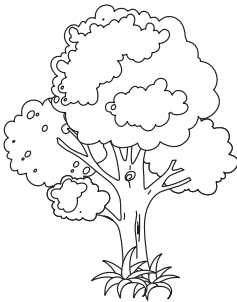
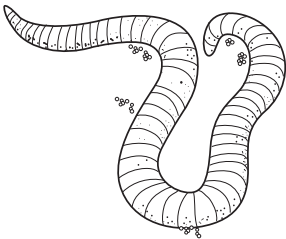
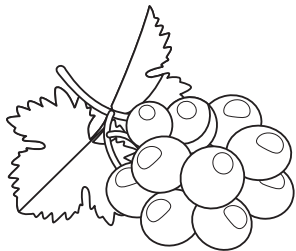
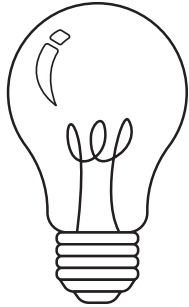
Activity Page 15

Use with Lesson 15

System Parts



Circle the pictures that are part of a system for robins that live in the wild.

Bicycle 	Tree 	Worm 	Bed 
Berries 	Sand 	Small pond 	Light bulb 

Name _____

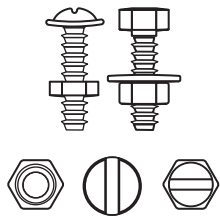
Date _____

Activity Page 16

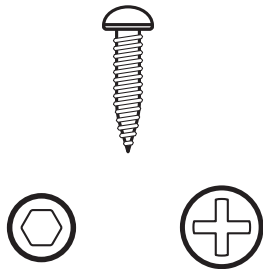
Use with Lesson 16

Fast Fasteners

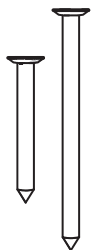
Find objects built with these types of fasteners. Write about or draw what you find.



Nuts and bolts



Screws



Nails

Name _____

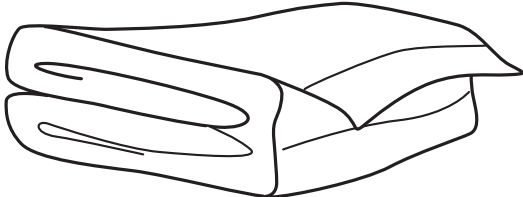
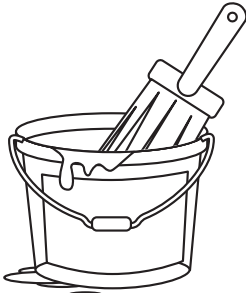
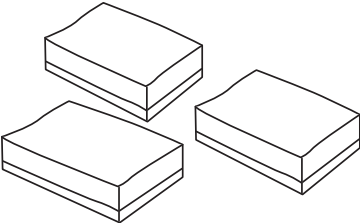
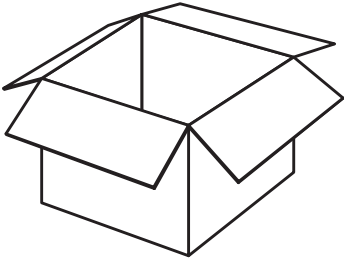
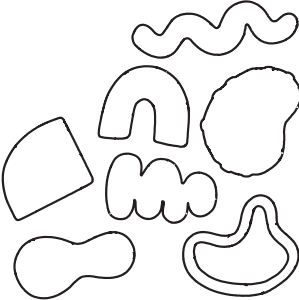
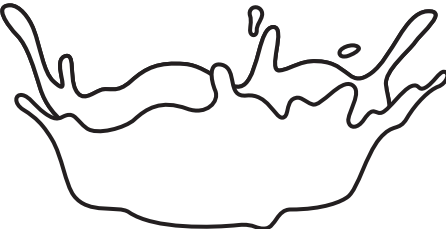
Date _____

Activity Page 17

Use with Lesson 17

Types of Materials

Circle the materials that are liquids in the collection below.

 Fabric	 Paint
 Glue	 Foam blocks
 Cardboard	 Clay
 Elastic bands	 Water

Name _____

Date _____

Activity Page 18

Use with Lesson 18

Change or No Change

Draw something that changes.

Now draw something that changes more slowly than your top picture.

Draw something that doesn't change.

Name _____

Date _____

Problems and Solutions

Draw each problem and solution. Then draw a line to match each problem in the natural world to a solution.

Problem	Solution
rainy day	flashlight
sunny day	warm jacket
fire	sunglasses
snowy day	fire extinguisher
dark night	umbrella

Answer Key: Science for Everyone

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.

What Would You Do? (AP 1) **(page 176)**

Correct order of images: 1, Be curious. Ask a question. 2, Talk to others about your question. 3, Plan how to answer your question. 4, Compare your results with those of others.

A Few of My Favorite Things (AP 2) **(page 177)**

Make sure students are accurately classifying things that they find nature and human-made things.

Practice Measuring (AP 3) **(page 178)**

Ensure that students are including a drawing, a measurement made with a ruler or scale, and correct units.

Questions to Investigate (AP 4) **(page 179)**

Circled questions: 1, 3, 5, 6

Mária Telkes—Connect the Ideas! (AP 5) **(page 180)**

Circle: ask a question, build a model, draw a diagram, use sunlight; Rectangles: cook food, clean drinking water, warm a house

Fix This Mix-Up! (AP 6) **(page 181)**

Step 1: Giving plants water and soil; Step 2: Labeling plants Sunny and Shady; Step 3: Moving plants to windowsill; Step 4: Making observations

My, How You Grow! (AP 7) **(page 182)**

Fifth year length prediction: 50 inches. Responses should indicate that they can find Allie and measure his length.

Sort It Out (AP 8) **(page 183)**

Quantity cards: animals drinking, measuring person's back, two girls measuring height, taking temperature

Quality cards: mountain landscape, sun setting, many flowers in a field, trees with sunlight breaking through

Problem-Solving Invention (AP 9) **(page 184)**

The drawing should be indicative of a back scratcher. The materials should be whatever is used to make the back scratcher. The final drawing should show the back scratcher being used.

Cookie Mystery (AP 10) **(page 185)**

Lines should be through clues 2,3,4,5. Clue 1: circles around Dan and Spot; Clue 6: circles around Dan and Spot; Clue 7: circle around Dan. Claim: Dan stole the last cookie.

Finding Information (AP 11) **(page 186)**

The poster is about the nervous system. Three inside body parts are labeled. The circle icons tell you the senses that the nervous system controls.

Spotting Patterns (AP 12) **(page 187)**

Possible answers: Patterns in nature may include shapes of leaves, shapes of shells or rocks. Human-made patterns may be lines on a road, shapes of buildings. A pattern in something that you do might be brushing teeth, going to school each day, walking in lines to places.

Cause, Effect, Problem, and Solution (AP 13) **(page 188)**

Row 1: fix table leg/clean up milk; Row 2: tardy to school; Row 3: shoes were untied; Row 4: no jacket

Quantities (AP 14)
(page 189)

Look for circles around polar bears, geese, eggs, wolf cubs, and turtles

System Parts (AP 15)
(page 190)

Look for circles around tree, worm, berries, and small pond

Fast Fasteners (AP 16)
(page 191)

Possible answers: Some objects with nuts and bolts include desks, lamps, or chairs. Objects with screws include windows, doors, tables or desks. Objects with nails include tables or desks, shelves, or bed frames.

Types of Materials (AP 17)
(page 192)

Look for circles around paint, glue, and water.

Change or No Change (AP 18)
(page 193)

The first drawing should be anything that changes. Make sure that the second drawing is of something that changes more slowly than the first thing and that the third drawing is of something that doesn't change.

Discovery or Invention (AP 19)
(page 194)

Look for circles around the children in a box and the child being pushed in a box. Look for squares around the windows, tables, and toys. Drawings should show a new invention using cardboard boxes.

Problems and Solutions (AP 20)
(page 195)

rainy day, umbrella; sunny day, sunglasses; fire, fire extinguisher; snowy day, warm jacket; dark night, flashlight

Glossary

Purple words and phrases are Core Vocabulary in the lessons, though in Grade 1 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.

A

accidental, adj. not happening or done on purpose

amount, n. the total number or quantity

aquarium, n. a place where aquatic organisms are kept and exhibited

B

bolts, n. metal rods or pins used along with nuts to fasten objects together

C

caption, n. a comment that explains a picture or image

cardboard, n. a thick paperlike material

cause, n. the reason that something happens

change, v. to become different

claim, n. a statement of something one believes to be true

count, v. to tally the number of units

curious, adj. a desire to investigate and learn

D

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

design, v. to plan how to arrange or construct a solution

diagram, n. a picture that relates how something functions

diorama, n. an exhibit that displays figures and lifelike details in miniature

discovery, n. something newly found

E

effect, n. a change that happens because of a cause

engineer, n. a person who uses science to design solutions to problems, especially by constructing tools or devices

estimate, v. to guess at a quantity without taking a precise measurement

evidence, n. a detail that supports a claim or helps prove an idea is true

exact, adj. correct in every detail; very accurate or precise

experiment, n. a scientific process used to test an idea or determine something

F

fabric, n. a material that is like cloth

fastener, n. a hardware device that joins two or more objects together

flexible, adj. to have the ability to bend or move a muscle easily

G

graph, n. a diagram that shows how information is related

H

header, n. a title

human-made, adj. created or constructed by humans and not directly from nature

I

information, n. knowledge or facts that are given or received

invention, n. something humans create that didn't exist before

investigate, v. to observe and study something to collect information

investigation, n. an instance of investigating

L

length, n. a measurement that identifies the distance between two points

light, n. a natural source of illumination that makes things visible

liquid, n. matter that does not have its own shape but retains its volume

M

material, n. the physical matter something is made of

measure, v. to quantify by time, distance, volume, or mass

model, n. a representation of something that can help people learn about the real thing

N

nails, n. slender metal objects that are pointed at one end and flat on the other and are used for fastening one or more objects to each other

natural, adj. based on or existing in nature

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

notice, v. to see and pay attention to something

nuts, n. blocks of metal with a hole in the center that are used to secure bolts

O

observation, n. a noted detail

observe, v. to notice details about something

opinion, n. a belief about something that cannot be proven with factual evidence

P

parts, n. individual pieces that something or a system can be made up of

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

penicillin, n. a medicine that fights infections and illnesses

predict, v. to say that something is expected to happen

prediction, n. a declaration of an expected outcome

problem, n. a want or need that requires a solution

process, n. a series of actions or steps taken in order to achieve a particular end

Q

quality, n. a description or characteristic of something

quantity, n. the amount or number of a thing

question, n. an expression for the purpose of inquiring or looking for a reason or explanation

R

represent, v. to stand for or mean something else

resource, n. a material that is used to gain information

results, n. the outcome of something

rivets, n. metal fasteners with a head at one end that join pieces together

S

same, adj. identical or similar to another

science, n. a system of knowledge and investigation to determine the truth and physical laws governing phenomena

scientist, n. a person who investigates using scientific methodology

screws, n. metal fasteners with a long wedge spiraled around a central rod, the rotation of which pulls the device into a solid material

solar, adj. having to do with the sun

solid, n. matter that keeps its own size and shape without a container

solution, n. a process, action, or device that fixes a problem

sound, n. vibration detected by the sense of hearing

stable, adj. not changing, enduring

system, n. a group of things that work together and affect each other

T

terrarium, n. a closed container with soil, plants, and air in it

traits, n. characteristics or quality that may be physical or behavioral

U

useful, adj. helpful for a specific purpose

W

weight, n. a measurement that describes how heavy something is

working model, n. life-size replica of a machine that can perform the same work as the machine itself

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 Literacy 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 media 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

.....

Strategies for Acquiring Materials

The materials used in the Core Knowledge Science Literacy 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

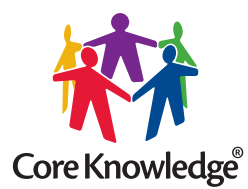
Ways to Engage with Your Community

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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Core Knowledge **SCIENCE™**

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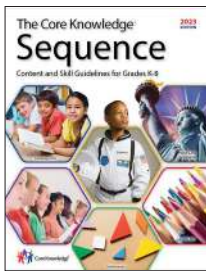
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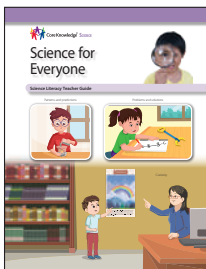
CKSci™ Core Knowledge SCIENCE™

Science for Everyone Core Knowledge Science 1



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 Grade 1 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.

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