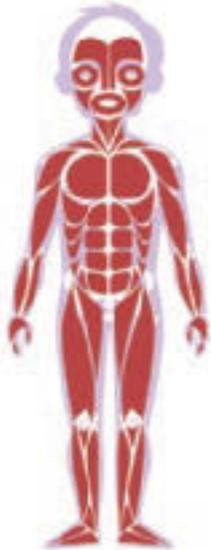


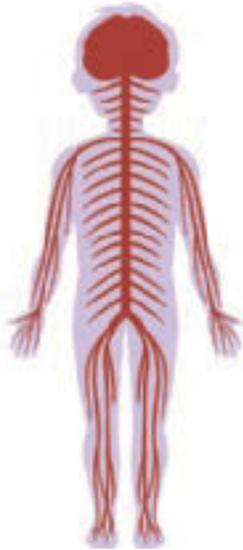
Human Body Systems



Teacher Guide



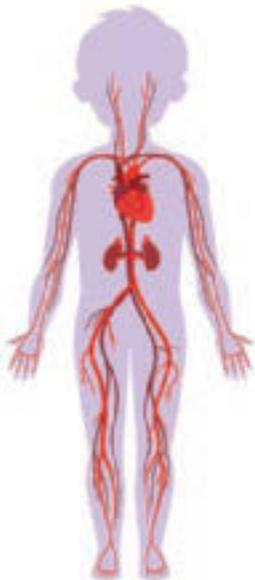
muscular system



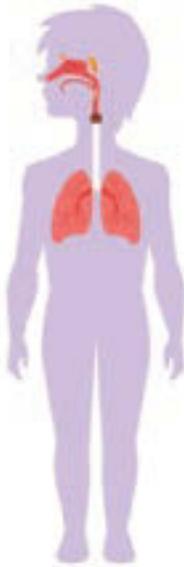
nervous system



skeletal system



circulatory system



respiratory system



nutrition

Human Body Systems

Teacher Guide



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Human Body Systems

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Human Body Systems

Teacher Guide

Core Knowledge Science™ 1

Introduction

ABOUT THIS UNIT

The Big Idea

This unit focuses on the scientific concept behind the human body and how the body works to allow it to move and perform.

Students understand that their bodies allow them to do many things, such as moving and breathing. What students may not realize is that their bodies are made up of several systems that do different jobs but work together to allow their bodies to function. Students probably are not familiar with how and where the different body systems interact and how each system works to enable people to carry out all human activities.

In this unit, students will identify several body systems, including the skeletal, muscular, respiratory, circulatory, and nervous systems. Students will explore the different organs that are part of each system. Students will also investigate how these systems work in their own bodies.

In this unit, students investigate the human body to answer a question. Students will further explore the human body in Grade 2 Unit 5 *Human Cells and Digestion*.

Note to Core Knowledge Teachers

Thanks to ongoing research in the field, our understanding of how children learn continues to evolve. In the subject area of science, students benefit not just from reading about concepts and ideas, but from hands-on experiences. Following the release of the Next Generation Science Standards (NGSS), the Core Knowledge Foundation used this opportunity to update and enhance the science portion of the *Core Knowledge Sequence*.

While there have been some shifts in the grade levels at which certain topics are recommended, the fundamental principles of pedagogy inherent to the Core Knowledge approach, such as the importance of building a sequential, coherent, and cumulative knowledge base, have been retained.

Although the NGSS guidelines do not reference teaching about the human body, the Core Knowledge Foundation considers student knowledge of this topic, and health, an important part of students' instruction and learning. As a result, this unit can be used in conjunction with the other CKSci units at this grade level or on its own.

Online Resources



To learn more about the changes and to access resources for this unit, please use the links found in the Online Resources Guide.

www.coreknowledge.org/cksci-online-resources

This science unit embodies Core Knowledge’s vision of best practices in science instruction and knowledge-based schooling, such as the following:

- building students’ knowledge of core ideas in life, physical, and Earth sciences, as well as engineering design;
- developing scientific practices that give students’ firsthand experience in scientific inquiry, engineering, and technology; and,
- connecting scientific learning to concepts across various disciplines, such as mathematics and literacy.

Related NGSS Dimensions*

This unit, *Human Body Systems*, provides the opportunity to further reinforce the following NGSS Dimensions.

Science and Engineering Practices:

- Asking questions (for science) and defining problems (for engineering)
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence

Crosscutting Concepts:

- Cause and effect
- Structure and function

Online Resources



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

www.coreknowledge.org/cksci-online-resources

*NEXT GENERATION SCIENCE STANDARDS (NGSS) is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards were 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.

What Students Should Already Know

The concept of progressions, articulated in the National Research Council's *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*, is very much aligned to the Core Knowledge principle of building new knowledge on prior knowledge. According to the NRC, students build “progressively more sophisticated explanations of natural phenomena” over the course of many years of schooling. “Because learning progressions extend over multiple years, they can prompt educators to consider how topics are presented at each grade level so that they build on prior understanding and can support increasingly sophisticated learning.” In schools following NGSS recommendations, teachers can build on the “prior understandings” captured in the following summaries of NGSS Disciplinary Core Ideas:

LS1.A: Structure and Function

- In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.

LS1.D: Information Processing

- Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (MS-LS1-8)

What Students Need to Learn

For this unit, the *Core Knowledge Science Sequence* specifies the following content and skills. Specific learning objectives are provided in each lesson throughout the unit.

Lesson 1: Graceful Grace

- Observe, experience, and describe variations in human motion.

Lesson 2: Bones

- Identify and describe parts of the skeletal system.
- Summarize the functions of the skeletal system.

Lesson 3: Muscles

- Identify and describe parts of the muscular system.
- Summarize the functions of the muscular system.

Lesson 4: Breathing

- Identify and describe parts of the respiratory system.
- Summarize the functions of the respiratory system.

Lesson 5: Pumping Blood

- Identify and describe parts of the circulatory system.
- Summarize the functions of the circulatory system.

Lesson 6: Body Control

- Identify and describe parts of the nervous system.
- Summarize the functions of the nervous system.

Lesson 7: Science in Action: Physiologists and Anatomy

- Identify careers that help people move their bodies for safety and strength.
- Describe technologies that support adaptive movement and fight diseases that limit the ability to move.

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, as well as connections to relevant math and reading language arts standards.

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

USING THE STUDENT BOOK

Student Book



The *Human Body Systems* Student Book includes seven chapters, intended to be read aloud by the teacher as the students look at images on each page.

As you will note when you examine the Student Book, minimal 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 CKSci lessons is to build students’ understanding and knowledge of science concepts, as well as of associated practices and skills. It is for this very reason that in Grades K–2 CKSci, the core content of each lesson is reinforced to students 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 text 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.

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

USING THE TEACHER GUIDE

Pacing

The *Human Body Systems* unit is one of five units in the Grade 1 CKSci series. We encourage teachers who are using the full series to complete all units during the school year. Each Core Lesson requires thirty to forty-five minutes of instruction time. The time it takes to complete a full lesson depends on class size and individual circumstances. Each lesson concludes with a Check for Understanding, providing the teacher with an opportunity for formative assessment.

At the end of this unit Introduction, you will find a blank Pacing Guide on page 10, which you may use to plan how you might pace the lessons, as well as when to use the various other resources in this unit. We strongly recommend that you preview the unit in full before beginning and create your pacing guide before teaching the first lesson. As a general rule, we recommend that you spend no more than ten days teaching *Human Body Systems* unit so that you have time to teach the other units in the Grade 1 CKSci series.

If you are familiar with the previous units at this grade level, you may notice that this unit differs slightly in organization from the NGSS units in the CKSci program. Lessons in the NGSS CKSci units are comprised of multiple segments that build to students’ demonstration of a complex Performance

Expectation. Because *Human Body Systems* is not designed to support any specific NGSS Performance Expectation, the instructional episodes are not grouped into multipart lessons. As such, they are identified simply as *lessons* instead of *lesson segments*.

The Core Lessons

- Lesson time: Most Core Lessons constitute one classroom session of thirty to forty-five minutes. Some lessons cover two or three days of instruction. Some single-day activities and performance tasks might require setting aside a longer block of time.
- Lesson order: The lessons are coherently sequenced to build from one to the next, linking student engagement across lessons and helping students build new learning on prior knowledge.

Unit Big Question: What goes on in a gymnast's moving body?		Lesson Questions
Lesson 1	Graceful Grace (two class sessions)	What movements can we make our bodies perform?
Lesson 2	Bones (two class sessions)	What are bones, and how do they work inside the body?
Lesson 3	Muscles	What are muscles, and how do they work inside the body?
Lesson 4	Breathing	What body parts are used for breathing?
Lesson 5	Pumping Blood	What body parts move blood through the body?
Lesson 6	Body Control (two class sessions)	What body parts control the body?
Lesson 7	Science in Action: Physiologists and Anatomy	Who helps athletes and other people stay safe and healthy?

Activity Pages

Activity Pages



AP 1.1
AP 2.1
AP 3.1
AP 4.1
AP 5.1
AP 6.1
AP 7.1

Black line reproducible masters for Activity Pages, as well as an Answer Key, are included in Teacher Resources on pages 51–58. The icon shown to the left appears throughout the Teacher Guide wherever Activity Pages (AP) are referenced.

Lesson 1—If I Were a Gymnast (AP 1.1)

Lesson 2—Connecting Bones (AP 2.1)

Lesson 3—What Happens to Muscles That Are Used a Lot? (AP 3.1)

Lesson 4—How Does My Breathing Change? (AP 4.1)

Lesson 5—What Do the Heart, Blood, and Blood Vessels Do? (AP 5.1)

Lesson 6—What's So Hard about Stacking Cups? (AP 6.1)

Lesson 7—Helping People Heal (AP 7.1)

Online Resources for Science

Online Resources



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

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

www.coreknowledge.org/cksci-online-resources

Teaching Strategies

Start with the familiar.

Lead with an experience. Begin each lesson with a demonstration, activity, or question about a phenomenon to engage students and focus their attention on the topic. Start with the familiar. Every science topic introduced to students relates in some way to their known world and everyday experiences. The purpose of every lesson is to build a bridge between what is familiar to students and broader knowledge about the way the world works.

Ask driving questions.

The unit is governed by a Big Question, and each lesson poses a more specific sub-question as students are introduced to new science content. Use these questions to engage students in conversation and help them think about how their own real-world experiences relate to the topic.

Encourage scientific thinking.

Approach the lessons with students not as learning about science but as learning about the world with a scientific mind. Science learning models science practice.

Throughout the lessons, encourage students to ask questions about what they observe, do, and read. Record relevant questions in a prominent place in the classroom. Guide students back to these questions as opportunities to answer them emerge from readings, demonstrations, and activities.

Use continuous Core Vocabulary instruction.

During instruction, emphasize Core Vocabulary terms and their meanings in context rather than relying on isolated drill for memorization of definitions. Through scaffolded questioning, encourage students to come up with definitions in their own words and to use the words in their own sentences.

Core Vocabulary words for each lesson, as well as Language of Instruction, other key terms teachers are encouraged to use in discussing topics with students, are provided at the start of each lesson. You can find Core Vocabulary and Language of Instruction definitions in the Glossary on pages 59–60.

Emphasize observation and experience.

Lessons employ various ways for students to learn, including watching, listening, reading, doing, discussing, and writing.

Use science practices.	Give students opportunities to discover new content knowledge through investigation and to use their new knowledge both in problem-solving exercises and as evidence to support reasoning. Students learn what science and engineering practices are by engaging in those same practices as they learn.
Make frequent connections.	Use a combination of demonstrations and reading materials, rich with examples, to help students recognize how the science concepts they are learning apply in their everyday lives. Prompt students to relate lesson content to their own experiences, to relate the new and unfamiliar to the familiar, and to connect ideas and examples across disciplines.
Monitor student progress.	Use verbal questioning, student work, and the Check for Understanding assessments at the end of each lesson to monitor progress during each lesson and to measure understanding at the conclusion of the unit. Many lessons provide tips to help you support students who need further explanations or clarifications.

Effective and Safe Classroom Activities

Online Resources



Conducting safe classroom demonstrations and activities is essential to successful elementary science education. The following resources provide Core Knowledge's recommendations for developing effective science classroom activities.

These resources, included at the back of the Teacher Guide on pages 61–65, consist of the following:

- Classroom Safety for Activities and Demonstrations
- Strategies for Acquiring Materials
- Advance Preparation for Activities and Demonstrations
- What to Do When Activities Don't Give Expected Results

These resources may also be accessed within the CKSci Online Resources Guide for this unit, available at

www.coreknowledge.org/cksci-online-resources

MATERIALS AND EQUIPMENT

The unit requires a large variety of materials to support various ways of learning (including doing, discussing, listening, watching, reading, and writing). Prepare in advance by collecting the materials and equipment needed for all the demonstrations and hands-on investigations.

- Roll paper, poster board, or a bulletin board should be dedicated at the beginning of the unit to serve as a question board to cumulatively document and return to student questions. The question board is referred to in the materials for lessons in which it is used but is not repeated in the materials listed here.
- Internet access and the means to project images/videos for whole-class viewing are also required in many lessons but are not repeated below.

Lesson 1 Graceful Grace

- timer
- 48-inch-wide roll of craft or butcher paper (1 48-inch-long piece per student)
- pencils (1 per student)
- rubber bands (1 per student)

Lesson 2 Bones

- 8.5 x 11-inch pieces of drawing paper (1 per student)
- 9 x 12-inch pinning boards, foam core boards, or pieces of corrugated cardboard (1 per student)
- pushpins (8 per student)
- scissors (1 per student)
- body outlines students made in Lesson 1 (1 per student)
- colored pencils, crayons, or markers (1 set per student)

Lesson 3 Muscles

- spring-hinged clothespins (1 per pair)
- timer
- body outlines students made in Lesson 1 (1 per student)
- colored pencils, crayons, or markers (1 set per student)

Lesson 4 Breathing

- timer
- body outlines students made in Lesson 1 (1 per student)
- colored pencils, crayons, or markers (1 set per student)

For Differentiation:

- paper lunch bag or balloon (1 per class)

Lesson 5 Pumping Blood

- plastic pitcher or bottle for pouring
- squeeze bottle of red food dye
- 8-ounce clear plastic cups (7)
- tray
- body outlines students made in Lesson 1 (1 per student)
- colored pencils, crayons, or markers (1 set per student)

For Differentiation:

- 8-ounce clear plastic cups (23)
- turkey baster
- cup of water

Lesson 6 Body Control

- heavyweight plastic stacking cups (4 sets of 10)
- stopwatch or stopwatch app
- body outlines students made in Lesson 1 (1 per student)
- colored pencils, crayons, or markers (1 set per student)

For Differentiation:

- 12 x 12 inch pieces of craft paper (1 per student)

Lesson 7 Science in Action: Physiologists and Anatomy

- body outlines students made in Lesson 1 (1 per student)
- scissors (1 per student)

HUMAN BODY SYSTEMS PACING GUIDE

_____’s Class

Note to Teacher: When using *Human Body Systems* as part of the Grade 1 CKSci series, this unit is intended to be taught as the fifth unit of Grade 1 CKSci.

Week 1

Day 1

Day 2

Day 3

Day 4

Day 5

--	--	--	--	--

Week 2

Day 6

Day 7

Day 8

Day 9

Day 10

--	--	--	--	--

Week 3

Day 11

Day 12

Day 13

Day 14

Day 15

--	--	--	--	--

UNIT 5

Human Body Systems

OVERVIEW

Big Question: What goes on in a gymnast's moving body?

Lessons	Lesson Questions	Advance Preparation
1. Graceful Grace (2 days)	What movements can we make our bodies perform?	Read Student Book, Chapter 1. Gather materials for demonstration.
2. Bones (2 days)	What are bones, and how do they work inside the body?	Read Student Book, Chapter 2. Gather materials for demonstration.
3. Muscles	What are muscles, and how do they work inside the body?	Read Student Book, Chapter 3. Gather materials for demonstration.
4. Breathing	What body parts are used for breathing?	Read Student Book, Chapter 4. Gather materials for demonstration.
5. Pumping Blood	What body parts move blood through the body?	Read Student Book, Chapter 5. Gather materials for demonstration.
6. Body Control (2 days)	What body parts control the body?	Read Student Book, Chapter 6. Gather materials for demonstration.
7. Science in Action: Physiologists and Anatomy	Who helps athletes and other people stay safe and healthy?	Read Student Book, Chapter 7. Gather materials for demonstration.

What's the Story?

Human body systems are parts of the body that carry out specific functions. These systems include organs and tissues that share a related function. While this unit only covers five body systems, there are eleven systems in the body.

In Lessons 1–7, students listen and read along with teacher Read Aloud of Student Book Chapters 1–7. Students identify the skeletal, muscular, respiratory, circulatory, and nervous systems. Reading about these body systems is reinforced by teacher demonstrations. Students further explore the different body systems through observations of their own body movements and through investigations in which they manipulate objects and materials.

LESSON 1

Graceful Grace

Big Question: What goes on in a gymnast's moving body?

Lesson Question: What movements can we make our bodies perform?

Tie to the Anchoring Phenomenon: This lesson introduces the unit storyline about a young gymnast named Grace. Students have the opportunity to learn what gymnasts can do and get ready to explore the body systems most involved in this sport.

AT A GLANCE

Learning Objective

✓ Observe, experience, and describe variations in human motion.

Instructional Activities (2 days)

- watching a video
- trying plank pose
- teacher Read Aloud
- class discussion
- preparing body outlines

Core Vocabulary

Core Vocabulary: Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

body

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

backbend flexible gymnast handstand

gymnastics

Instructional Resources

Student Book



Ch. 1

Student Book, Chapter 1
“Graceful Grace”

Activity Page



AP 1.1

Activity Page
If I Were a Gymnast (AP 1.1)

Materials and Equipment

Collect or prepare the following items:

- timer
- 48-inch-wide roll of craft or butcher paper (1 48-inch-long piece per student)
- pencils (1 per student)
- rubber bands (1 per student)
- internet access and the means to project images/video for whole-class viewing

THE CORE LESSON 1

Day 1: 1. Introduce the Big Question.

Online Resources



Share the Big Question with your class—**What goes on in a gymnast’s moving body?** Display this question where students can refer to it throughout the unit. Explain to students that a gymnast is a person who practices the sport of gymnastics, including movements on a balance beam and flipping and twisting during floor routines. (See **Know the Science.**)

Tell students that many gymnasts begin training when they are very young. Show students a video of a gymnastics class for children, and have them identify the movements made.

Then show students a video of an Olympic-level gymnastics floor competition. Have students describe the movements the gymnast makes with their body.

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

www.coreknowledge.org/cksci-online-resources

Know the Science

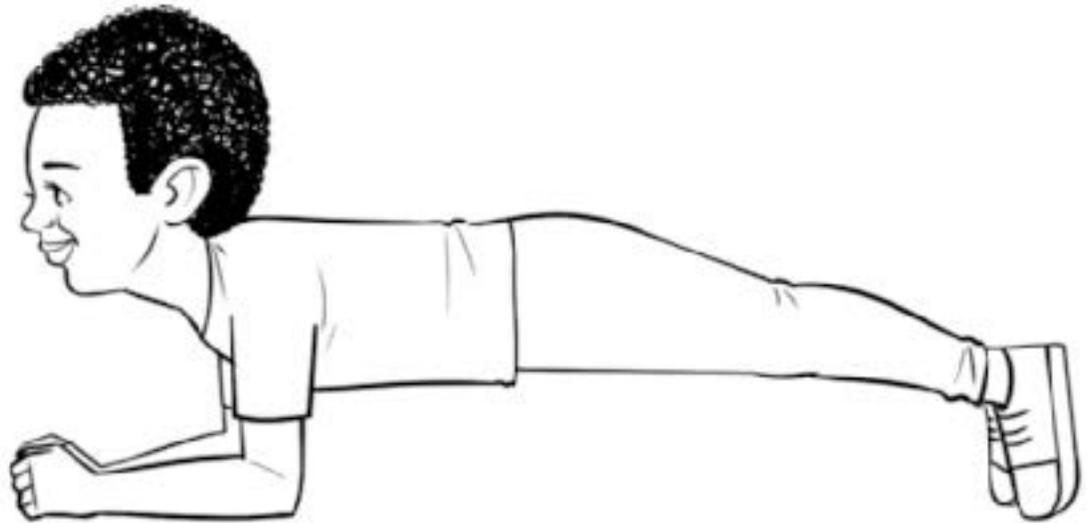
TEACHER DEVELOPMENT

How Demanding Is Gymnastics? The sport of gymnastics includes many different events. In the Olympics, the men’s events are the floor exercise, horizontal bars, parallel bars, pommel horse, rings, and vault. The women compete in the floor exercise, balance beam, uneven bars, and vault. Gymnastics is considered by many scientists to be the most physically demanding of all sports. It requires balance, core strength, arm and leg strength, flexibility, and endurance. Overuse injuries are common. Unlike many other sports, short stature is an advantage, allowing the gymnast—with most of their weight very close to their axis of rotation—to more easily rotate in the air.

2. Focus student attention on the Lesson Question.

In what ways can we make our bodies move? Explain to students that gymnasts have to have very strong muscles in their tummy area (abdominal, pelvic, and back muscles) and that one way to strengthen this part of their body is by practicing the plank pose.

Have students perform the modified plank pose on the floor of your classroom or gymnasium, resting on their forearms and keeping their backs straight, as shown in the image. Remind students to breathe steadily while they hold the pose. Once students know how to do plank pose, time them to see if they can hold it for thirty seconds.



Differentiation

SUPPORT—Students with strong cores and upper bodies may want to try the full plank pose, in which their arms are straight and they rest only on their hands. Students with physical disabilities can substitute any appropriate strength pose or movement, such as bicep curls holding filled water bottles for weights.

Ask, How did your body feel holding the plank pose?

» It felt tired and shaky, and I was out of breath.

Explain that if students practice the pose every day for a few weeks, their bodies will get stronger and they will be able to hold the plank pose longer.

Have students suggest answers to the Lesson Question.

3. Read together: “Graceful Grace.”

Student Book



Ch. 1

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 teachers and parents can read it when sharing the Student Book with students.

Read Aloud Support

Pages 2–3

Differentiation

Ask students to turn to pages 2–3 of the Student Book and look at the images as you read aloud. Remind them that the title of this chapter is “Graceful Grace,” and tell them to pay special attention to how Grace can move her body as you read.

LITERAL—What did Grace share on show-and-tell day?

- » She showed the class how she does a backbend.

INFERENTIAL—Why is Grace proud to show how she can do a backbend?

- » It was difficult for her to learn, and not everyone can do it.

EXTEND—Ask students to think about why the author called this chapter “Graceful Grace.” Explain how repeating sounds in a phrase creates rhythm that makes it fun to listen to the story. Also point out that when you say someone moves their body with grace, it means that their body movements are smooth and easy. (See **Know the Standards.**)

Pages 4–5

Differentiation

Ask students to turn to pages 4–5 of the Student Book and look at the images as you read aloud.

LITERAL—Why is it harder to do a handstand than it is to stand on your legs and feet?

- » Holding the body up with arms and hands is harder because those body parts are not as strong as legs and feet.

SUPPORT—Make sure students understand the meaning of the word *flexible*. Show students how to flex their index fingers, and explain that things that are flexible can bend easily.

Know the Standards

TEACHER DEVELOPMENT

Language Arts Connection: The alliteration used in the chapter title, “Graceful Grace,” is a writing technique students will become more familiar with in Grade 2 as they develop Craft and Structure skills such as, *Describe how words and phrases (e.g., regular beats, alliteration, rhymes, repeated lines) supply rhythm and meaning in a story, poem, or song.* (ELA RL.2.4)

CORE VOCABULARY—Explain that your **body** is all the parts that make up you. Tell students to hold their arms over their heads. Explain that all of the parts between their fingertips and their toes are part of the body.

INFERENTIAL—What are some other reasons it is hard to do a handstand?

» Your head is upside down, and it could make you dizzy

Day 2: 1. Begin a model of the human body.

Arrange students into pairs, and give each student a large sheet of craft paper. Have one student lie on the paper and the other student trace the outline of their body in pencil. Then have students switch places.

Have students roll up their sheets of paper, put a rubber band around them, and write their names on the rolls.

Explain that students will record what they learn about what is inside their bodies as they complete each lesson in this unit.

2. Check for understanding.

Activity Page



AP 1.1

Return to the Lesson Question. **Ask**, What movements can we make our bodies perform?

» Sample answer: plank pose, jumping, running, backbends, handstands, flips

Formative Assessment

Online Resources



Distribute If I Were a Gymnast (AP 1.1), and have students follow the directions to draw themselves moving like a gymnast and write about it. Use this exercise as an opportunity to make sure students understand how a gymnast moves and how it requires strong body parts.

Monitor Progress
Differentiation

See the Activity Page Answer Key for sample student responses.

CHALLENGE—Challenge students to follow along with a video dance tutorial. Have students demonstrate what they learn for the rest of the class and explain the body movements involved in the dance.

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

www.coreknowledge.org/cksci-online-resources

LESSON 2

Bones

Big Question: What goes on in a gymnast's moving body?

Lesson Question: What are bones, and how do they work inside the body?

Tie to the Anchoring Phenomenon: As students learn about the skeletal system in this lesson, have them think about how Grace uses her skeleton to do gymnastics, including for holding poses such as backbends and handstands, which require strong bones and flexible joints.

AT A GLANCE

Learning Objectives

- ✓ Identify and describe parts of the skeletal system.
- ✓ Summarize the functions of the skeletal system.

Instructional Activities (2 days)

- teacher Read Aloud
- class discussion
- mapping hand bones
- building a model skeleton
- drawing on body outlines

Core Vocabulary

Core Vocabulary: Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

bend **bone** **joint** **movement**
skeleton **skull** **stiff**

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

organs **rib** **skeletal system** **system**

Instructional Resources

Student Book



Ch. 2

Student Book, Chapter 2
“Bones”

Activity Page



AP 2.1

Activity Page
Connecting Bones (AP 2.1)

Materials and Equipment

Collect or prepare the following items:

- 8.5 x 11-inch pieces of drawing paper (1 per student)
- 9 x 12-inch pinning boards, foam core boards, or pieces of corrugated cardboard (1 per student)
- pushpins (8 per student)
- scissors (1 per student)
- body outlines students made in Lesson 1 (1 per student)
- colored pencils, crayons, or markers (1 set per student)

THE CORE LESSON 2

Day 1: 1. Focus student attention on the Lesson Question.

What are bones, and how do they work inside the body? Invite students to share what they know about bones and what jobs they do. Accept all reasonable answers. (See **Know the Science 1.**)

Have students practice the plank pose they learned in Lesson 1. Remind students that if they practice the pose every day for a few weeks, their bodies will get stronger and they will be able to hold the plank pose longer.

Ask, How do you think bones help you hold the plank pose?

» They keep my body straight, and they hold up my body.

2. Read together: “Bones.”

Student Book



Ch. 2

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 teachers and parents can read it when sharing the Student Book with students.

Know the Science

TEACHER DEVELOPMENT

1. What Are the Functions of the Skeletal System? The skeletal system interacts with other human body systems in numerous ways. It works with the muscular system so humans can stand up. It is necessary for body movement. It also protects soft internal organs, such as the brain, spinal cord, lungs, and heart, from injury. Bones also store minerals and fats that are essential for other body functions and release them into the bloodstream. Finally, bones manufacture red blood cells, white blood cells, and platelets.

Read Aloud Support

Pages 6–7

Differentiation

Ask students to turn to pages 6–7 of the Student Book and look at the images as you read aloud. Remind them that the title of this chapter is “Bones,” and tell them to pay special attention to how bones fit together so that Grace can move.

LITERAL—How is Grace bending her body in the picture on page 6?

» She is arching her back and bending one leg and two arms upward.

CORE VOCABULARY—Explain that, in this use of the word, **movement** is how a person changes the way they hold their body or changes the place their body is located. Point out that the photo of Grace shows that she has changed the way she holds her body but not where she is physically standing.

CORE VOCABULARY—Point out to students that when they **bend** an object, they take an object that is straight and make a curve in it or take a curved object and make it straight.

CORE VOCABULARY—Explain that a **joint** is a place where the body can bend. Have students touch both sides of their face where their jaw connects to their skull. **Ask**, What movements can you make at these two joints? (See **Know the Science 2**.)

» open the mouth by moving up and down, moving from side to side

CHALLENGE—Challenge students to locate and (if possible) name as many skeletal joints as they can. Remind students that joints are the areas of the body that bend. Some joints that students should identify include the elbows, knees, ankles, hips, shoulders, and jaw.

Pages 8–9

Differentiation

Ask students to turn to pages 8–9 of the Student Book and look at the images as you read aloud.

LITERAL—Which part of the skeleton protects your heart and lungs?

» the rib cage; breastbone

CORE VOCABULARY—Remind students that **bones** are hard structures and that they do not bend. They are **stiff** rather than flexible.

Know the Science

TEACHER DEVELOPMENT

2. What Are Joints? Joints are locations where bones meet. Socket joints at the shoulders and hips allow rotating motion while hinge joints at the knees and elbows only allow bending and straightening. These joints involve several kinds of living tissue. The ends of the bones that meet are covered in cartilage to reduce friction. Ligaments hold bones together. Tendons connect the bones to the muscles that initiate movement. A membrane surrounds the entire joint and holds a lubricating fluid. Some joints, such as those between skull bones, do not allow movement.

CORE VOCABULARY—Have students put their hands on their heads and work their way down to the tips of the toes, feeling the bones that make up their **skeleton**. Point out that their skeleton is also called the skeletal *system* because the bones work together to move and hold up the body.

CORE VOCABULARY—Have students feel their **skull** and notice that this bone is round in shape. (See **Know the Standards**.)

INFERENTIAL—What other bone is found in your head and is connected to the skull?

» the jawbone

SUPPORT—Have students answer the text question, *Can you count how many bones each finger has?* by using one hand to feel the individual fingers in their other hand. Then give each student a piece of drawing paper. Have students trace the outline of their hand with their fingers spread out. Next, have students draw on the outline where they think each individual bone is located in their hand.

Pages 10–11

Ask students to turn to pages 10–11 of the Student Book and look at the images as you read aloud.

LITERAL—Which foods have the calcium your bones need to grow? (See **Know the Science 3**.)

» milk or other dairy products, leafy vegetables

INFERENTIAL—How is the cast a doctor puts on your arm or leg like a bone in your body?

» It is hard, doesn't bend, and protects what's inside it.

Know the Standards

TEACHER DEVELOPMENT

CCC 6 Structure and Function: Structure and function is a major theme of this unit. In Grades K–2, students should understand that *The shape and stability of structures of natural and designed objects are related to their function(s)*. The stability of bones is related to their internal structure, which makes them rigid and able to support weight.

Know the Science

TEACHER DEVELOPMENT

3. Calcium-Rich Foods: The major source of dietary calcium for children in the United States is dairy products such as milk, cheese, and yogurt. Those who do not eat dairy usually get their largest amounts of calcium from calcium-fortified orange juice, soy milk, and breakfast cereals. In addition to these sources, certain vegetables contain calcium, though in smaller amounts per serving than the first two groups. These include spinach, turnip greens, kale, bok choy, and broccoli.

3. Make a model of bones and joints.

Activity Page



AP 2.1

Differentiation

Give each student a copy of Connecting Bones (AP 2.1). **Ask**, Which parts of the skeletal system do you recognize?

- » skull, rib cage, finger bones, foot bones, arms bones, leg bones

EXTEND—Though not identified in Chapter 2, some students may want to do some online research to identify the sternum, vertebrae, and hip bones. Point out that two of the arm and leg puzzle pieces have two bones in them—the lower arm bones are the ulna and radius, and the lower leg bones are the tibia and fibula.

- Distribute scissors, and have students carefully cut out the puzzle pieces on the dotted lines.
- Then distribute pinning boards. Guide students to arrange the puzzle pieces on the board so that the bones connect in the right places to make a skeleton.
- When students have made a skeleton, provide the eight pins. **SAFETY:** Remind students that the pinpoints are sharp and to only touch the heads.
- Show students how to overlap two puzzle pieces so that their pin dots are on top of one another and to push the pin through both pieces to affix them to the board.
- **Ask students**, How can you use your model to show how your skeleton moves?
 - » move the pieces connected to each pin
- **Ask**, What do the pins on your model represent in a real skeletal system?
 - » They represent joints.

Day 2: 1. Add the skeletal system to body outlines.

Differentiation

- Have students get out their traced body outlines and unroll them.
- Review the parts of the skeletal system that students have learned about, and have students draw them in the correct places on the outline. Show students how to use a pencil to lightly label the parts they know the names of.
- Have students think about the scale of each bone in proportion to the size of their body as a whole.

SUPPORT—If students are struggling with this task, do it as a whole-class activity. Begin by having all students draw the skull bones inside the head, giving hints such as, “The skull bones should fill most of your head.” Next, have students draw the neck and back bones, followed by the ribs, hip bones, arm bones, and leg bones.

2. Check for understanding.

Monitor Progress

Return to the Lesson Question. **Ask,** What are bones, and how do they work inside the body?

- » Bones are hard parts of the body that make up the skeleton. They hold up the body and help it move.

Formative Assessment

Have students stand, and review the rules for playing “Simon Says.” Lead the game by calling out the following commands. You may choose when or when not to use “Simon says . . .” before a command:

- Point to a bone in your arm.
- Point to your skull. (top of head).
- Point to a bone connected to your skull. (jaw or neck)
- Put your hands on a leg joint. (knee, hip, or ankle)
- Point to the bones that protect your lungs. (rib cage)

Instead of having students sit down when they make an error, ask them to correct themselves.

LESSON 3

Muscles

Big Question: What goes on in a gymnast's moving body?

Lesson Question: What are muscles, and how do they work inside the body?

Tie to the Anchoring Phenomenon: As students explore the muscular system in this lesson, connect their learning to how Grace uses her muscles in the sport of gymnastics, including learning how to safely do splits.

AT A GLANCE

Learning Objectives

- ✓ Identify and describe parts of the muscular system.
- ✓ Summarize the functions of the muscular system.

Instructional Activities

- teacher Read Aloud
- class discussion
- student investigation
- student drawing

Core Vocabulary

Core Vocabulary: Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

heart **muscles**

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

contract **flex** **muscular system** **relax**

skeletal muscles **stretch**

Instructional Resources

Student Book



Ch. 3

Student Book, Chapter 3
“Muscles”

Activity Page



AP 3.1

Activity Page
What Happens to Muscles That
Are Used a Lot? (AP 3.1)

Materials and Equipment

Collect or prepare the following items:

- spring-hinged clothespins (1 per pair)
- timer
- body outlines students made in Lesson 1 (1 per student)
- colored pencils, crayons, or markers (1 set per student)

THE CORE LESSON 3

1. Focus student attention on the Lesson Question.

What are muscles, and how do they work inside the body? Allow students to share what they know about muscles and how they function.

Have students continue to practice the plank pose they learned in Lesson 1.

Ask, Where are the muscles inside your body that are important for holding the plank pose?

» They are around my tummy and in my arms and legs.

2. Read together: “Muscles.”

Student Book



Ch. 3

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 teachers and parents can read it when sharing the Student Book with students.

Read Aloud Support

Pages 12–13

Differentiation

Ask students to turn to pages 12–13 of the Student Book and look at the images as you read aloud. Remind them that the title of this chapter is “Muscles,” and tell them to pay special attention to where muscles are in the body and how they give it shape.

CORE VOCABULARY—Make sure students understand that **muscles** are parts inside their bodies, some of which they can feel right below their skin. Point out that muscles are made of a stretchy material that can change shape.

SUPPORT—For students who are not sure where their muscles are located, have them flex one arm while using the other hand to feel the flesh between their elbow and shoulder. Explain that the body part that feels softer and then harder as they flex is a muscle called a *bicep*.

LITERAL—What does Grace do to make her muscles stronger?

- » She exercises; she practices gymnastics.

INFERENTIAL—How do muscles and the skeleton work together?

- » The bones hold up the muscles, and the muscles move the bones.

Pages 14–15

Differentiation

Ask students to turn to pages 14–15 of the Student Book and look at the images as you read aloud.

LITERAL—What pulls on bones to make them move?

- » muscles

SUPPORT—Have students feel their calf muscles contract and relax as they flex their foot by pointing their toes toward and away from their bodies.

LITERAL—How do muscles get stronger?

- » exercising them over and over again until they are tired and then letting them rest and recover

INFERENTIAL—Why do you think Grace might run and do push-ups and leg lifts often?

- » because these exercises make her muscles stronger so that she can do better at gymnastics

Pages 16–17

Ask students to turn to pages 16–17 of the Student Book and look at the images as you read aloud.

CORE VOCABULARY—Point out to students that the **heart** is a body part located deep inside the rib cage, where it is protected from injury. The heart is made of muscle that is always working—it constantly contracts and relaxes to pump blood through the body. (See **Know the Science.**)

INFERENTIAL—How does exercise affect the heart?

- » Exercise makes the heart stronger.

Know the Science

TEACHER DEVELOPMENT

Different Kinds of Muscles: Muscles are classified by their cellular structure and how they function. Most of the muscles in the body are a type of muscle called skeletal muscle, or *striated* muscle. These muscles are attached to bones by tendons and control body movements. They are called *voluntary* muscles because we choose when to use them. Smooth muscles, such as those that line the walls of the stomach, intestines, and blood vessels, are *involuntary* muscles. They work on their own. Heart muscle, also called *cardiac* muscle, works on its own as well, contracting in a steady rhythm that increases when the body needs more oxygen.

LITERAL—What happens to muscles that are used to lift weights?

- » They get stronger.

INFERENTIAL—If you want to learn gymnastics movements that stretch muscles, why is it important to work with a coach?

- » A coach can show you how to do the movement correctly without stretching too far and pulling your muscles.

3. Investigate and interpret data on muscle fatigue.

Activity Page



AP 3.1

Differentiation

- Give each student a copy of What Happens to Muscles That Are Used a Lot? (AP 3.1), and group students in pairs.
- Give a spring-hinged clothespin to each pair of students. Show students how to pinch the clothespin between the index finger and thumb to open and close it.
- Tell students they will squeeze the clothespin as many times as they can in two one-minute intervals.
- Start the timer. Have one partner record the number of squeezes made during the first minute and second minute in the table on the Activity Page.
- Then have students switch roles and repeat the investigation.
- Have students interpret the data in their charts and answer the questions on their Activity Page. (See **Know the Standards.**)

EXTEND—Have students carry out a related investigation using light weights, such as small filled water bottles, to test muscle fatigue in their upper arm (bicep) muscles. Show them how to do slow bicep curls and count the number of curls they can do before their arm muscles feel tired. Have students compare their left and right arms, too.

4. Add the muscular system to body outlines.

- Have students retrieve their traced body outlines and unroll them.
- Review the parts of the muscular system that students have just learned about.
- Distribute drawing materials.
- Have students refer to the illustration on Student Book page 13 and draw some basic muscles (abdominal muscles, arm muscles, leg muscles, and so on) in the correct places on the outline.

Know the Standards

TEACHER DEVELOPMENT

SEP 4 Analyzing and Interpreting Data: Scientific investigations such as this one yield data for students to analyze and interpret. Students in Grades K–2 are expected to record their observations in writing and then use their observations to identify patterns and relationships and answer questions.

5. Check for understanding.

Monitor Progress Differentiation

Return students' attention to the Lesson Question. **Ask**, What are muscles, and how do they work inside the body? Look for understanding of the following concepts in students' answers:

- Muscles are parts of the body.
- Many muscles attach to bones so they can move the body.
- Muscles work by contracting and relaxing.
- Exercise makes muscles tired but also strengthens them.
- The heart is also a muscle and pumps blood.

Have a student read the Big Question to the class. **Ask students**, Now that you have learned about the skeletal and muscular systems, how can you answer the question?

- » When a gymnast moves, their bones hold up their body, and the muscles move the bones into the positions they want.

CHALLENGE—Have interested students identify their favorite sporting events and do research to find out which muscles are most important for that sport. Students can interview a physical education teacher or coach, get a book from the library, or try an online search using keywords to find answers.

Formative Assessment

Collect Activity Page 3.1, and review the data table and answers to questions to determine if students understand that muscles can become tired from repeated use.

LESSON 4

Breathing

Big Question: What goes on in a gymnast's moving body?

Lesson Question: What body parts are used for breathing?

Tie to the Anchoring Phenomenon: Gymnastics routines vary in their demands on the respiratory system. The vault and balance beams do not require large intakes of oxygen, but the floor routines and uneven bars do. Throughout this lesson, have students think about when Grace needs to take in the most air.

AT A GLANCE

Learning Objectives

- ✓ Identify and describe parts of the respiratory system.
- ✓ Summarize the functions of the respiratory system.

Instructional Activities

- student investigation
- teacher Read Aloud
- class discussion
- student drawing

Core Vocabulary

Core Vocabulary: Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

air breathe lungs nose
throat windpipe

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diaphragm exhale inhale respiratory system

Instructional Resources

Student Book



Ch. 4

Student Book, Chapter 4
“Breathing”

Activity Page



AP 4.1

Activity Page
How Does My Breathing
Change? (AP 4.1)

Materials and Equipment

Collect or prepare the following items:

- timer
- body outlines students made in Lesson 1 (1 per student)
- colored pencils, crayons, or markers (1 set per student)

For Differentiation:

- paper lunch bag or balloon

THE CORE LESSON 4

1. Focus student attention on the Lesson Question.

What body parts are used for breathing? Draw a spider diagram for the class with the word *Breathing* in the middle. Invite students to share what they know about this topic. Write students’ ideas on the diagram.

Have students continue to practice the plank pose they learned in Lesson 1. Remind students to focus on breathing in and out while holding the pose for thirty seconds.

Ask, How does the plank pose affect your breathing?

- » Sample answer: When I started the pose, my breathing was slow, but as I held it longer, I had to breathe a little faster.

2. Investigate changes in breathing rate.

Activity Page



AP 4.1

- Give each student a copy of How Does My Breathing Change? (AP 4.1). Explain that students are about to investigate the question in the title. (See **Know the Standards.**)
- Have students follow the directions to sit quietly for one minute. Then use the timer while students count their own breaths for one minute. Remind students that a breath is one inhalation and one exhalation. Have students record their data in the chart.

Know the Standards

TEACHER DEVELOPMENT

SEP 3 Planning and Carrying Out Investigations: In this activity, students *Make observations (firsthand or from media) to collect data that can be used to make comparisons.* Emphasize the importance of all students following the directions in the same way and recording their observations accurately on the chart. This will make comparing the data on the charts fairer.

Differentiation

- Wait two more minutes while students sit and read or talk quietly. Then have students count their breaths again for one minute and record the count in the chart.
- Take students where they can do jumping jacks safely. Space students several feet apart. Have students do jumping jacks for one minute and then count their breaths in the minute that immediately follows. Then have students sit down, wait two more minutes, and count again. Make sure students record their data accurately.

SUPPORT—For students with disabilities that prevent them from doing jumping jacks, choose alternate exercises that will increase their breathing rates.

- Have students interpret the data in their charts to answer the question on the Activity Page.

EXTEND—If students have access to a pet in the classroom or at home, have them investigate the resting breathing rate of another species. First, students will have to observe the animal to identify whether they can see or feel it inhaling and exhaling. Then students can count the number of resting breaths in one minute. Record students' data on a graph, and have the class interpret the data, looking for patterns.

3. Read together: "Breathing."

Student Book



Ch. 4

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 teachers and parents can read it when sharing the Student Book with students.

Read Aloud Support

Pages 18–19

Differentiation

Ask students to turn to pages 18–19 of the Student Book and look at the images as you read aloud. Remind them that the title of this chapter is "Breathing," and tell them to pay special attention to how breathing changes based on activity level.

LITERAL—Why is Grace breathing so fast?

- » She worked very hard when she demonstrated some of her gymnastics skills.

INFERENTIAL—How is Grace's breathing pattern like what you found when you did an investigation of your own breathing?

- » Her breathing was faster when she exercised and slower when she rested, just like mine.

CORE VOCABULARY—Make sure students understand that **air** is a kind of matter that is invisible yet all around them. Explain that air is what the lungs take in every time students take a breath. It is the oxygen gas in the air that is important for the body, especially during exercising.

CORE VOCABULARY—Point out to students that they can **breathe** when they are surrounded by air but cannot breathe when they are surrounded by water. This is why people who spend a lot of time underwater use snorkels and scuba gear to get the air they need.

SUPPORT—Because air is invisible, it is understandable that some students may be skeptical that it exists. Blow into a lightweight paper lunch bag or balloon, and then tightly close it to trap the air. Allow students to feel the pressure from the air pushing on the sides of the bag or balloon. Then, let the air out, and have students feel it again. Talk about the evidence that air was present.

Pages 20–21

Differentiation

Ask students to turn to 20–21 of the Student Book and look at the images as you read aloud.

LITERAL—What happens when you inhale?

» I take fresh air into my lungs.

CORE VOCABULARY—Have students point to the **lungs** in the pictures. Then have them feel their rib cage. Remind them that rib bones protect their lungs from injury.

CORE VOCABULARY—Make sure students understand that their **nose** has two passageways that allow air to move into the **throat**.

CORE VOCABULARY—Use the illustration to point out that the **windpipe** is a tube that air moves through from the nose and throat to the lungs.

SUPPORT—Have students place their hands over both sides of their lower rib cage and then inhale and exhale. Students should be able to observe that their chest and stomach get bigger and smaller as they inhale and exhale.

INFERENTIAL—Explain that the diaphragm moves to allow the lungs to take in air and push out air. Point out that the diaphragm is a muscle. **Ask students**, Does this body part belong in the muscular system, the respiratory system, or both?

» both

Pages 22–23

Ask students to turn to pages 22–23 of the Student Book and look at the images as you read aloud.

LITERAL—When does your body need more air? When does it need less air? (See **Know the Science**.)

Know the Science

TEACHER DEVELOPMENT

Why Your Body Needs More Air When You Exercise: Your body uses oxygen from the air you breathe for the chemical reactions that release energy for cell use, including the contraction of muscle cells when you exercise. Because the body can only store small quantities of oxygen, vigorous exercise quickly depletes its oxygen supply. Then the respiratory system increases the rate at which it brings in oxygen. In addition, the heart must beat faster to move more oxygen through blood vessels to the cells that need it, especially the muscle cells involved in exercise.

- » It needs more air when I exercise and less when I sleep.

INFERENTIAL—Why do you think some people keep their mouths open when they are exercising?

- » because they can take in more air through their mouth and nose than just their nose alone

INFERENTIAL—Why do people sometimes wear masks when they go outside their homes?

- » They wear them to block germs from moving from one person to another and smoke from entering their body.

4. Add the respiratory system to body outlines.

- Have students retrieve their traced body outlines and unroll them.
- Review the parts of the respiratory system that students have just learned about.
- Distribute drawing materials. Have students refer to the illustration on Student Book page 21 and add parts of the respiratory system in the correct places on the outline. Suggest that students add small labels in pencil.
- **Ask students**, Which part of the muscular system should you also add to your drawing, and why?
 - » the diaphragm—because it helps the body inhale and exhale

5. Check for understanding.

Monitor Progress
Differentiation

Invite a volunteer to read the Lesson Question: **What body parts are used for breathing?** In a discussion, look for understanding of the following:

- The nose, throat, windpipe, lungs, and diaphragm are body parts needed for breathing.
- These parts work together to bring fresh air into the body and get rid of old air.
- The body needs more air when it exercises than when it is resting.

Review the spider diagram the class made at the beginning of the lesson. Have students suggest changes they would make based on what they have learned.

Have a student read the Big Question to the class. **Ask students**, Now that you have learned about the respiratory system, how would you answer the question?

- » Sample answer: Air goes in their nose or mouth, through the throat and windpipe, and into their lungs. Old air goes out of the body through the same parts.

Formative Assessment

Collect Activity Page 4.1. Review the data table and answers to the questions to determine if students understand that the rate of breathing changes when the body needs more air during exercise or less air when it is at rest.

LESSON 5

Pumping Blood

Big Question: What goes on in a gymnast's moving body?

Lesson Question: What body parts move blood through the body?

Tie to the Anchoring Phenomenon: Throughout this lesson, encourage students to think about when Grace's heart beats faster and slower as she participates in her gymnastics class.

AT A GLANCE

Learning Objectives

- ✓ Identify and describe parts of the circulatory system.
- ✓ Summarize the functions of the circulatory system.

Instructional Activities

- student investigation
- teacher Read Aloud
- class discussion
- student drawing

Core Vocabulary

Core Vocabulary: Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

blood **blood vessels** **heart** **heartbeat**

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

artery **circulatory system** **pulse** **vein**

Instructional Resources

Student Book



Ch. 5

Student Book, Chapter 5
“Pumping Blood”

Activity Page



AP 5.1

Activity Page
What Do the Heart, Blood, and
Blood Vessels Do? (AP 5.1)

Materials and Equipment

Collect or prepare the following items:

- plastic pitcher or bottle for pouring
- squeeze bottle of red food dye
- 8-ounce clear plastic cups (7)
- tray
- body outlines students made in Lesson 1 (1 per student)
- colored pencils, crayons, or markers (1 set per student)

For Differentiation:

- 8-ounce clear plastic cups (23)
- turkey baster
- cup of water

Advance Preparation

For Step 2, pour seven cups of water into a two-liter or half-gallon clear container. Add a few drops of red food dye.

THE CORE LESSON 5

1. Focus student attention on the Lesson Question.

What body parts move blood through the body? Draw a K-W-L chart for the class. Fill in what students already know about moving blood in the first column and questions they have about the topic in the middle column.

What We KNOW	What We WONDER	What We LEARNED

Have students continue to practice the plank pose they learned in Lesson 1. Remind students to breathe in and out while holding the pose for thirty or more seconds.

Ask, How does the plank pose affect your heart?

» Sample answer: It makes my heart beat faster.

2. Model blood capacity.

- Explain to students that everyone has blood inside their bodies. **Ask,** How much blood do you think your body can hold? (See **Know the Science 1.**)
- Show students the half-gallon or two-liter clear bottle with the dyed red water you measured before class. Explain that it represents the amount of blood in a first Grade 1 student’s body.
- Place a stack of clear plastic eight-ounce cups on a tray. Tell students they are now going to measure how much blood is in their bodies.
- Have students take turns holding the cups over the tray while you pour “blood” into them.
- **Ask students,** How many cups did we fill up?

» seven

EXTEND—If students ask how much blood other age people have, take them online to use a web-based calculator. Students may enjoy inputting various weights, ages, and sexes and finding out how these variables affect blood volume. If you have enough plastic cups, allow students to fill them to show how a teenager’s blood volume compares to theirs.

3. Read together: “Pumping Blood.”

Student Book



Ch. 5

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 teachers and parents can read it when sharing the Student Book with students.

Know the Science

TEACHER DEVELOPMENT

1. Human Blood Volume: The amount of blood circulating in a human’s blood vessels and heart depends on their weight and age. Newborns have the highest percentage of their total weight in blood and adults the lowest. A typical seven-year-old weighs about 50 pounds and has about 7 cups of blood. An adult man’s body may contain up to 23 cups of blood.

Read Aloud Support

Pages 24–25

Ask students to turn to pages 24–25 of the Student Book and look at the images as you read aloud. Remind them that the title of this chapter is “Pumping Blood,” and tell them to pay special attention to how body parts work together to bring blood and air to the whole body.

CORE VOCABULARY—Remind students that they learned about the **heart** in Lesson 3. **Ask students**, What kind of body part is the heart?

- » a muscle

LITERAL—When does your heart beat?

- » all the time

INFERENTIAL—Why do you feel your heart pounding after you run or do the plank pose?

- » My heart beats faster and harder because I was active.

Pages 26–27

Differentiation

Ask students to turn to pages 26–27 of the Student Book and look at the images as you read aloud.

LITERAL—What is the job of the circulatory system?

- » to move blood throughout the body

CORE VOCABULARY—Explain to students that **blood** is a thick mixture of different materials that are needed by all parts of the body.

CORE VOCABULARY—Point out the **blood vessels** in the diagram on page 26. Explain that they are shaped like tubes and that blood flows through them.

SUPPORT—Explain that blood flows in only one direction in each blood vessel. Using the diagram, point out that the red-colored arteries carry blood from the heart to all parts of the body. The darker-colored veins carry blood from all parts of the body back to the heart. (It is a common misconception that the actual blood in arteries is red and the actual blood in veins is blue. In reality, all blood is reddish in color, though veins seen through the skin may sometimes appear bluish due to an optical illusion.)

Pages 28–29

Ask students to turn to pages 28–29 of the Student Book and look at the images as you read aloud.

CORE VOCABULARY—Make sure students understand that the **heartbeat** they can hear by putting their ear on someone’s chest is caused by the heart contracting, or squeezing, and pushing blood throughout the body. The average heart rate of a seven-year-old is between 70 and 100 beats per minute.

LITERAL—What healthy foods are in the image on page 29? (See **Know the Science 2.**)

» mushrooms, peppers, carrots

INFERENTIAL—What can a doctor or nurse learn by checking your pulse?

» how many times your heart beats in a minute

SUPPORT—Students may be uncertain about how the heart moves blood. Use a turkey baster with a rubber bulb and a glass of water with a few drops of red food dye to demonstrate the pumping action of the heart. Explain that in this model, the bulb is the heart and the tube is a blood vessel. Place the baster tube in the water, and squeeze and release the bulb. Remind students that the heart is a muscle and that it contracts and relaxes. Students can observe how water is drawn into the “heart” as it relaxes and pushed out into the blood vessel as it contracts. Place these materials in a learning center where students can try using the model during the day.

4. Add the circulatory system to body outlines.

- Have students retrieve their traced body outlines and unroll them.
- Review the parts of the circulatory system that students have just learned about—heart, blood vessels, and blood.
- Distribute drawing materials.
- Have students refer to the illustration on Student Book page 26 and add the heart and blood vessels in the correct places on the outline. Suggest that students add small labels in pencil.
- **Ask students,** Where is the blood in your drawing?
 - » inside the blood vessels and the heart

Know the Science

TEACHER DEVELOPMENT

2. Which Foods Support a Healthy Circulatory System? Choose fresh, frozen, or canned vegetables that are not fried or served with fatty sauces. Fruits may come from these sources, too, but canned fruits may contain added sugar. Choose whole-grain breads, cereals, and pasta over white, refined grains. Consuming non-fat milk, lean meats, fish, and beans over fatty meats will help reduce your intake of saturated fats. Avoid salty prepared foods and oversalting fresh foods, substituting lemon, lime, and spices to boost flavor instead.

5. Check for understanding.

Activity Page



AP 5.1

Monitor Progress

Formative Assessment

Distribute What Do the Heart, Blood, and Blood Vessels Do? (AP 5.1) to students. Have students work in small groups to discuss, but have them complete the table individually. Encourage students to be creative in describing how each part looks. Circulate among students as they work, giving support as needed.

See the Activity Page Answer Key for sample student responses.

Invite a volunteer to read the Lesson Question: **What body parts move blood through the body?** Return to the K-W-L chart, and have students help you complete the “What We Learned” column.

Direct students’ attention to this unit’s Big Question. **Ask students,** How does knowing about the circulatory system help you answer the question?

- » Sample answer: A gymnast’s heart beats all the time. The heart pushes blood through blood vessels to all the other parts of the body. During a gymnastics routine, the heart beats faster to get enough air and food to the gymnast’s hardworking muscles.

Online Resources



Differentiation

CHALLENGE—Some students may want to learn more details about the interactions between the circulatory and respiratory systems. If so, show students a video that explains how oxygen is distributed to all parts of the body and carbon dioxide is removed from all parts of the body. See the Online Resources Guide for a link to the recommended resource.

www.coreknowledge.org/cksci-online-resources

LESSON 6

Body Control

Big Question: What goes on in a gymnast's moving body?

Lesson Question: What body parts control the body?

Tie to the Anchoring Phenomenon: As she practices her gymnastics skills, Grace has to train her body to improve its balance, timing, and preciseness of the body movements needed for each event. All of these are controlled by the nervous system.

AT A GLANCE

Learning Objectives

- ✓ Identify and describe parts of the nervous system.
- ✓ Summarize the functions of the nervous system.

Instructional Activities (2 Days)

- student game
- teacher Read Aloud
- class discussion
- student drawing

Core Vocabulary

Core Vocabulary: Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

brain nerves spinal cord spine

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

control nervous system

Instructional Resources

Student Book



Ch. 6

Student Book, Chapter 6
“Body Control”

Activity Page



AP 6.1

Activity Page
What’s So Hard about Stacking
Cups? (AP 6.1)

Materials and Equipment

Collect or prepare the following items:

- heavyweight plastic stacking cups (4 sets of 10)
- stopwatch or stopwatch app
- body outlines students made in Lesson 1 (1 per student)
- colored pencils, crayons, or markers (1 set per student)

For Differentiation:

- 12 x 12-inch pieces of craft paper (1 per student)

THE CORE LESSON 6

1. Focus student attention on the Lesson Question.

What body parts control the body? Have students continue to practice the plank pose they learned in Lesson 1. Remind students to breathe in and out slowly while holding the pose for thirty or more seconds.

Ask, How do your muscles know to stay in the plank pose?

- » Accept all reasonable answers. Sample answer: I think about squeezing muscles in my arms, legs, and tummy.

2. Play a game.

Have students take turns playing a game in which they try to take apart and restack a tower of cups as quickly as they can.

- Demonstrate for the class how to invert the ten cups and stack them on a table, as shown in the image. Point out that there are four cups on the bottom row, three on the second row, two on the third row, and one on the top. Tell students that they will need to remember the pattern.



- Tell students that the challenge is to take apart the tower, stack the cups one inside another (as they came out of their package), and then restack them to make the same tower.
- Invite a volunteer to play first. Use a stopwatch or timer app to time how long it takes to complete the task.
- Write the time on a sticky note, and give it to the student.
- Repeat the game for a few more students.
- If you have enough cups, you can time several students at once. Try having four students all start the game at the same time, and invite student volunteers to help you time them.

Collect the sticky notes, and hang them up. **Ask students,** What differences do you see in the amount of time it took to play the game?

» Answers will vary, with some students taking more time than others.

Ask, What makes it hard to stack the cups quickly? (See **Know the Science.**)

» Sample answers: They fall over easily; they fall off the stack; I get nervous; my hands shake.

Ask, Is it possible to get a faster time than on your first try?

» Sample answer: maybe, if I practice

Know the Science

TEACHER DEVELOPMENT

How Does Practice Affect Performance? Elite athletes have a nervous system that is finely tuned. When athletes compete, the nervous system (brain, spinal cord, nerves) controls every move their muscles make. While the body is moving, the brain is receiving and processing information from the eyes, ears, and other sense receptors to know where in space the body is and to maintain balance. Practicing a sport trains the nervous system to do a better job with fewer mistakes by rewiring the brain and strengthening its nerve connections. In addition, the brain learns to ignore information that is not needed for the sport and tunes into information that is necessary.

Allow interested students to practice playing the game, and then time them again to see if they can do the task faster. Point out that not only are students training the muscles in the arms, but their entire nervous system is learning to work better. (See **Know the Standards.**)

3. Read together: “Body Control.”

Student Book



Ch. 6

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 teachers and parents can read it when sharing the Student Book with students.

Read Aloud Support

Pages 30–31

Ask students to turn to pages 30–31 of the Student Book and look at the images as you read aloud. Remind them that the title of this chapter is “Body Control,” and tell them to pay special attention to how messages move through the body.

LITERAL—What part of Grace’s body controls all her gymnastics movements?

» her brain

CORE VOCABULARY—Remind students that the **brain** is a body part located inside their skull. It is the control center for the entire body.

INFERENTIAL—Why do athletes practice their sports over and over again?

» Practice helps their brains and bodies remember how to do things the right way.

Pages 32–33

Differentiation

Ask students to turn to pages 32–33 of the Student Book and look at the images as you read aloud.

LITERAL—What is the job of the nervous system?

» to send messages between the brain and the rest of the body

CORE VOCABULARY—Explain that **nerves** are a long, thin network of body parts that help the brain get information from all other parts of the body.

Know the Standards

TEACHER DEVELOPMENT

SEP 4 Analyzing and Interpreting Data: Although students may consider this activity a game, careful collection and recording of data turns it into a scientific investigation. Students answer a question that requires a predication and then collect more data after a period of practice. Have students compare their predictions to the results and discuss any surprises.

CORE VOCABULARY—Make sure students understand that the top of the **spinal cord** is connected to the brain and that the brain and the spinal cord work together to control body functions.

CORE VOCABULARY—Remind students that the **spine** is a group of bones that are located in the neck and back.

SUPPORT—Students can use their hands to touch the individual vertebra in their necks and in their upper and lower spine that make up the spinal column.

Ask students, What do these bones feel like?

» They feel small; they feel round.

Pages 34–35

Differentiation

Ask students to turn to pages 34–35 of the Student Book and look at the images as you read aloud.

SUPPORT—Remind students that they learned about senses in Kindergarten.

Ask, Which body parts collect information for your senses?

- » eyes for sight
- » ears for hearing
- » nose for smell
- » tongue for taste
- » skin for touch

EXTEND—Point out to students that when athletes practice a sport, they train their brains to pay attention only to sensory information that is necessary for doing the sport and to block out unnecessary information.

LITERAL—What connects each of these parts to the brain?

» nerves

EVALUATIVE—How do people protect their sense of sight when performing a sport?

» They wear goggles, safety glasses, or helmets with face protection.

CHALLENGE—Challenge interested students to find out more about sports safety equipment that protects the nervous system. Students can search online using keywords, ask a librarian to help them find reference materials, or interview a physical education teacher. Have students share what they learn by giving a brief talk to their classmates.

4. Add the nervous system to body outlines.

Differentiation

- Have students retrieve their traced body outlines and unroll them.
- Review the parts of the nervous system that students have just learned about—brain, nerves, spinal cord.

- Distribute drawing materials. Have students refer to the illustration on Student Book page 32, which shows the brain, spinal cord, and nerves. Suggest that students add small labels in pencil.
- **Ask students,** In which direction do messages travel in the nervous system?
 - » from the brain, along the nerves, and to the other body parts; from the body parts, along the nerves, and to the brain

EXTEND—If students want to include the sense organs on their body outlines, suggest they cut out a piece of craft paper that fits over the head on their outline. On this paper, students can draw and label the exterior sense organs (eyes, ears, nose, tongue, and skin). Have students place the drawing in the correct place on the large outline and use a strip of clear tape to make a hinge. Students can then lift the flap to show the inside of the head.

5. Check for understanding.

Activity Page



AP 6.1

Monitor Progress
Differentiation

Formative Assessment

Distribute What's So Hard about Stacking Cups? (AP 6.1) to students. Have students follow the directions to draw on the picture and write labels.

SUPPORT—If some students are unsure how to begin, ask a volunteer to stand in front of students and show where on their own body the hidden body parts needed to stack the cups are located. The student should point to the skull (where the brain is hidden), the eyes, and the spine (where the spinal cord is hidden) and then draw an imaginary line from the neck down one arm to the tips of the fingers to show where the nerves that control fingers are hidden.

See the Activity Page Answer Key for sample student responses.

Invite a volunteer to read the Lesson Question: **What body parts control the body?** Look for understanding of the following concepts in student responses:

- The brain controls nearly all the things the body does, including thinking and movements.
- Nerves send information between the brain and the rest of the body.
- The spinal cord is where nerves meet to connect to the brain.

Direct students' attention to this unit's Big Question. **Ask,** How does knowing about the nervous system help you answer the question?

- » Sample answer: A gymnast's arms, legs, and body move because the brain sends messages to these parts through the spinal cord and nerves.

LESSON 7

Science in Action: Physiologists and Anatomy

Big Question: What goes on in a gymnast's moving body?

Lesson Question: Who helps athletes and other people stay safe and healthy?

Tie to the Anchoring Phenomenon: Remind students that they have been exploring the story of Grace and how her body systems work together so that she can do gymnastics. Throughout this lesson, have students think about the people who can help Grace stay safe and healthy so that she can enjoy and improve in her sport.

AT A GLANCE

Learning Objectives

- ✓ Identify careers that help people move their bodies for safety and strength.
- ✓ Describe technologies that support adaptive movement and fight movement diseases.

Instructional Activities

- student brainstorming
- teacher Read Aloud
- class discussion
- student data interpretation
- student presentations

Core Vocabulary

Core Vocabulary: Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

athlete **fitness** **vaccine** **virus**

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

exercise physiologist **physical therapist** **sports physiologist**

Instructional Resources

Student Book



Ch. 7

Student Book, Chapter 7
“Science in Action:
Physiologists and Anatomy”

Activity Page



AP 7.1

Activity Page
Helping People Heal (AP 7.1)

Materials and Equipment

Collect or prepare the following items:

- body outlines students made in Lesson 1 (1 per student)
- scissors (1 per student)

For Differentiation:

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

THE CORE LESSON 7

1. Focus student attention on the Lesson Question.

Who helps athletes and other people stay safe and healthy? Invite students to brainstorm jobs that adults may have, and list them on the board or poster paper.

Review the job list with students, and check off any jobs that involve caring for or improving the human body. If there are none, give a few hints by **asking questions** such as the following:

- Who takes care of your teeth?
 - » a dental hygienist; a dentist
- Who bandages your finger if it gets cut in school?
 - » a school nurse
- Who teaches you how to do somersaults?
 - » a physical education teacher or coach

Explain to students that they will now read about jobs that require people to understand how the parts of the body work together. (See **Know the Science 1.**)

Know the Science

TEACHER DEVELOPMENT

1. Anatomy and Physiology: Both fields of study are in the biological and medical sciences. Human anatomy focuses on describing the structures, or parts, of the human body. These structures may be large enough to see with the unaided eye or so small that you need a microscope to view them. Anatomists may specialize in one region of the body or one body system. In contrast, a physiologist focuses more on functions—how a body part works with other body parts. This requires investigation of the chemistry and physics of the structures and how these activities keep the body alive and healthy. In high schools and colleges, the two fields are often taught in one course so that students better understand how structure and function are related.

2. Read together: “Science in Action: Physiologists and Anatomy.”

Student Book



Ch. 7

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 teachers and parents can read it when sharing the Student Book with students.

Read Aloud Support

Pages 36–37

Ask students to turn to pages 36–37 of the Student Book and look at the images as you read aloud. Remind them that the title of this chapter is “Science in Action: Physiologists and Anatomy,” and tell them to pay special attention to how understanding of the human body is used to help other people.

CORE VOCABULARY—Make sure students understand that an **athlete** is a person who is skilled in one or more sports. Grace is a gymnastics athlete. Baseball players, runners, fencers, and cyclists are all athletes, too.

LITERAL—What is the job of a sports coach?

- » to teach skills of the sport and make sure athletes do not get hurt

INFERENTIAL—Why does the sports physiologist who helps Grace need to know about gymnastics?

- » She needs to understand which body parts a gymnast uses in the sport.

CORE VOCABULARY—Explain to students that physical **fitness** is how healthy and strong a person is and how well they can perform in a sport.

Pages 38–39

Differentiation

Ask students to turn to pages 38–39 of the Student Book and look at the images as you read aloud.

Invite students who have had a broken bone that needed to be in a cast to share what it was like to use that body part after the cast came off. Discuss how it takes some time for the muscles to become strong again. **Ask students** to share their experiences, including with physical therapy.

LITERAL—What do physiologists and physical therapists study?

- » the human body; how the parts of the human body work together

INFERENTIAL—Direct student attention to the image on page 38. **Ask**, How is the physical therapist helping the woman get stronger?

- » She is helping the woman balance on a ball; she is helping the woman lift a heavy bar.

INFERENTIAL—Direct student attention to the image on page 39. What is the device helping the young girl do?

- » walk

INFERENTIAL—Why do you think she needs help?

- » She has an illness or injury that makes walking difficult.

SUPPORT—If students are not sure what *balance* means in the context of physical movement, have them practice standing on one foot. Explain that this is one of the skills gymnasts use when they are on the balance beam. It is a skill that physical therapists can help people recover after illness, injury, or surgery.

Pages 40–41

Differentiation

Ask students to turn to pages 40–41 of the Student Book and look at the images as you read aloud.

CORE VOCABULARY—Explain that a **virus** is an extremely tiny particle that can make more of itself inside a living thing. Some viruses make people very sick. (See **Know the Science 2.**)

LITERAL—What is polio?

- » a disease caused by a virus

CORE VOCABULARY—Explain to students that a **vaccine** helps fight a virus once it gets inside the body. Each vaccine works on only one kind of virus, so people need to get several vaccines.

LITERAL—Who invented the polio vaccine?

- » Jonas Salk

INFERENTIAL—Why were most parents so happy to hear about the invention of a polio vaccine?

- » They would no longer have to worry about their kids getting sick and losing their ability to walk.

Online Resources



SUPPORT—Students are likely to have questions about viruses. Explain that viruses are too small to be seen, can be passed from person to person, and can cause illness. Show them a video that presents information about germ transmission and prevention in a nonthreatening presentation.

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

www.coreknowledge.org/cksci-online-resources

Know the Science

TEACHER DEVELOPMENT

2. Polio and Society: While polio has been mostly eradicated in the U.S., it still exists in a few countries around the world. More than half of polio cases occur in children under age five. While most people are asymptomatic or exhibit flu-like symptoms, about 0.5 percent of those infected experience paralysis. This occurs when the virus attacks the brain stem and spinal cord. There is evidence that polio has existed in human populations for thousands of years. Until the invention of a vaccine, periodic epidemics occurred in the U.S. from the late 1800s through the 1950s and caused great dread in the parents of young children.

3. Answer questions about an X-ray.

Activity Page



AP 7.1

Distribute Helping People Heal (AP 7.1) to students. Have students interpret the image showing a person's broken ulna bone in their forearm and then complete the sentences. See the Activity Page Answer Key for sample student responses.

4. Check for understanding.

Monitor Progress
Differentiation

- Have students retrieve their traced body outlines and unroll them.
- Provide scissors, and have students cut around their body outlines. Have students write their names on the backs of their outlines.
- Hang the outlines on a wall or clothesline.
- Invite volunteers to describe what body parts and systems their drawings show. Encourage students to describe the function of each system as well as identify some of the structures in it.

CHALLENGE—Help students find and print a picture of someone doing a gymnastics movement and trace the outline of the body in that position. Then challenge students to draw some of the body parts they learned about in the new outline, especially those important for the movement.

Invite a volunteer to read the Lesson Question: **Who helps athletes and other people stay safe and healthy?** In a discussion, look for understanding of the following concepts, but do not require students to know the names of each job, such as *sports physiologist* and *physical therapist*:

- Some people have jobs in which they teach athletes how to play a sport while keeping their bodies safe and fit.
- If someone receives an injury, there are people who can help them get better.
- Viruses can make people sick, but there are vaccines that can protect them.
- Very few people in the U.S. get the polio virus today because there is a vaccine that prevents it.

Direct students' attention to this unit's Big Question. **Ask students** to use their model body outlines to answer the question: **What goes on in a gymnast's moving body?**

- » Sample answer: Bones hold a gymnast up. Muscles move the bones. The brain sends signals to the muscles to move the bones. When a gymnast is exercising, more air is brought into the lungs, and the heart pumps faster to send more air to the muscles that are working so hard.

Teacher Resources

Activity Pages

- If I Were a Gymnast (AP 1.1) 51
- Connecting Bones (AP 2.1) 52
- What Happens to Muscles That Are Used a Lot? (AP 3.1) 53
- How Does My Breathing Change? (AP 4.1) 54
- What Do the Heart, Blood, and Blood Vessels Do? (AP 5.1) 55
- What's So Hard about Stacking Cups? (AP 6.1) 56
- Helping People Heal (AP 7.1) 57

Activity Pages Answer Key: *Human Body Systems* 58

Name _____

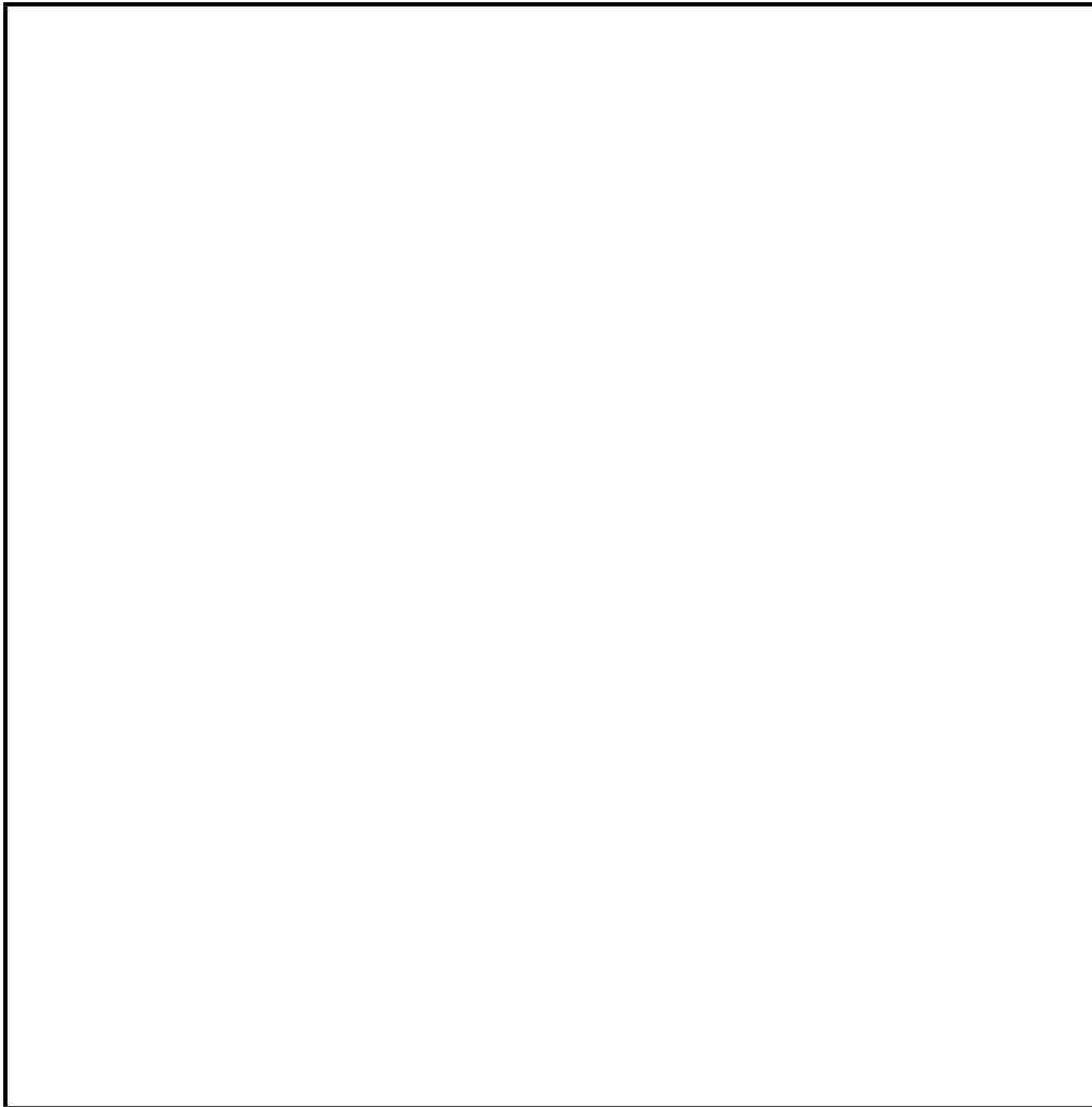
Date _____

Activity Page 1.1

Use with Lesson 1

If I Were a Gymnast

What if you were a gymnast? Draw your body moving like a gymnast. Then answer the question.



What parts of your body have to be strong to move this way?

Name _____

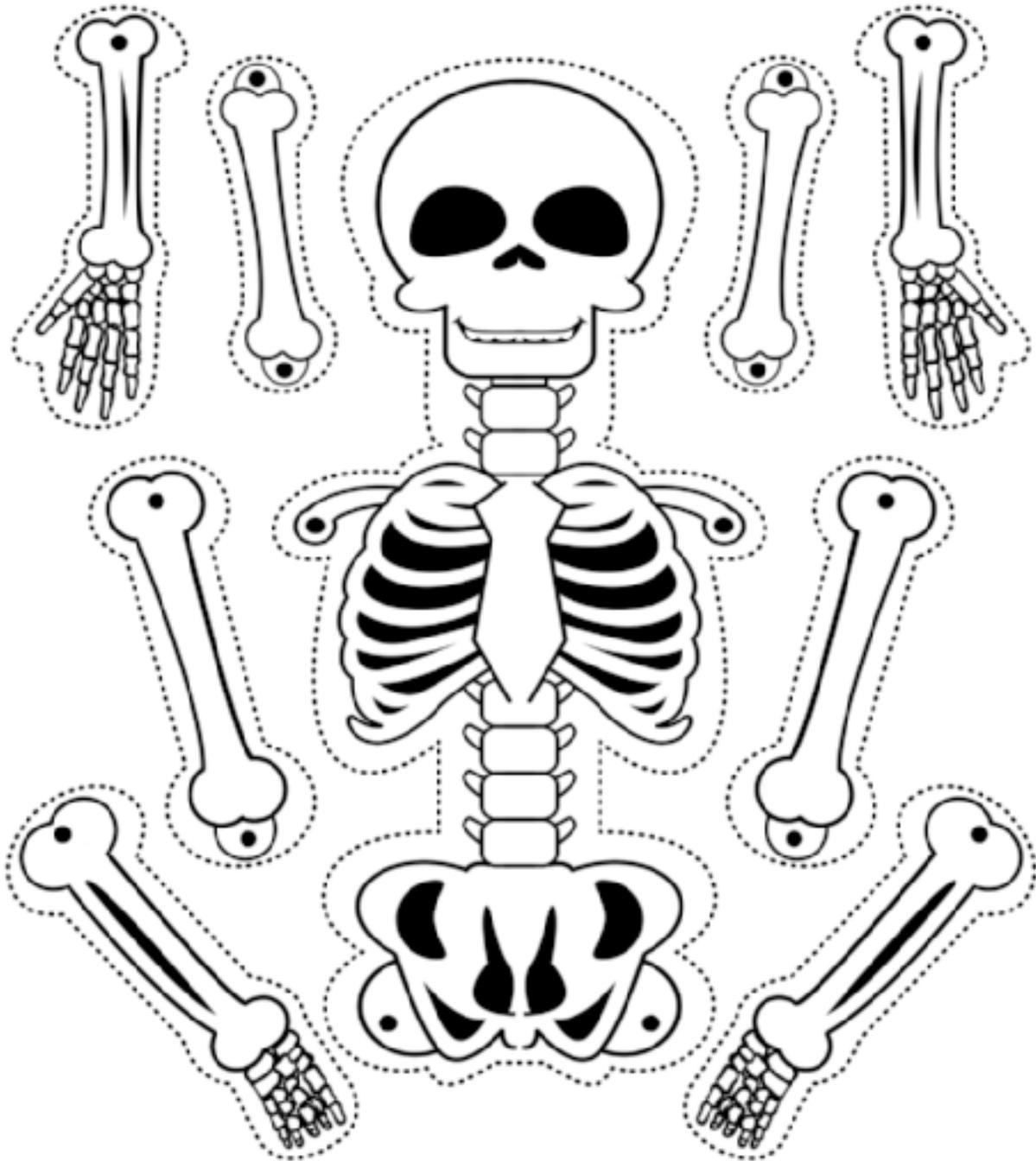
Date _____

Activity Page 2.1

Use with Lesson 2

Connecting Bones

Cut out the puzzle parts. Use pins to connect the bones. Show how the joints can move.



Name _____

Date _____

What Happens to Muscles That Are Used a Lot?

1. Hold the clothespin between your thumb and index finger.
2. When your teacher says “go,” squeeze it as many times as you can.
3. Count the number of squeezes in the first minute. Have your partner write the number in the chart.
4. Keep squeezing for one more minute. Have your partner count and write down the number of squeezes in the second minute.

Time	Number of Squeezes
First minute	
Second minute	

Look at your chart. How do the number of squeezes compare?

What happened to your muscles when you used them a lot?

How Does My Breathing Change?



1. Sit quietly for one minute.
2. Count your breaths right afterward. Fill in the chart.
3. Count your breaths after you rest for two more minutes. Fill in the chart.
4. Do jumping jacks or another exercise for one minute.
5. Count your breaths right afterward. Fill in the chart.
6. Count your breaths after you rest for two minutes. Fill in the chart.

Activity for one minute	Number of Breaths in One Minute	
	Right afterward	Three minutes afterward
rest		
jumping jacks or other exercise		

Look at your chart. How did your breathing change, and why?

Name _____

Date _____

Activity Page 5.1

Use with Lesson 5

What Do the Heart, Blood, and Blood Vessels Do?

Write in the chart about these body parts. Then answer the question.

The Circulatory System		
Name of Part	What it looks like	What it does
heart		
blood		
blood vessels		

Look at your chart. What would happen if one part were missing?

What's So Hard about Stacking Cups?

Draw and label the picture to show what body parts are needed for the game. Then answer the question.



How is learning to stack cups like learning gymnastics?

Name _____

Date _____

Activity Page 7.1

Use with Lesson 7

Helping People Heal

Grace brought this X-ray to school for show-and-tell. Write in the blanks to show what you have learned.



What body parts does this X-ray show? _____.

Grace has to wear a cast until _____.

After the cast comes off, a physical therapist will help Grace _____.

Activity Pages Answer Key: Human Body Systems

This answer key offers guidance to help you assess your students' learning progress. Here you will find descriptions of the expectations and correct answers for each Activity Page of this unit.

If I Were a Gymnast (AP 1.1) **(page 51)**

Sample answer to first question: Students may draw themselves doing a backbend or handstand like Grace in their Student Book, in plank pose, or doing one of the gymnastics moves they saw in the videos, such as flips, rolls, or walking on a balance beam.

Sample answer to second question: My legs and feet have to be very strong to do a flip.

Connecting Bones (AP 2.1) **(page 52)**

Reference the page 8 image that shows how students should put the puzzle pieces together to show a complete skeletal system.

What Happens to Muscles That Are Used a Lot? (AP 3.1) **(page 53)**

Answers in table will vary. Students should observe that they can squeeze more times in the first minute than in the second minute.

How Does My Breathing Change? (AP 4.1) **(page 54)**

Answers in table will vary. Sample answer to question: I took fewer breaths when at rest and more right after exercising.

What Do the Heart, Blood, and Blood Vessels Do? (AP 5.1) **(page 55)**

Sample answers:

top left: like a ball of muscles

top right: moves the blood, makes a heartbeat

middle left: like red water

middle right: holds materials the body needs

bottom left: like tubes

bottom right: allows blood to move throughout the body

Sample answer to question: The body would not get any of the materials it needs.

What's So Hard about Stacking Cups? (AP 6.1) **(page 56)**

Sample answers for labeling the picture: brain, eyes, spinal cord, and nerves to arm and hand muscles

Sample answer to question: You can get better and faster by practicing.

Helping People Heal (AP 7.1) **(page 57)**

Sample answers:

first question: bones, arm bones, the skeleton

second question: the broken bone heals

third question: get her arm stronger again

Glossary

Purple words and phrases are Core Vocabulary for the unit. **Bold-faced words and phrases** are Language of Instruction, additional vocabulary terms related to the unit that you should model for students during instruction. Vocabulary words are not intended for use in isolated drill or memorization.

A

air, n. a kind of gas that is invisible yet all around

artery, n. a blood vessel that carries oxygenated blood from the heart to the rest of the body

athlete, n. a person who is skilled in one or more sports

B

backbend, n. a move in gymnastics that starts in the standing position and then the body arches backward until the hands reach the ground

bend, v. to take an object that is straight and make a curve in it or take a curved object and make it straight

blood, n. a thick mixture of different materials that are needed by all parts of the body

blood vessels, n. structures in the body that are shaped like tubes and that blood flows through

body, n. all the parts that make up you

bone, n. hard structures in the body that do not bend

brain, n. a body part located inside the skull and that is the control center for the entire body

breathe, v. to take air into the lungs and then to expel from the lungs

C

circulatory system, n. the system that is made up of the organs and parts that move blood throughout the body

contract, n. in regard to muscles, a shortening of the muscle length

control, n. the power to direct or influence something

D

diaphragm, n. a body part made up of muscle and connective tissue that separates the chest and abdominal cavity

E

exercise, n. physical activity that is done to improve health

exhale, v. to push air out of the lungs

F

fitness, n. how healthy and strong a person is and how well they can perform in a sport

flex, v. to bend or move a muscle

flexible, adj. to have the ability to bend or move a muscle easily

G

gymnast, n. a person who practices gymnastics

gymnastics, n. physical activities that involve balance, flexibility, tumbling, and strength

H

handstand n. an inverted gymnastics pose performed by balancing vertically supported on the palms of the hands

heart, n. a body part located deep inside the rib cage, where it is protected from injury

heartbeat, n. caused by the heart contracting, or squeezing, and pushing blood throughout the body

I

inhale, v. to bring air into the lungs

J

joint, n. a place where the body can bend

L

lungs, n. a pair of organs found in the chest cavity that take in oxygen and expel carbon dioxide from the blood

M

movement, n. how a person changes the way they hold their body or changes the place their body is located

muscle, n. fibrous tissue in the body that produces movement by contracting

muscular system, n. the system that consists of all the different muscles that allow the body to move

N

nerves, n. long, thin network of body parts that help the brain get information from all other parts of the body

nervous system, n. the system of organs, tissues, and nerves that receive and respond to stimuli

nose, n. a body part with two passageways that allow air to move into the throat

P

physical therapist, n. a person who specializes in rehabilitating people by using exercise to improve physical capabilities

physiologist, n. a person who specializes in the study of body functions and processes

pulse, n. the regular throbbing of blood through an artery each time the heart beats that can be felt on the wrist or neck

R

relax, v. to be less tense and more calm

respiratory system, n. a system of organs that work to take in oxygen to be distributed to the body and to remove carbon dioxide

rib, n. one of several curved bones that attach to the spine and protect the organs in the chest cavity

S

skeletal system, n. the system made up of bones, cartilage, and joints that provides support for the body and is the point of attachment for muscles

skeleton, n. the internal body structure made up of bones, cartilage, and joints

skull, n. the bone and cartilage found on the head that surrounds the brain

spinal cord, n. a body part connected to the brain and that works with the brain to control body functions

spine, n. a group of bones that are located in the neck and back

sports, n. physical activities played for fun as a group or individual

stiff, adj. rigid or not easily bent

stretch, v. to extend something to make longer or wider without breaking or tearing

system, n. a group of things that work together or interact

T

throat, n. a passage from the back of the mouth that leads to the lungs and stomach

V

vaccine, n. helps fight a virus once it gets inside the body

vein, n. a blood vessel that carries deoxygenated blood back toward the heart

virus, n. an extremely tiny particle that can make more of itself inside a living thing

W

windpipe, n. a tube that air moves through from the nose and throat to the lungs

Classroom Safety for Activities and Demonstrations

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 this unit have been selected and designed to engage students in a safe manner. The activities and demonstrations 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:

- Be aware of students who have food allergies, and adjust related activities or make materials substitutions as necessary. Check the ingredients of all food to make sure known allergies are not listed. Students with food allergies can still be affected even if they do not ingest the food item. Some common food allergies are peanuts, tree nuts (e.g., almonds, walnuts, hazelnuts, etc.), and cow's milk (rice milk is a good nut-free alternative).
- 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 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.

Copy and distribute the Student Safety Contract, found on the next page. Have a read-along, and have students agree to the expectations for students when engaged in science activities prior to the start of the first unit.

Online Resources



For additional support for safety in the science classroom, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Student Safety Contract

When doing science activities, I will do the following:

- Report spills, breakages, or injuries to the teacher right away.
- Listen to the teacher for special instructions and safety directions. If I have questions, I will ask the teacher.
- Avoid eating or drinking anything during the activity unless told to by my teacher.
- Review the steps of the activity before I begin. If I have questions, I will ask the teacher.
- Wear safety goggles when working with liquids or things that can fly into my eyes.
- Be careful around electric appliances and unplug them, just by pulling on the plug, when a teacher is supervising.
- Keep my hands dry when using tools and devices that use electricity.
- Be careful to use safety equipment like gloves or tongs when handling materials that may be hot.
- Know when a hot plate is on or off and let it cool before touching it.
- Roll or push up long sleeves, keep my hair tied back, and secure any jewelry I am wearing.
- Return unused materials to the teacher.
- Clean up my area after the activity and wash my hands.
- Treat all living things and the environment with respect.

I have read and agree to the safety rules in this contract.

_____ / ____ / ____ /

Student signature and date

Print name

Dear Parent or Guardian,

During science class, we want to create and maintain a safe classroom. With this in mind, we are making sure students are aware of the expectations for their behavior while engaged in science activities. We are asking you to review the safety rules with your student and sign this contract. If you have any questions, please feel free to contact me.

_____ / ____ / ____ /

Parent or guardian signature and date

Strategies for Acquiring Materials

The materials used in the Core Knowledge Science program (CKSci) are readily available and can be acquired through both retail and online stores. Some of the materials will be reusable and are meant to be used repeatedly. This includes equipment such as scales, beakers, and safety goggles but also items such as plastic cups that can be safely used again. Often these materials are durable, can be cleaned, and will last for more than one activity or even one school year. Other materials are classified as consumable and are not able to be used more than once, such as glue, baking soda, and aluminum foil.

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 can add up for an entire unit, even when the materials required for activities and demonstrations have been selected to be individually affordable. And 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 with the teaching of science, as well as to 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.

Advance Preparation for Activities and Demonstrations

Being properly prepared for classroom activities and demonstrations is the first step to having a successful and enriching science program. Advance preparation is critical to effectively support student learning and understanding of the content in a lesson.

Before doing demonstrations and activities with the class, do the following:

- Familiarize yourself with the activity by performing the activity yourself or with a team, and identify any issues or talking points that could be brought up.
- Gather the necessary materials for class usage. Consider if students will gather their materials at stations or if you will preassemble the materials to be distributed to the students and/or groups.
- Identify safety issues, such as food allergies, that could occur during an activity or demonstration, and plan and prepare how to address them.
- Review the Teacher's Guide before teaching, and identify opportunities for instructional support during activities and demonstrations. Consider other Support and/or Challenge opportunities that may arise as you work to keep students engaged with the content.
- Prepare a plan for postactivity collection and disposal of materials/equipment.

While engaged in the activity or demonstration, do the following:

- Address any emergencies immediately.
- Check that students are observing proper science safety practices as well as wearing any necessary safety gear, such as goggles, aprons, or gloves.
- When possible, circulate around the room, and provide support for the activity. Return to the Teacher Guide as students work, to utilize any Support and Challenge opportunities that will make the learning experience most meaningful for your students.

After the activity or demonstration, do the following:

- Use your plan for students to set aside or dispose of their materials as necessary.
- Have students wash their hands after any activity in which they could come in contact with any potentially harmful substances.

When engaging students in activities and demonstrations, model good science practices, such as wearing proper safety equipment, never eating during an investigation, etc. Good science practices at a young age will lead to students observing good science practices themselves and being better prepared as they move into upper-level science classes.

What to Do When Activities Don't Give Expected Results

Science activities and experiments do not always go according to plan. Microwave ovens, super glue, and X-rays are just some of the discoveries made when people were practicing science and something did not go according to plan. In your classroom, however, you should be prepared for what to do when activities don't give the expected results or when an activity doesn't work.

When going over an activity with an unexpected result, consider these points in discussion with your students:

- Was there an error in following the steps in order? You or the student may have skipped a step. To help control for this, have students review the steps to an investigation in advance and make a check mark next to each step as they complete it.
- Did students design their own investigation? Perhaps their steps are out of sequence, or they missed a step when performing the activity. Review and provide feedback on students' investigation plan to ensure the work is done in proper sequence and that it supports the lesson segment's guiding question.
- When measurements were taken, were they done correctly? It is possible a number was written down incorrectly; a measurement was made in error, such as a wrong unit of measure or quantity; or the starting or ending point of a measurement was not accurate.
- Did the equipment or materials contribute to the situation? For example, chemicals that have lost their potency or a scale that is not measuring accurately can contribute to the success or failure of an activity.

One of the greatest gifts a student can learn when engaged in science is to develop a curiosity for *why something happened*. Students may find it challenging or frustrating to work through a problem during an activity, but guiding them through the problem to figure out *why* something happened will help them to develop a better sense of how to do science.



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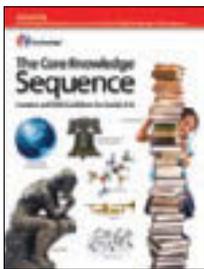
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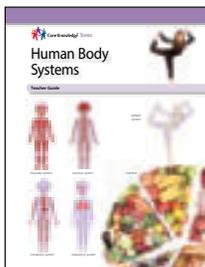
Human Body Systems

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, and the fine arts. In the domains of science, including Earth and space, physical, and life sciences, the *Core Knowledge Sequence* outlines topics that build systematically grade by grade to support student learning progressions coherently and comprehensively over time.



For which grade levels is this book intended?

In general, the content and presentation 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
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