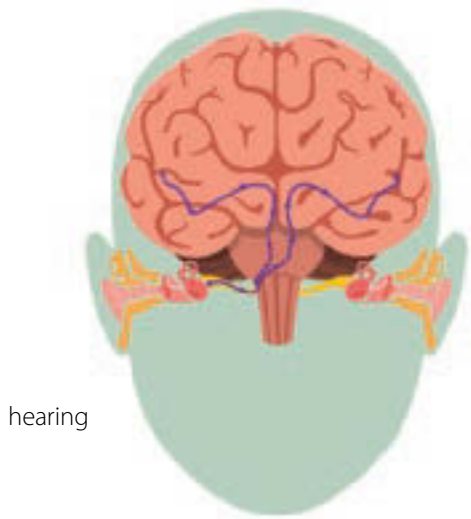


Human Senses and Movement

Teacher Guide



Human Senses and Movement

Teacher Guide



Core Knowledge®

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Human Senses and Movement

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Human Senses and Movement

Teacher Guide

Core Knowledge Science™ 3

Introduction

ABOUT THIS UNIT

The Big Idea

This unit focuses on the introductory scientific concepts related to sensorimotor functions of the human body.

Students are familiar both with their body's ability to sense information from the environment and with their ability to move. What they may not have studied yet is the relationship between senses and movement—the notion that most of the time when they move a body part, that movement is initiated or guided by their senses. Their bodies are coordinating complex operations among multiple body systems with every movement.

In this unit, students will consider the body structures, systems, and functions that contribute to the ability to play table tennis, particularly to the ability to return a fast serve of a table tennis ball. Vision and hearing provide the perception needed for the response. The interactions of the nervous, skeletal, and muscular systems produce the body's motion in the response.

In this unit, students build on their understanding from previous grades about human body structures and their functions. They also discover adaptive technologies that assist with different aspects of impaired sensorimotor function.

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.



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 Senses and Movement*, 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



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: Returning a Serve

- Observe visible body parts involved in the return of a served table tennis ball and explain their functions.

Lesson 2: Human Hearing

- Relate the significance of hearing to human activity.
- Identify body parts associated with human hearing.
- Describe hearing health and safety practices.

Lesson 3: Human Vision

- Relate the significance of vision to human activity.
- Identify body parts associated with human vision.
- Describe vision health and safety practices.

Lesson 4: The Muscular System

- Explain the function of muscles.
- Differentiate between voluntary and involuntary muscles.
- Identify major muscles.

Lesson 5: The Skeletal System

- Explain the function of the skeletal system and identify major bones.
- Explain the interrelationship between bones and muscles.
- Identify ways to keep bones healthy and safe.

Lesson 6: The Nervous System

- Describe sensory functions of the nervous system.
- Describe motor functions of the nervous system.

Lesson 7: Helpful Body Technology

- Describe adaptive technologies that support hearing, vision, and mobility functions.

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 READER

Student Reader



The *Human Senses and Movement* Student Reader has seven chapters and a student Glossary providing definitions to Core Vocabulary words. Engaging text, photographs, and diagrams encourage students to draw upon their own experiences and the world around them to understand scientific concepts. In addition to Core Vocabulary, the Student Readers include a feature called Word to Know, which provides background information to help students understand key terms, and may sometimes include additional informational boxes, such as Think About.

Independent reading or group read-aloud: While the text in the Student Readers is written for independent reading, we encourage group read-alouds and engagement with the text. The Teacher Guide provides Guided Reading Supports to prompt discussion, clarify misconceptions, and promote understanding in relation to the Big Questions.

USING THE TEACHER GUIDE

Pacing

The *Human Senses and Movement* unit is one of five units in the Grade 3 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 the *Human Senses and Movement* unit so that you have time to teach the other units in the Grade 3 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 Senses and Movement* 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 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: How does a human body return a table tennis serve?		Lesson Big Questions
Lesson 1	Returning a Serve	How does a human body return a table tennis serve?
Lesson 2	Human Hearing	How does human hearing work?
Lesson 3	Human Vision	How does human vision work?
Lesson 4	The Muscular System	How do muscles work in the human body?
Lesson 5	The Skeletal System	How does the skeleton work in the human body?
Lesson 6	The Nervous System	How do nerves support senses and movement?
Lesson 7	Helpful Body Technology	How can inventions help with senses and movement?

Activity Pages

Activity Pages



AP 1.1
AP 2.1
AP 3.1
AP 5.1
AP 6.1
AP 7.1
AP 7.2

Black line reproducible masters for Activity Pages, as well as an Answer Key, are included in Teacher Resources on pages 50–57. The icon shown to the left appears throughout the Teacher Guide wherever Activity Pages (AP) are referenced.

Lesson 1—Ask Questions About Learning Table Tennis (AP 1.1)

Lesson 2—Take Care of Your Hearing (AP 2.1)

Lesson 3—Investigating Eyes and Light (AP 3.1)

Lesson 5—Label a Skeleton (AP 5.1)

Lesson 6—Your Nervous System at Play (AP 6.1)

Lesson 7—Write with a Pattern of Bumps (AP 7.1)

Lesson 7—Returning a Table Tennis Serve (AP 7.2)

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 58–59.

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 60–64, 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 Returning a Serve

- poster paper
- markers (1 set)

Lesson 2 Human Hearing

- table tennis ball
- sanitized blindfold
- rubber band
- colored pencils or markers (1 set per student or group)

Lesson 3 Human Vision

- table tennis ball
- small flashlights (1 per pair)
- hand mirrors (a few for sharing)

Lesson 4 The Muscular System

- small flashlight

Lesson 5 The Skeletal System

- cooked whole chicken legs (thigh attached to the drumstick) (1 per group)
- plastic bowls or food storage containers (1 per group)
- plastic forks and knives (1 set per group)
- yellow and blue highlighters (1 set per group)

Lesson 6 The Nervous System

- inflated round balloons, about 6 inches in diameter (2 or more)
- table tennis paddles (2 or more)

Lesson 7 Helpful Body Technology

- ballpoint pens (1 per student)
- 9 x 12 inch corrugated cardboard (1 per student)

HUMAN SENSES AND MOVEMENT PACING GUIDE

_____’s Class

Note to Teacher: When using *Human Senses and Movement* as part of the Grade 3 CKSci series, this unit is intended to be taught as the fifth unit of Grade 3 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

--	--	--	--	--

UNIT 5

Human Senses and Movement

OVERVIEW

Big Question: How does a human body return a table tennis serve?

Lessons	Lesson Questions	Advance Preparation
1. Returning a Serve	How does a human body return a table tennis serve?	Read Chapter 1 in the Student Reader.
2. Human Hearing	How does human hearing work?	Read Chapter 2 in the Student Reader. Gather materials for student investigation. (See Materials and Equipment, page 9.)
3. Human Vision	How does human vision work?	Read Chapter 3 in the Student Reader. Gather materials for student investigation.
4. The Muscular System	How do muscles work in the human body?	Read Chapter 4 in the Student Reader. Gather materials for demonstration.
5. The Skeletal System	How does the skeleton work in the human body?	Read Chapter 5 in the Student Reader. Gather materials for student investigation. Cook chicken pieces, or purchase precooked ones.
6. The Nervous System	How do nerves support senses and movement?	Read Chapter 6 in the Student Reader. Gather materials for student investigation.
7. Helpful Body Technology	How can inventions help with senses and movement?	Read Chapter 7 in the Student Reader. Gather materials for student investigation.

What's the Story?

Voluntary action of the human body is guided by sensory input, particularly by vision and hearing. The nervous system is at the center of sensorimotor function, providing the bridge between information the body receives and action the body carries out in response. Motor functions orchestrated by the nervous system are executed through movement enabled by the interaction of the muscular and skeletal systems.

In Lessons 1–7, students read about vision, hearing, and the nervous, skeletal, and muscular systems. Specifically, students read about these body structures and functions as they relate to the task of returning a serve of a table tennis ball. Reading about these body structures and functions in this context is reinforced by teacher demonstrations. Students further explore the different aspects of the body's performance of the task through observations of their own body movements and through investigations in which they manipulate objects and materials.

LESSON 1

Returning a Serve

Big Question: How does a human body return a table tennis serve?

Tie to the Anchoring Phenomenon: This lesson introduces the unit phenomenon of a table tennis player returning a served ball. Throughout the unit, students will use what they learn about the functions of human structures to explain how the body plays this sport.

AT A GLANCE

Learning Objective

- ✓ Observe visible body parts involved in the return of a served table tennis ball and explain their functions.

Instructional Activities

- video viewing
- teacher Read Aloud
- class discussion
- question generation

Core Vocabulary

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.

enable **serve**

Instructional Resources

Student Reader



Ch. 1

Student Reader, Chapter 1
"Returning a Serve"

Activity Page

Ask Questions about Learning Table Tennis (AP 1.1)

Make sufficient copies for your students prior to conducting the lesson.

Activity Page



AP 1.1

Materials and Equipment

Collect or prepare the following items:

- poster paper
- markers (1 set)
- internet access and the means to project images/video for whole-class viewing

1. Focus student attention on the Big Question.

10 MIN

Online Resources



Share the Big Question with your class—**How does a human body return a table tennis serve?** Display this question where students can refer to it throughout the chapter. Explain to students that to *serve* means to put the ball in play by tossing it up with one hand and using the paddle to hit it with the other hand, making sure to bounce it once on their own side of the table before it crosses the net. (See **Know the Science**.)

Show students a video of young people playing in a competitive table tennis match. Make sure students understand that a rally (when the ball is in play) ends when someone does not hit the ball back over the net to their opponent. Explain that the player who wins the rally gets one point and the game is over when one player gets eleven points. However, if both players have ten points, the winner is the first person to have a two-point lead.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

EXTEND—Invite students who enjoy learning new vocabulary to use internet resources to develop a glossary of table tennis terms as they encounter them in this unit. The list should include the word *serve* from Chapter 1 and *rally* from the video. (See **Know the Standards 1**.)

Know the Science

What Does It Take to Play Competitive Table Tennis? Table tennis is a high-speed sport that requires good physical and mental conditioning and a high degree of skill. Speed, hand-eye coordination, reflexes, balance, and legwork are all involved. With practice, the brain develops its ability to analyze the speed and position of the ball and make decisions for how to respond. The brain's motor control functions direct the muscles to move into positions and return the ball with force and accuracy. Using the whole body and rotating the hips and shoulders gives power to the strokes, especially the forehand.

Know the Standards

1. Language Arts Connection: There are several language acquisition and use standards for Grade 3 related to acquiring new vocabulary, among them: *Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases, including those that signal spatial and temporal relationships.* You can also use this Extend activity to address CCSS.ELA-Literacy.L.3.4 by encouraging students to use dictionaries to identify the multiple meanings of table tennis terms such as *serve*. (**CCSS.ELA-Literacy.L.3.6**)

2. Student Reader: Read and discuss together.

20 MIN

Student Reader



Ch. 1

Read together, or have students read independently, the Student Reader Chapter 1, "Returning a Serve." The selection introduces the sport of table tennis and how the senses of vision and hearing are involved in play of the game.

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 1

After reading, ask: Which body parts does the player in the photo use to sense what is happening during the game? Which body parts does the player use to react when the ball is returned to her?

Remind students that in this chapter, the word *serve* is used to describe putting a table tennis ball in play by tossing it up with one hand and using the paddle to bounce it over the net with the other hand. Ask students how they have heard the word *serve* used in other ways (such as to serve food or to serve others through an act of kindness).

SUPPORT—For students unfamiliar with the sport of table tennis, have two students stand at either end of a large table and act out hitting a small ball from one side of the table to the other with paddles. Explain that the player who *serves* puts the ball in motion and that the ball stays in play whenever it is hit over the net and bounces on the other side.

Page 2

Prompt students to look at the photo of the child juggling tennis balls. Ask: In addition to sight and hearing, what is another sense that enables the child in the photo to juggle the balls?

Online Resources



Point out the word *enable* to students in the text on page 2 of the Student Reader, and ask them to propose a definition based on reading the sentence context.

CHALLENGE—Some students may be inspired by the photo to try juggling. Show them a video about children learning to juggle. Discuss how the children sense and react to keep objects aloft. Provide two pieces of cloth, such as small scarves or bandanas, to students who wish to try tossing one piece of cloth from hand to hand and then two pieces of cloth.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

3. Brainstorm scientific questions.

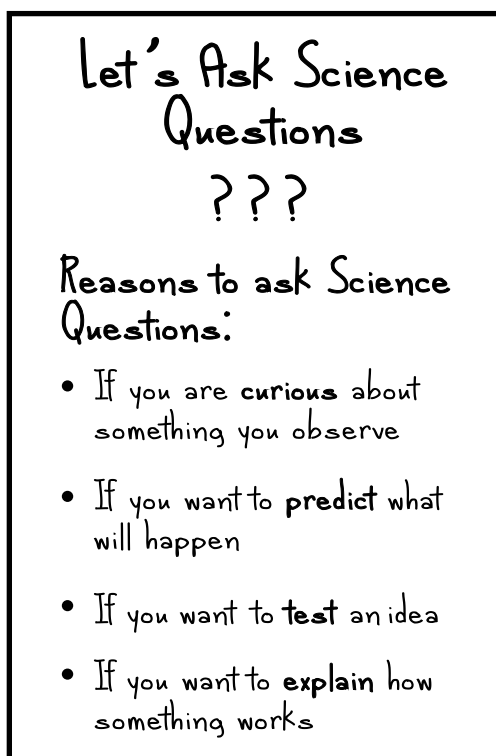
10 MIN

Activity Page



AP 1.1

Make an anchor chart like the one shown below to guide students in generating scientific questions. Display the chart in the classroom, and discuss with students each reason to ask scientific questions. (See **Know the Standards 2.**)



Give each student a copy of Ask Questions About Learning Table Tennis (AP 1.1). Have students brainstorm questions in pairs and then each write on their own Activity Page four questions that most interest them about learning table tennis.

See the Activity Pages Answer Key for sample student responses.

SUPPORT—If you have English language learners in your class, make the anchor chart in front of them so that they can use hearing as well as sight to process the information. Discuss with students the importance of the one bold word in each bullet point and how looking at these words will remind them of what scientists do when they ask questions. Consider making a small copy of the anchor chart for each English language learner to use as their own.

Know the Standards

2. SEP 1 Asking Questions and Defining Problems: Eliciting questions about a phenomenon is a productive way to begin a unit of study. Guide students to ask scientific questions—those that can be answered with investigations and supporting empirical evidence. The questions your students ask about how the human body senses and reacts during a table tennis game will provide insight into their prior knowledge on the topic and can be used to guide your instruction throughout the unit.

4. Check for understanding.

5 MIN

Return to the Big Question. Direct students to think about what they read in Chapter 1, and ask: How does a human body return a table tennis serve?

» Sample answer: You use your eyes and ears to sense the ball coming and your hands, arms, feet, and legs to hit it back across the net.

Point out to students that the rest of the chapters in this unit will provide more details about how these body parts work together.

Formative Assessment

Activity Page



AP 1.1

Review students' responses to Ask Questions About Learning Table Tennis (AP 1.1). Invite students to share their questions. Referring to the anchor chart used in Step 3, determine if students were able to ask scientific questions.

LESSON 2

Human Hearing

Big Question: How does human hearing work?

Tie to the Anchoring Phenomenon: After a hands-on activity and reading, students will be able to explain that hearing with two ears helps a table tennis competitor locate the position of the ball. Have students also explain why asking the audience at a competition to be silent helps the players.

AT A GLANCE

Learning Objectives

- ✓ Relate the significance of hearing to human activity.
- ✓ Identify body parts associated with human hearing.
- ✓ Describe hearing health and safety practices.

Instructional Activities

- class discussion
- class investigation
- teacher Read Aloud
- infographic creation

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.

hearing sound vibrate

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.

auditory nerve cochlea detect ear canal
eardrum enable outer ear

Instructional Resources

Student Reader



Ch. 2

Activity Page



AP 2.1

Student Reader, Chapter 2
"Human Hearing"

Activity Page
Take Care of Your Hearing
(AP 2.1)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- table tennis ball
- sanitized blindfold
- rubber band
- colored pencils or markers (1 set per student or group)
- internet access and the means to project images/video for whole-class viewing

TEACH THE CORE LESSON 45–60 MIN

1. Introduce the Big Question.

5 MIN

Share the Big Question with your class—**How does human hearing work?** Then ask students: What do you do during the week that requires you to raise your voice or shout so that others can hear you?

- » Sample answers: play video games, talk to friends while riding the bus or eating in the school lunchroom, cheer at basketball games, call to someone from another room

Have students review their understanding of how to play table tennis, including how their body moves and what they see and hear during the game.

2. Investigate sources of sound.

5 MIN

- Demonstrate for students how a table tennis ball bounces on a table or a desk, and instruct them to use their sense of hearing to observe the sound it makes.
- Have one student put on a blindfold. Move quietly to another part of the room that is in front of, to the side of, or behind the blindfolded student. Tell the student to listen while you bounce the ball again. Then ask the student, while still blindfolded, to point in the direction where they heard the sound.
- Repeat these steps, but this time, have the student cover one ear with a hand.
- Ask students: Which sense did the student use to detect sound?
 - » hearing
- Ask the blindfolded student: Was it easier to know where the sound was coming from with one ear or two ears?
 - » two ears

- Then ask the whole class: How does hearing help someone playing table tennis?
» The sound helps the player know where the ball has bounced.

3. Student Reader: Read and discuss together.

30 MIN

Student Reader



Ch. 2

Read together, or have students read independently, the Student Reader Chapter 2, "Human Hearing." The selection identifies the importance of hearing in communicating with others and detecting the environment around you. It also explains vibration as the origin of sound, identifies parts of the ear, and discusses the importance of taking care of your ears to protect your hearing.

Preview Core Vocabulary Terms

Before students read, write these terms on the board. Encourage students to pay special attention to these terms as they read.

hearing **sound** **vibrate**

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 3

Ask students to turn to page 3 of the Student Reader and look at the image as you read aloud. Remind students that the title of this chapter is "Human Hearing," and tell them to pay special attention to the body parts that are involved and how they work. Ask students: What objects make sound when they move?

Remind students of the investigation you did with the table tennis ball and the blindfolded student. Ask students: What evidence from our investigation with the table tennis ball and blindfold supports the first paragraph on this page?

Make sure students understand that the verb *detect* means "to notice or discover" and is used as a synonym for the verb *sense* in this context.

Pages 4–5

SUPPORT—Help students interpret the diagram on page 4. Explain that the air particles move back and forth within a very small space but that as they do, they bump into one another. It's the bumping that sends sound from the source to their ears.

While looking at the diagram of parts of the ear, ask: Which parts of the ear can you see when you look at other students? Which parts can't you see? Why can't you see some of the parts? Point to each part on the diagram, and have students repeat them aloud with you.

CHALLENGE—Have students find and define other words with the same root as *auditory*. Related words with *aud-*, meaning “to hear,” are *auditorium*, *audio*, *audience*, *audition*, and *audible*. (See **Know the Standards**.)

Students learned the word *enable* in Chapter 1. Remind students that it is a verb meaning “to make possible.”

Pages 6–7

Ask: How do you know when a sound source is coming closer or moving farther away?

Then ask: Why is a sound coming from the left louder in your left ear than in your right ear?

Page 8

Ask students why they think it is important to protect their ears from loud sounds. (See **Know the Science**.)

Online Resources



EXTEND—Explain to students that scientists compare the loudness of sounds by measuring in units called *decibels*. Allow students to explore an online simulated decibel meter that enables them to hear various sound sources and compare their loudness in decibels.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

Know the Standards

Language Arts Connection: Grade 3 students build language acquisition and use language skills when they use a known root word as a clue to the meaning of an unknown word with the same root. Have students explain how the root *aud-* at the beginning of words signals that the word is related to hearing. (**CCSS.ELA-Literacy.L.3.4.c**)

Know the Science

What Changes to the Ear Can Affect Hearing? Damage to the eardrum usually heals without permanent consequences, but these injuries can be painful. In addition to loud noises, eardrums can be injured by traumatic head injuries, infections of the inner or middle ear, or sudden changes in air pressure. Young children are prone to middle ear infections in which fluid builds up behind the eardrum in the middle ear and surrounds the three tiny bones found there. While any associated hearing loss due to an infection is usually temporary, repeated infections can cause permanent hearing loss.

4. Make an infographic.

10 MIN

Activity Page



AP 2.1

Distribute Take Care of Your Hearing (AP 2.1) to students. Explain that infographics are colorfully designed ways to share information using a combination of words, pictures, and other graphics, such as graphs. Tell students they will complete the infographic by adding their own colors and pictures.

SUPPORT—If some students become frustrated by their ability to draw, allow them to search online for images that they can print, cut out, and glue onto their Activity Page.

See the Activity Pages Answer Key for sample student responses.

5. Teach Core Vocabulary.

5 MIN

Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary words (displayed on the board earlier in the lesson). Have students write each term in the upper left corner of an index card and underline it (one term per card).

hearing **sound** **vibrate**

Word Work

hearing: Remind students that hearing is one of the five human senses, and ask them what they use to hear (ears) and what hearing helps them detect (sound). Ask students to name the other four senses (sight, smell, touch, and taste) and identify which parts of the body are affected by these senses.

sound: Remind students that sound is the detection of an object's vibration. Name different objects, and ask students to describe their sounds. Some examples are ambulance siren, chirping bird, footsteps, a choir singing, and someone knocking on the door.

vibrate: Have a student demonstrate how a rubber band vibrates as you move it back and forth very fast. You can also demonstrate this by plucking the strings on a guitar.

6. Check for understanding.

5 MIN

Activity Page



AP 2.1

Invite students to summarize their answers to the Big Question: **How does human hearing work?** Listen for evidence that students understand the following:

- Sound is related to vibrations of matter.
- The human ear has external parts students can see and internal parts they cannot see.
- Two ears help a person locate sound sources.
- Ears can be injured, and hearing affected, by putting objects in the ear canal and sounds that are too loud.

Return students' attention to the unit's Big Question. Have students describe evidence from their investigation with the blindfold and bouncing ball and what they read in Chapter 2 to support their claims.

Formative Assessment

Review students' work on Take Care of Your Hearing (AP 2.1), and look for evidence that they recognized practical solutions for dealing with dangerously loud sounds.

LESSON 3

Human Vision

Big Question: How does human vision work?

Tie to the Anchoring Phenomenon: Strong visual skills are essential for competitive table tennis. The players' eyes need to stay in focus on the fast-moving ball without their eye muscles becoming fatigued. Good depth perception is essential to returning a serve from a distance and making sure it lands on the table. When playing doubles table tennis, peripheral vision is especially important to be able to sense a partner's movements.

AT A GLANCE

Learning Objectives

- ✓ Relate the significance of vision to human activity.
- ✓ Identify body parts associated with human vision.
- ✓ Describe vision health and safety practices.

Instructional Activities

- teacher demonstration
- class discussion
- class investigation
- teacher Read Aloud

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.

vision

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.

cornea **iris** **lens** **optic**
optic nerve **pupil** **retina**

Instructional Resources

Student Reader



Ch. 3

Activity Page



AP 3.1

Student Reader, Chapter 3 “Human Vision”

Activity Page

Investigating Eyes and Light (AP 3.1)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- table tennis ball
- small flashlight (1 per pair)
- hand mirrors (a few for sharing)
- internet access and the means to project images/video for whole-class viewing

For Differentiation:

- orange
- marker
- pens (1 per student)

TEACH THE CORE LESSON 45 MIN

1. Focus student attention on the Big Question.

5 MIN

Share the Big Question with your class—**How does human vision work?** Invite students to propose answers, and accept all reasonable responses.

Toss a table tennis ball for a student to catch. Ask students: How do you use your eyes to catch a ball?

» Sample answer: You have to look at the ball and look at your hands.

2. Investigate effects of light on the eye.

5 MIN

Activity Page



AP 3.1

- Arrange students in seated pairs, and have them face one another. Turn off the classroom lights, and wait about one minute.
- Have one student stare straight ahead and the other student observe the size of the black dots (pupils) in the middle of their partner’s eyes, comparing them to the size of the ring of color surrounding the dots.
- Give each pair of students a flashlight. Then have the student holding the flashlight turn it on and shine it toward the other students’ face while looking at the pupils. **SAFETY:** Caution students not to shine the flashlight directly into their partner’s eyes. As an alternative, you can also do this activity by turning the classroom lights off and back on.
- Have the students in each pair switch roles and repeat the steps. Distribute Investigating Eyes and Light (AP 3.1) for students to complete. See the Activity Pages Answer Key for sample student responses.

Discuss any cause-and-effect relationships that the students observed. (See **Know the Standards.**)

3. Student Reader: Read and discuss together.

25 MIN

Student Reader



Ch. 3

Read together, or have students read independently, the Student Reader Chapter 3, "Human Vision." The selection discusses vision as the detection of light and how the various parts of the eye work together to take in information from the world around us. Students will also read about vision problems and what can be done to keep their eyes healthy.

Preview Core Vocabulary Terms

Before students read, write this term on the board. Encourage students to pay special attention to this term as they read.

vision

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 9

Remind students that the title of this chapter is "Human Vision," and tell them to pay special attention to the body parts that are involved in the sense of vision and how they work. Ask students: How is the sense of vision used in a table tennis game?

Ask: How do you know the table tennis ball in the photo is in motion?

Pages 10–11

Ask students: What are some words you can use to describe how an object looks?

Discuss the diagram on page 11 with students. Point to each part, and pronounce it aloud for students. Allow students to pass around a hand mirror to identify the parts of their own eyes that they can see, such as the pupil and cornea.

Know the Standards

CCC 2 Cause and Effect: Before students can identify a cause-and-effect relationship, they need to observe a pattern in events. Allow time in this investigation for students to repeat the procedure as many times as needed to recognize the pattern. Then students should be able to explain that the light from the flashlight caused the size of the eye's pupil to change.

Remind students of the investigation they did with the flashlights. Ask: What is the black dot in the center of the iris called? How do you know from the investigation that the pupil takes in just the right amount of light to see?

SUPPORT—Some students may need help reconciling the facing-front image of the eye with the side-view diagram. Show students an orange on which you have drawn with a marker how the eye looks from the front. Then turn the orange (eyeball) so that the side is visible. Point out that the pupil is on the front of the sphere and the retina and optic nerve are on the back of the sphere.

Pages 12–13

Explain to students that muscles are soft body parts that cause motion and that because eye muscles can only pull (not push), six muscles are needed to move the eyeball to look in all directions.

SUPPORT—Make sure students understand that to *focus* means to make what they are seeing look clear and sharp.

EXTEND—Have students test their depth perception by holding a pen vertically in one hand at eye level. Then have students close one eye and use the index finger from their other hand to touch the very top of the pen. Next have students open both eyes and try to touch the pen top again. Have students describe which was easier, and discuss how using two eyes is necessary for good depth perception.

Invite students who wear glasses to share why. Ask students: Who would need glasses to help with reading—a farsighted person or a nearsighted person? Why?

Page 14

Talk with students about ways they keep their eyes healthy. Examples may include wearing sunglasses on sunny days, using protective eyewear when playing sports, and eating certain foods.

Ask: Which foods have vitamins that are good for your eyes?

Ask: What are some dangers to the eyes when playing sports?

CHALLENGE—Have students do online research to find images of eye protection equipment for sports. Allow students to print the images and use them to design a poster to teach other students about eye safety.

4. Teach Core Vocabulary.

5 MIN

Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary word (displayed on the board earlier in the lesson). Have students write the term in the upper left corner of an index card and underline it.

vision

Word Work

vision: Explain to students that the word *vision* is used in this chapter to describe the sense that humans use to see the world around them. Tell students that the root word *vis-* is Latin for “see.” Ask students to think of other words that begin with *vis-*, such as *visible* and *visit*.

5. Check for understanding.

5 MIN

Online Resources



Formative Assessment

Remind students that the Big Question is **How does human vision work?** Then show the class an animation that helps answer the question. Try turning down the sound of the narration and having students narrate it themselves using what they learned in this lesson. Look for understanding of the following concepts:

- People see the world around them when their eyes interact with light.
- Light bounces off objects into the eye and passes through the cornea and the opening called the pupil.
- The iris controls the size of the pupil and how much light enters the rest of the eye.
- Information from the eye goes to the brain.

SUPPORT—If students find it difficult to keep up with the animation, try stopping the video at key points and having them narrate the picture on the screen.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

LESSON 4

The Muscular System

Big Question: How do muscles work in the human body?

Tie to the Anchoring Phenomenon: Table tennis is not a contact sport, and the players don't move a great distance during the game, but it does require strong muscles for power and coordination. Core and lower-body muscle strength is very important for getting into positions to return a ball, and so are the muscles of the arm and back, especially for the side that holds the paddle.

AT A GLANCE

Learning Objectives

- ✓ Explain the function of muscles.
- ✓ Differentiate between voluntary and involuntary muscles.
- ✓ Identify major muscles.

Instructional Activities

- teacher demonstration
- class discussion
- teacher Read Aloud

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.

involuntary muscle **muscle** **voluntary muscle**

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 **function** **system** **tissue**
voluntary

Instructional Resources

Student Reader



Ch. 4

Student Reader, Chapter 4 "The Muscular System"

Materials and Equipment

Collect or prepare the following items:

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

For Differentiation:

- white paper plate (1 per student)

TEACH THE CORE LESSON 45 MIN

1. Introduce the Big Question.

5 MIN

Share the Big Question with your class—**How do muscles work in the human body?** Point out that there are muscles all over the body, and accept all reasonable answers to the question.

Recap the Lesson 3 investigation, in which students observed the change in the size of the eye's pupil. Ask: Was the change in the size of the pupil something that you controlled by thinking about it? If students are not sure how to answer, demonstrate the procedure again with a flashlight and a student volunteer. (See **Know the Science.**)

2. Student Reader: Read and discuss together.

30 MIN

Student Reader



Ch. 4

Read together, or have students read independently, the Student Reader Chapter 4, "The Muscular System." This selection introduces students to different kinds of muscles, including voluntary muscles (such as those used for exercise) and involuntary muscles (such as the heart). Students learn how exercise and a nutritious diet can help keep muscles functioning properly.

Know the Science

Pupil Dilation: Students observed during the investigation that their pupils respond to changes in light intensity. These changes occur without a person having to think about them. One set of muscles in the iris contracts to expand the pupil, and another set of muscles contracts to reduce the size of the pupil. Other stimuli also affect pupil size. A difficult task, such as a multiplication problem, will cause the pupils to expand slightly. Different emotional states can also affect pupil size. However, none of these causes produce changes as dramatic as those triggered by light.

Preview Core Vocabulary Terms

Before students read, write these terms on the board. Encourage students to pay special attention to these terms as they read.

involuntary muscle **muscle** **voluntary muscle**

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 15

Ask students to turn to page 15 of the Student Reader and look at the image on the page. Remind students that the title of this chapter is “The Muscular System.” Ask students: How do you know the table tennis player’s muscles are working?

Make sure students understand that the word *function* in this chapter is used as a noun that describes an action that contributes to how the body works and stays alive.

Pages 16–17

Ask: What are skeletal muscles?

Direct students to look at the labeled diagrams of skeletal muscles. Ask: What is the relationship between the size of the body part that needs to move and the size of the muscles that move it?

SUPPORT—Play a game of Simon Says in which you call out the names of muscles and students point to them.

Pages 18–19

Ask: What is the function of heart muscle?

Ask: Do you expect a table tennis player’s heart to beat faster or slower during a game than after the game?

» Sample answer: It probably beat faster during the game

SUPPORT—Support Grade 3 reading skills by comparing the words *voluntary* and *involuntary*. Make sure students notice that the only difference between the two is the common prefix *in-*, meaning “not.” Point out that if students can remove the prefix and recognize the word that remains, they may be able to determine the word’s meaning. Share other examples of words that have the prefix *in-*, such as *incomplete* and *inexpensive*.

Page 20

Ask: How does exercise affect your muscles?

EXTEND—Point out that muscles can be injured, and talk with students about muscle safety. When a muscle is too sore after exercise, it may be injured. Many injuries can be avoided by warming up muscles prior to exercising or playing a sport. Warm-ups make the heart beat faster and help supply blood to the muscles. A warm-up should include short, dynamic stretching (stretching with movement) of the muscles that will be used. Do a warm-up with students in which they jog in place for two minutes followed by rapid flexing of their ankles to stretch their lower leg muscles.

CHALLENGE—Have students use the nutrition guidelines provided to plan a meal that supports healthy muscles. Give students a white paper plate, and have them draw and label the foods they would eat. Have students share their meal plans, and discuss how many different combinations of foods can be good for their muscles.

3. Teach Core Vocabulary.

5 MIN

Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary words (displayed on the board earlier in the lesson). Have students write each term in the upper left corner of an index card and underline it (one term per card).

involuntary muscle **muscle** **voluntary muscle**

Word Work

involuntary muscle: Make sure students understand that, in contrast to a voluntary muscle, they do not have to think about moving an involuntary muscle.

Have students recall their investigation of the eye's pupil in Lesson 3. Ask: Did you have to think about changing the size of your pupil? Why?

muscle: Make sure students understand that a muscle is a soft body part that moves by contracting. Guide students to model contracting and relaxing by clenching their hand into a fist (contraction) and by unclenching and spreading out their fingers (relaxing). Point out that their hand appears smaller when it contracts and larger when it relaxes.

voluntary muscle: Ask students if they know what it means to volunteer. Point out that when you volunteer, you choose to do something. Explain to students that voluntary muscles are those that you choose to use at a specific time in a specific way.

4. Check for understanding.

5 MIN

Formative Assessment

Restate the Big Question—**How do muscles work in the human body?** In a class discussion, look for understanding of the following concepts:

- Muscles are soft body parts called tissue that contract and relax.
- Humans can control the use of voluntary muscles, such as skeletal muscles. Involuntary muscles, such as the heart, contract and relax on their own.

- Skeletal muscles include neck muscles, shoulder muscles, abdominal muscles, back muscles, biceps and triceps, gluteus muscles, and thigh muscles.
- Muscles work better when a person is physically active, gets plenty of sleep, and eats a diet rich in nutrients from fruits and vegetables, grains, and healthful proteins.

Stress that in table tennis, individual muscles work together to allow a player to move in all the ways needed to return a serve. Explain that parts working together to perform a task are described as a system and that the muscular system is but one system in the human body. (See **Know the Standards.**)

Know the Standards

CCC 4 Systems and System Models: In Grades K–2, students learn that systems have parts that work together. In Grades 3–5, students take a closer look at parts and see how they interact, learning that individual parts cannot carry out all the functions of the system as a whole. This crosscutting concept is also a major theme of the Grade 3 study of the interdependent relationships of living things in an ecosystem.

LESSON 5

The Skeletal System

Big Question: How does the skeleton work in the human body?

Tie to the Anchoring Phenomenon: Throughout this lesson, talk to students about how their skeleton changes position to allow their body to stay upright and hit a table tennis ball as it moves in many different directions. Point out that research shows that recreational table tennis, in addition to increasing muscle strength and overall fitness, strengthens bones by increasing their mineral content.

AT A GLANCE

Learning Objectives

- ✓ Explain the function of the skeletal system and identify major bones.
- ✓ Explain the interrelationship between bones and muscles.
- ✓ Identify ways to keep bones healthy and safe.

Instructional Activities

- chicken leg dissection
- teacher Read Aloud
- class discussion
- diagram labeling

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.

bone **connective tissue**

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.

coordinated **joint** **organ** **skeletal system**
spine **tissue**

Instructional Resources

Student Reader



Ch. 5

Student Reader, Chapter 5
"The Skeletal System"

Activity Page

Label a Skeleton (AP 5.1)

Activity Page



AP 5.1

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- cooked whole chicken legs (thigh attached to the drumstick) (1 per group)
- plastic bowls or food storage containers (1 per group)
- plastic forks and knives (1 set per group)
- yellow and blue highlighters (1 set per group)

For Differentiation:

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

Advance Preparation:

- Place fresh or defrosted whole chicken legs in a large pot, cover them with water, and simmer until they are fully cooked (forty to fifty minutes). Refrigerate for up to three days before the activity. You may also choose to purchase precooked rotisserie chicken pieces from the grocery store.

TEACH THE CORE LESSON 45 MIN

1. Introduce the Big Question.

10 MIN

Share the Big Question with your class—**How does the skeleton work in the human body?** Explain that although students cannot observe human bones directly, they can observe the bones of other animals with skeletons.

- Arrange students into groups, depending on the number of chicken legs you have prepared.
- Provide a cooked chicken leg in a bowl or container to each group, along with a plastic knife and fork. **SAFETY:** Remind students never to eat materials used in a science investigation.
- Have students gently scrape away the skin on the chicken leg and identify various parts they see, including muscle (meat), white stretchy parts that connect the muscle to the bone (tendons), and the joint (where the leg can bend).
- Next, have students use the knife to scrape aside the muscles and view the bones. Have students tap or probe the bone, and ask: How does the structure of bones compare to those of muscles and tendons?
 - » Bones are harder and stiffer than tendons or muscle.

- Give the class directions for safely disposing of the materials, cleaning up surfaces, and washing their hands.
- Ask: In what ways is examining the bones of other animals helpful to understanding the human skeleton?
 - » Sample answer: Some kinds of animals have skeletons that are similar to humans, so looking at chicken bones can give us some ideas about how human bones fit together or work to hold us up.

2. Student Reader: Read and discuss together.

20 MIN

Student Reader



Ch. 5

Read together, or have students read independently, the Student Reader Chapter 5, "The Skeletal System." This selection introduces students to the bones, tendons, and ligaments that help the body move. Students learn the role of bones in protecting parts of the body, such as the brain and heart, and read about the importance of diet and exercise in keeping the skeletal system healthy.

Preview Core Vocabulary Terms

Before students read, write these terms on the board. Encourage students to pay special attention to these terms as they read.

bone **connective tissue**

Guided Reading Supports

Page 21

Ask students to turn to page 21 of the Student Reader. Remind them that the title of this chapter is "The Skeletal System." Have students hold one arm and hand as if they are holding a table tennis paddle and are ready to play. Tell them to use their other hand to feel the bones and find the joints. Ask: How do you know where the joints are located?

Make sure students understand that *coordinated* means able to move several body parts at the same time to do a task.

Point out that the players in the photo have their arms bent at the elbow joint. Ask students: At what points in the game will they need to straighten their elbows?

Pages 22–23

Ask: What does connective tissue link together?

Explain to students that the human body is symmetrical, meaning that one side is the same as the other. Ask: If the human body has about two hundred bones, about how many bones are probably on one side of it?

SUPPORT—For students who are not sure how to answer the question, have them think about it as a division problem. Help students write an equation to represent the problem ($200 \div 2 = ?$). Students can also think about it as a

multiplication problem. Ask: What number would you multiply by 2 to get 200? ($? \times 2 = 200$). Finally, you could represent it as an addition problem, asking: What number do I add to itself to equal 200? ($? + ? = 200$). (See **Know the Standards.**)

Pages 24–25

Ask students: What is the function of the skull, spine, and ribs?

Remind students that the spine is a group of small bones that run down the center of the back and neck. These bones protect the spinal cord. Organs, such as the lungs and the brain, are body parts with specific functions that are protected by other bony structures.

SUPPORT—Have students think about what they learned in Lesson 3 about the eye. Have students look at the skull diagram on page 24. Point out the area of the eye socket. Guide students to understand that while the skull protects most soft parts of the head, the parts where light enters the eye are not protected. This is why protective eyewear is important.

Page 26

Point out the photo of a healthy meal. Ask: What are some foods that you should eat to keep your bones healthy? (See **Know the Science.**)

Explain that children do not typically lift heavy weights in gyms but that there are other body weight-bearing activities that can help strengthen their bones. Ask students: What activities do you do that help you take care of your bones?

CHALLENGE—Challenge students to search online to find a delicious recipe for a food that is rich in calcium. Guide students to search using keywords such as dairy (milk, cheese, yogurt), almonds, broccoli, kale, turnip greens, figs, or tofu. Have students print the recipe and explain, either verbally or in writing, why it is a good choice for bone health.

Know the Standards

Math Connection: Common Core Mathematics Standard CCSS.Math.Content.3.OA.A.3 only requires Grade 3 students to solve word problems with equations involving equal groups up to 100. So this question may challenge some students. Drawing an array of 200 dots or using 200 counters makes the problem more concrete and can be used to help solve it. (**CCSS.Math.Content.3.OA.A.3**)

Know the Science

Functions of Calcium and Vitamin D in the Human Body: Calcium is a metal found in the earth in limestone, chalk, and marble. In living things, it is part of the biochemistry that contributes to structural support of bones and is essential for blood clotting, transmitting nerve impulses, and regulating the heartbeat. Calcium has to be absorbed into the body's cells, and this process is promoted by Vitamin D. Vitamin D also is involved in cell growth and reducing inflammation. In addition to being found in some foods, the body makes its own vitamin D in the presence of sunlight.

3. Teach Core Vocabulary.

5 MIN

Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary words (displayed on the board earlier in the lesson). Have students write each term in the upper left corner of an index card and underline it (one term per card).

bone **connective tissue**

Word Work

bone: Make sure all students understand that bone is itself a hard, inflexible material but that it also refers to the many body parts in the skeleton that are formed from this material.

connective tissue: Ask students whether they recognize a smaller word within the word *connective*. (Some students should identify the word *connect*.) Ask students familiar with the word *connect* to tell what it means (to put two or more parts of something together), and then have them use this clue to define the word *connective*. Make sure students understand that connective tissues are several materials inside the human body, including ligaments and tendons, that connect one bone to another.

4. Check for understanding.

10 MIN

Activity Page



AP 5.1

Online Resources



Formative Assessment

Distribute Label a Skeleton (AP 5.1) along with yellow and blue highlighters. Have students follow the directions to label the diagram and write their answers to the question. Review students' work, and see the Activity Pages Answer Key for sample answers.

Restate the Big Question—**How does the skeleton work in the human body?** In a class discussion, look for understanding of the following concepts:

- The skeleton enables movement by giving muscles something to pull against.
- The skeleton protects some soft body parts inside the head and torso.
- Major bones include the skull, spine, ribs, pelvis, and femurs.
- For healthy bones, eat dairy and calcium-rich vegetables, and get plenty of exercise.

EXTEND—Invite students to watch a video that shows skeletons of other kinds of animals. Allow students to pause the video to closely observe each skeleton and take notes to describe some distinguishing features. Hold a discussion to elicit the most surprising discoveries students made.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

LESSON 6

The Nervous System

Big Question: How do nerves support senses and movement?

Tie to the Anchoring Phenomenon: Competitive table tennis players have well-developed eye-hand coordination. This lesson guides students to understand that the nervous system uses information from the eyes and ears to guide hand and other body movements. Through their own activity with a table tennis paddle and balloon, students may come to appreciate how their eyes, ears, hands, and brain interact and how practice improves performance.

AT A GLANCE

Learning Objectives

- ✓ Describe sensory functions of the nervous system.
- ✓ Describe motor functions of the nervous system.

Instructional Activities

- relay racing
- teacher Read Aloud
- class discussion
- diagram labeling

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.

nerve

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.

brain electrical impulses nervous system optic nerve
spinal cord

Instructional Resources

Student Reader



Ch. 6

Student Reader, Chapter 6
"The Nervous System"

Activity Page

Your Nervous System at Play
(AP 6.1)

Activity Page



AP 6.1

Materials and Equipment

Collect or prepare the following items:

- inflated round balloons, about 6 inches in diameter (2 or more)
- table tennis paddles (2 or more)

For Differentiation:

- internet access and tablets on which to play an app

TEACH THE CORE LESSON 50 MIN

1. Focus student attention on the Big Question.

5 MIN

Share the Big Question with your class—**How do nerves support senses and movement?** Point out that although nerves cannot be seen because they are inside the body, they are connected to parts you can see on the outside of the body, including the skin. Then have students brainstorm answers to the question and accept all reasonable answers.

2. Do a relay race.

10 MIN

Demonstrate for students how to hold the blade of the table tennis paddle flat like a tabletop and balance an inflated balloon on it.

Set up an indoor relay racecourse so that each student reaches a spot marked on the floor and returns to their team's starting line to pass the paddle and balloon to the next person in line.

Arrange the students into as many relay teams as you have table tennis paddles with balloons, and have them line up at the start line.

Give the first person in each team a paddle and an inflated balloon. Explain that the race requires students to walk (not run) as quickly as they can to the finish line without dropping the balloon. If the balloon falls off the paddle, students must stop and place it back on before starting to walk again.

At the conclusion of the first race, discuss the following with students:

- What body systems and parts were needed to complete the race?
- What makes it difficult to keep the balloon on the paddle?
- What would you do to get better at this race? (See **Know the Science 1.**)

Accept all reasonable answers, encouraging students to build on what they learned in Lessons 1–5 about hearing, vision, and the muscular and skeletal systems. (See **Know the Standards.**)

If you have time, allow students to repeat the race and discuss how they can improve their skills with practice.

CHALLENGE—If students master the skill of balancing the balloon on the paddle, repeat the race, replacing the balloons with table tennis balls.

3. Student Reader: Read and discuss together.

20 MIN

Student Reader



Ch. 6

Read together, or have students read independently, the Student Reader Chapter 6, "The Nervous System." This selection introduces students to nerves and how they carry messages to and from the brain to aid in movement and sensing. It discusses the importance of protecting the brain and spinal cord in order to avoid paralysis and traumatic brain injury.

Preview Core Vocabulary Terms

Before students read, write this term on the board. Encourage students to pay special attention to this term as they read.

nerve

Know the Science

1. How Does "Practice Make Perfect"? When an athlete practices a sport, extra insulating material builds around the fibers that transmit messages back and forth between the brain and the muscles in the eyes, the hands, the feet, and other body parts. Scientists have discovered that this extra insulation allows messages to travel faster, and this improves performance.

Know the Standards

CCC: Systems and System Models: As students learn about more human body systems, they can begin to think about the human body as a single system with subsystems. This kind of thinking promotes understanding of how subsystems interact and will help students explain the unit phenomenon.

Guided Reading Supports

Page 27

Ask students to turn to page 27 of the Student Reader. Remind students that the title of this chapter is “The Nervous System,” and tell them to pay special attention to how nerves are essential to the function of all of the body’s parts and systems.

Recap the human body systems students have already investigated (muscular system, skeletal system), and point out that the nervous system is another human body system that contains smaller parts that form a whole.

Ask: What are some parts of the nervous system?

Pages 28–29

Ask: What does the brain do with information from the optic nerves?

Ask: What would happen to your senses if the nerves from your eyes and ears were no longer connected to the brain?

SUPPORT—Invite students to discuss the kinds of information associated with each sense. Using the sense of sight, students can detect various interactions of light and matter, including color, shape, brightness, and motion. Hearing enables students to detect sounds, including pitch and volume. Students’ sense of smell detects many kinds of chemicals and possibly a trillion combinations of them. Students’ sense of taste detects salty, sweet, sour, bitter, and meaty flavors. Their sense of touch gives information about pressure, pain, temperature, and vibrations.

Pages 30–31

Ask: Through what body part do signals from the brain travel to reach parts below the neck?

Remind students that the spinal cord is protected by the spine—a group of small bones that run down the center of the back and neck.

SUPPORT—To help them visualize the central nervous system, tell students that they can think of the spinal cord as a highway system. The nerves are like entrance and exit ramps for all the messages that move between nerves and the brain.

Page 32

Ask students: What are things people can do to protect their heads and spines? (See **Know the Science 2.**)

» Sample answer: wear helmets, don’t play too roughly, use playground equipment safely

Know the Science

2. What Are Concussions, and How Should They Be Handled? A concussion is a traumatic brain injury that occurs when the brain bounces or twists inside the skull. Concussions are caused by hard bumps, blows, or a sudden movement of the body that shakes the head. The effects can be temporary and mild or long-term and serious. There may not be a loss of consciousness or external bruises, but symptoms can include slowness to respond to questions, clumsy movement, confusion, headache, or vomiting. Another sign of concussion is that one eye has a larger pupil than the other eye. This or other symptoms mean that the person should be seen by a medical provider.

EXTEND—Download the free app called “Rocket Blades” from the Centers for Disease Control and Prevention for students to play on a tablet. In a follow-up discussion, make sure students can relate the advice in the game about falling and bumping their heads to other daily experiences.

Online Resources



Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

4. Teach Core Vocabulary.

5 MIN

Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary word (displayed on the board earlier in the lesson). Have students write the term in the upper left corner of an index card and underline it.

nerve

Word Work

nerve: Make sure students understand that nerves transfer information throughout the body. (See **Know the Science 3.**) Relate this concept to the real world by asking students if there is a person in their community who is responsible for carrying messages to and from people around town, the country, and the world. (Students should make the connection to mail carriers.)

Know the Science

3. What Are Nerves Made Of? The fundamental unit of all body parts is the cell. Nervous system cells responsible for transmitting signals are called *neurons*. Most neurons have a central cell body, several short branches, called *dendrites*, that receive signals, and a longer branch, the *axon*, that sends signals to other nerve cells. The nerve fiber is the axon, and the nerve, described in the Student Reader, is a bundle of axons. Surrounding the bundle is a covering that insulates and protects the fibers.

5. Check for understanding.

10 MIN

Activity Page



AP 6.1

Restate the Big Question—**How do nerves support senses and movement?** Tell students they will answer by thinking about a table tennis game and completing an Activity Page.

Formative Assessment

Distribute a copy of Your Nervous System at Play (AP 6.1) to each student. Have students follow the directions to label the drawing. Allow students to discuss in pairs or use Student Reader Chapter 6 as a reference.

Circulate among the students as they work, asking clarifying questions to bring out the following overarching concepts:

- The sensing body parts send information about a situation to the brain to interpret.
- The brain sends messages to muscles to move the body in certain ways.

See the Activity Pages Answer Key for sample student responses.

LESSON 7

Helpful Body Technology

Big Question: How can inventions help with senses and movement?

Tie to the Anchoring Phenomenon: Over the course of this unit, students used what they learned from each lesson to build understanding of how the different body senses and systems function and interact, specifically in a game of table tennis. In this lesson, students examine different ways in which these senses and systems can be impaired and how technology can help.

AT A GLANCE

Learning Objective

- ✓ Describe adaptive technologies that support hearing, vision, and mobility functions.

Instructional Activities

- class discussion
- teacher Read Aloud
- student investigation

Core Vocabulary

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.

impaired technology

Instructional Resources

Student Reader



Ch. 7

Activity Pages



AP 7.1

AP 7.2

Student Reader, Chapter 7
"Helpful Body Technology"

Activity Pages

Write with a Pattern of Bumps
(AP 7.1)

Returning a Table Tennis Serve
(AP 7.2)

Materials and Equipment

Collect or prepare the following items:

- ballpoint pens (1 per student)
- 9 x 12 inch corrugated cardboard (1 per student)
- anchor chart paper
- internet access and the means to project images/video for whole-class viewing

1. Introduce the Big Question.

5 MIN

Introduce the Big Question to students—**How can inventions help with senses and movement?** Explain that inventions are types of technology that use science to solve specific problems. Brainstorm with students some problems people can use science to solve. Have students state the problems as questions. Remind students that technological solutions to problems can be both simple and complex. (See **Know the Science.**)

Sample questions:

- » How can we grow more food for people to eat?
- » How can people get to Mars and back?
- » What's the best shoe design for running fast?
- » How can kids protect their eyes while playing sports?

2. Student Reader: Read and discuss together.

20 MIN

Student Reader



Ch. 7

Read together, or have students read independently, the Student Reader Chapter 7, "Helpful Body Technology." The selection describes to students various forms of technology that are designed to provide aid to people who have hearing, vision, and mobility problems.

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 33

Explain to students that many people think of electronic tools and applications when they think of the word *technology*. However, long before the invention of computers, people used science to solve problems such as how to use stones as hammers, parts of plants to catch fish, and dogs to pull heavy loads on sleds.

Know the Science

What Exactly Is Technology? Many people use the word *technology* to refer to computer-based solutions to problems. But the term encompasses solutions to problems that predate the invention of computers and encompasses all practical inventions in human history. For example, the wheel is a technology designed to move heavy loads more easily than dragging them. Selective breeding of dogs produced breeds that are suited for specific tasks, such as herding sheep. Common to all examples is that people are applying their understanding of life science, Earth and space science, and physical science to solve real-world problems. The processes people use in solving these kinds of problems are the basis of engineering design.

Ask: What are some technologies used by people who have partial vision?

SUPPORT—Help students to visualize how patterns of letters can be used to build words by using an online tool called “The Name Game: See Your Name in Braille.” Students can type their name into a text box, and the dot pattern will appear in the upper left corner of the window. Allow students to print and display their names in braille.

EXTEND—Add to a classroom reading center the picture book biography called *Six Dots: A Story of Young Louis Braille* by Jen Bryant and Boris Kulikov (Knopf Books for Young Readers, 2016). Point out that Louis Braille was a teenager when he invented his system of using combinations of raised bumps to represent letters. Display a simple chart that shows the engineering design process, and have students explain how Braille’s story is an example of that process. (See **Know the Standards.**)

Page 34

Remind students that the retina is the thin layer of tissue at the back of the eye. Have students review the illustration on page 11 and notice that when light strikes the retina, information from it is transferred along the optic nerve to the brain.

Ask: What problem are designers of artificial vision trying to solve? What kinds of daily activities would be made easier for a blind person who uses artificial vision?

EXTEND—Show students a video of a news report about artificial vision technology that is referred to as a “bionic eye.” Discuss how the woman reacted to seeing for the first time in forty years. Ask: How do you think the person who designed the bionic eye feels when someone uses it for the first time?

Online Resources



Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

Pages 35–36

Point out that a person who has hearing loss is called *hearing impaired*. Ask students: How does a hearing aid help people who are hearing impaired?

Ask students: What problem can a cochlear implant help solve?

- Have students look at the diagram of the ear on page 5 of the Student Reader, and remind them that the cochlea is a part of the ear that is on the inside. It is connected to the auditory nerve, which sends information about sounds to the brain.

Know the Standards

ETS1 Engineering Design: NGSS integrates engineering design Disciplinary Core Ideas into many Performance Expectations. The DCIs are organized by grade spans (K–2, 3–5, 6–8, and 9–12). In Grades 3–5, ETS1.A requires problems to be defined and evaluated by constraints and criteria. ETS1.B identifies the need to do research, share proposed ideas, and test solutions. ETS1.C reiterates the importance of testing and using the results of tests to determine which solution solves the problem.

- Have students look at the photo on page 36 while you point out that the external device that sits behind the ear contains a microphone to pick up sound vibrations. Then point to the round device sitting on the head above the ear, and explain that it is a transmitter that sends sound signals to a device that was placed nearby, under the skin. From there, signals travel through a wire that ends in the cochlea.

Ask: Why would it be helpful to have a team of people working on inventing this technology?

Pages 37–38

Prompt students to think about the main entrance and lobby area of the school. Ask students to share what technologies have been put in place to assist people with mobility issues in entering, exiting, and moving around the building. Some examples may include ramps, elevators, and automatic doors.

Ask: What are some technologies to solve the problem of people needing help to stand or walk?

Ask students: Why might some people want their artificial limb to look like a natural limb?

Pages 39–40

Ask: How is a robotic artificial limb different from one that is not robotic?

Point out that *robotic* means “like a robot.” Ask students to explain how these devices are robot-like.

Online Resources



EXTEND—If students are interested to learn more about robotic prosthetic limbs, display additional websites and share clips from more videos about 3-D printing bionic prosthetic limbs. Explain that 3D printers make it possible for people to make limbs that can move and do tasks and are the right size for the person or other animal that wears them.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to these resources may be found:

www.coreknowledge.org/cksci-online-resources

3. Investigate writing and reading braille.

10 MIN

Activity Page



AP 7.1

Give each student a copy of Write with a Pattern of Bumps (AP 7.1), a ballpoint pen, and a sheet of corrugated cardboard about the same size as their Activity Page.

Review with students how the braille alphabet, shown at the top of their Activity Page, is a technology that people with complete vision loss can use to read and write. Explain that each letter forms a distinct patten of raised dots that the reader can feel on the page.

Have students place their Activity Page on top of the corrugated board and write their name or another word in braille in the set of blanks at the bottom of the page. Tell students to push hard enough with the point of the pen to break through the paper, leaving an indentation in the cardboard underneath it.

Next have students turn over the paper and feel the raised set of dots for each letter. Students can exchange papers with another student and see if they can use the chart on the Activity Page to decode the letters and read the word.

4. Check for understanding.

10 MIN

Activity Page



AP 7.2

Restate the Big Question—**How can inventions help with senses and movement?** Make a class chart, like the one shown below, and invite students to give examples. Make sure all students understand that every technology that is invented and used by people solves a specific problem. Point out that sometimes technology is used to solve a different problem than originally intended—for example, when someone uses a penny to play a game of hopscotch.

Problem	Technology That Solves It

Summative Assessment

Distribute a copy of Returning a Table Tennis Serve (AP 7.2) to each student. Have students follow the directions to label the drawing.

Circulate among the students as they work, making sure they address interactions between all three systems (nervous, muscular, and skeletal). If students are unsure, explain that the senses are part of the nervous system.

See the Activity Pages Answer Key for sample student responses.

Know the Science

See the Online Resources guide for a link to further teacher support about how information from the reader’s sense of touch travels along nerves from the fingertips to the brain, where the brain “sees” the word.

www.coreknowledge.org/cksci-online-resources

Teacher Resources

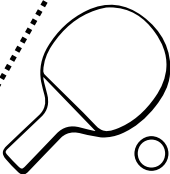
Activity Pages

- Ask Questions About Learning Table Tennis (AP 1.1) **50**
- Take Care of Your Hearing (AP 2.1) **51**
- Investigating Eyes and Light (AP 3.1) **52**
- Label a Skeleton (AP 5.1) **53**
- Your Nervous System at Play (AP 6.1) **54**
- Write with a Pattern of Bumps (AP 7.1) **55**
- Returning a Table Tennis Serve (AP 7.2) **56**

Activity Pages Answer Key: *Human Senses and Movement* **57**

Ask Questions About Learning Table Tennis

In each box, write a question about how people use their bodies to learn table tennis.



Learning
Table Tennis

Name _____

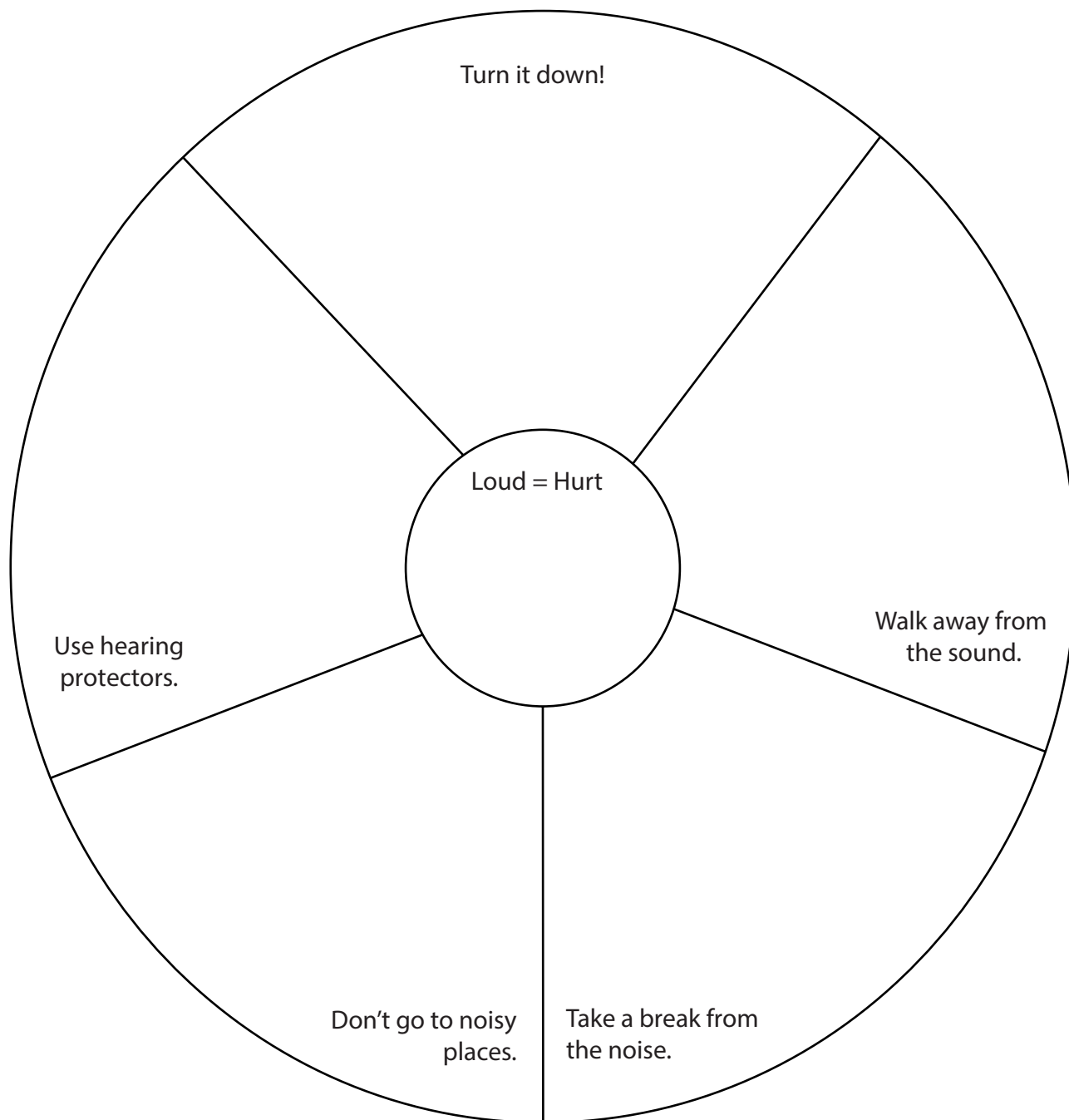
Date _____

Activity Page 2.1

Use with Lesson 2

Take Care of Your Hearing

Draw inside the shapes to show people how to protect their hearing from loud sounds.



Name _____

Date _____

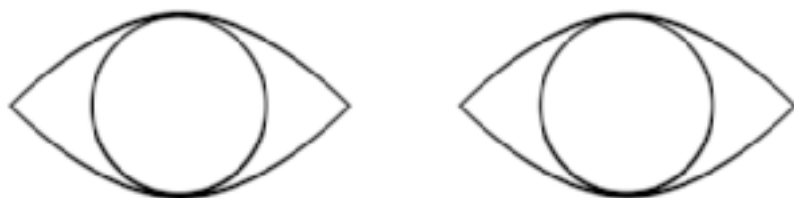
Activity Page 3.1

Use with Lesson 3

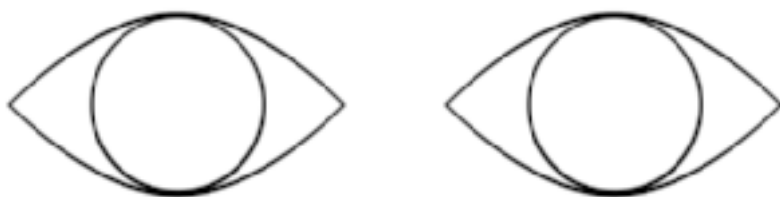
Investigating Eyes and Light

Write and draw to answer each question.

1. Draw how the black dots in the center of each eye looked when the flashlight was off.



2. Draw how the black dots in the center of each eye looked when the flashlight was shined on them.



3. How did the black dots change?

4. What caused the change?

Name _____

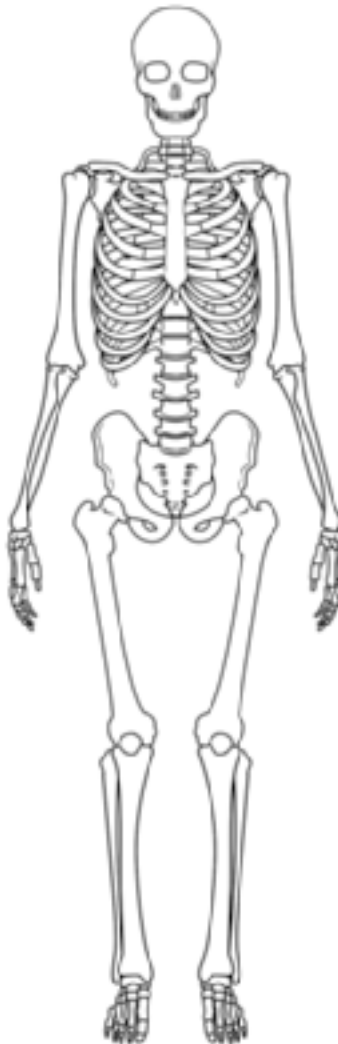
Date _____

Activity Page 5.1

Use with Lesson 5

Label a Skeleton

1. Use blue to color the bones that protect soft body parts.
2. Label bones you learned about with their names.
3. Use yellow to highlight some of the larger joints.
4. Draw a straight line from the head to the feet to show how the skeleton has matching parts on each side.



5. Write to explain how the skeleton moves.

Your Nervous System at Play

Draw and label the following parts. Write what each part does when you play table tennis.

brain	optic nerves	auditory nerves	spinal cord	motor nerves
-------	--------------	-----------------	-------------	--------------



Name _____

Date _____

Activity Page 7.1

Use with Lesson 7

Write with a Pattern of Bumps

Use the Braille Alphabet chart to write your name or another word in braille.

The Braille Alphabet

a	b	c	d	e	f	g	h	i	j
k	l	m	n	o	p	q	r	s	t
u	v	w	x	y	z				

Name _____

Date _____

Activity Page 7.2

Use with Lesson 7

Returning a Table Tennis Serve

You are the coach of a table tennis team. Add labels and arrows to the drawing to teach your players how the muscular, skeletal, and nervous systems work together to hit the ball. Then answer the question.



Which of the three body systems is the most important to hitting the ball? Explain your reasoning.

Activity Pages Answer Key: Human Senses and Movement

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.

Ask Questions About Learning Table Tennis (AP 1.1) (page 50)

Sample questions: Should I look at my paddle or at the ball?

Does it help to practice serving and hitting the ball?

How should I hold the paddle?

Should my feet be close together or far apart when I play?

Take Care of Your Hearing (AP 2.1) (page 51)

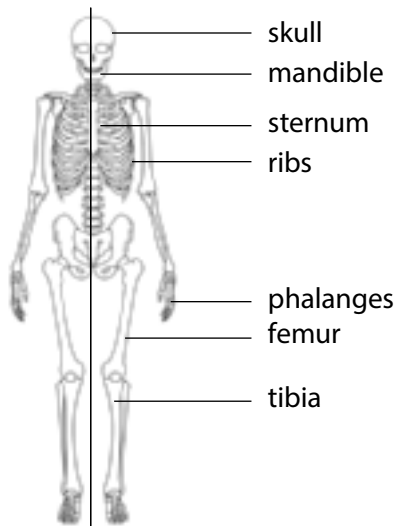
Accept reasonable depictions from students' experiences.

Investigating Eyes and Light (AP 3.1) (page 52)

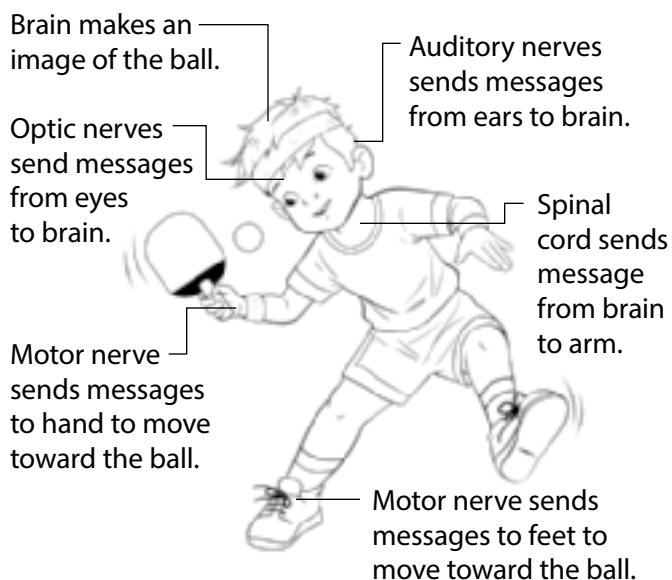
1. Drawings should depict pupils as large, dark circles.
2. Drawings should depict pupils as smaller dark circles.
3. They got smaller.
4. light

Label a Skeleton (AP 5.1) (page 53)

Skull and Ribs should be colored blue. Shoulders, elbows, hips, and knees should be colored yellow.



Your Nervous System at Play (AP 6.1) (page 54)



Write with a Pattern of Bumps (AP 7.1) (page 55)

Answers will vary. If time permits, you may choose to have students trade Activity Pages to decode each other's words or names.

Returning a Table Tennis Serve (AP 7.2) (page 56)

Look for the following pertinent details in students' text labels:

The brain sends messages down the spinal cord and nerves to arm and leg muscles.

Eyes watch the ball move and send information to the brain through a nerve.

Ears hear the bounce of a ball and send information to the brain through a nerve.

Arm muscles pull on arm bones to raise the arm.

Leg muscles pull on leg bones to bend and move into position.

Accept all reasonable explanations about most important body systems.

Glossary

Green 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

auditory, adj. relating to the sense of hearing

auditory nerve, n. the bundle of nerve fibers that carries hearing information between the cochlea and the brain

B

bone, n. rigid body material that provides structure and protection

brain, n. the organ located in the skull of animals with backbones that coordinates senses, body responses, and thought

C

cochlea, n. the spiral cavity in the inner ear that transfers vibration to the brain through the auditory nerve

connective tissue, n. tissue that joins bones to muscles or other bones

contract, v. to shorten

coordinated, adj. brought together in an organized relationship

cornea, n. the transparent layer that covers the front of the eye

D

detect, v. to identify the presence of something

E

ear canal, n. the passage leading from the external ear to the eardrum inside the ear

eardrum, n. the thin flap of skin inside the ear that vibrates when sound waves affect it

electrical impulse, n. a signal carried through and between nerves

enable, v. to make possible

F

femur, n. the bone of the thigh, reaching from the hip to the knee

function, v. to work for a specific purpose.

H

hearing, n. the ability to sense vibration as sound

I

impaired, adj. not fully functioning

involuntary muscle, n. muscle tissue that contracts without conscious thought

iris, n. the colored part of the front of the eye

J

joint, n. the place where two bones are joined together by connective tissue

L

lens, n. the clear part of the front of the eye that focuses light at the back of the eye

M

mandible, n. the jawbone

muscle, n. soft body tissue that contracts

N

nerve, n. a fiber in the body that transmits impulses to and from the brain

nervous system, n. the brain, spinal cord, and nerves that function in the body to provide sensation, coordination, and control

O

optic, adj. related to the eyes or vision

optic nerve, n. the bundle of fibers that relays information from the eyes to the brain

organ, n. a collection of tissues that form a unit to perform a body function

outer ear, n. the visible part of the ear

P

pelvis, n. the complex of bones that connect the trunk to the legs and contain the hip joints

phalanges, n. the bones that make up the fingers and toes

pupil, n. the circular opening in the front of the eye that lets light enter

R

retina, n. the collection of light-sensitive cells at the back of the eye

ribs, n. the set of bones in the upper torso that envelop the heart and lungs

S

serve, v. to set a ball into motion initiating play in a game

skeletal system, n. all the bones in the body, which work together to provide structure and protection and enable movement

skull, n. the bones of the head

sound, n. vibration detected by the sense of hearing

spinal cord, n. the bundle of nerve fibers that connects the brain to the nerves that branch throughout the body

spine, n. vertebrae taken together as the backbone

sternum, n. the breastbone

system, n. a collection of parts that function together

T

technology, n. the use of science in solving problems

tibia, n. the shin bone; the larger of two bones that extend from the knee to the ankle

tissue, n. a collection of similar cells that carry out a specific body function

V

vibrate, v. to move back and forth very quickly

vision, n. the ability to detect objects that reflect light; the sense of sight

voluntary, adj. done by choice

voluntary muscle, n. a muscle that moves as a result of conscious thought

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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Core Knowledge **SCIENCE™**

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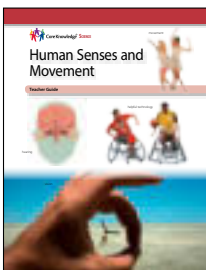
Human Senses and Movement

Core Knowledge Science 3



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 middle elementary grades. For teachers and schools following the *Core Knowledge Sequence*, this book is intended for Grade 3 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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