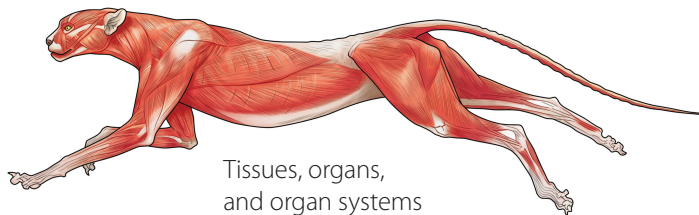
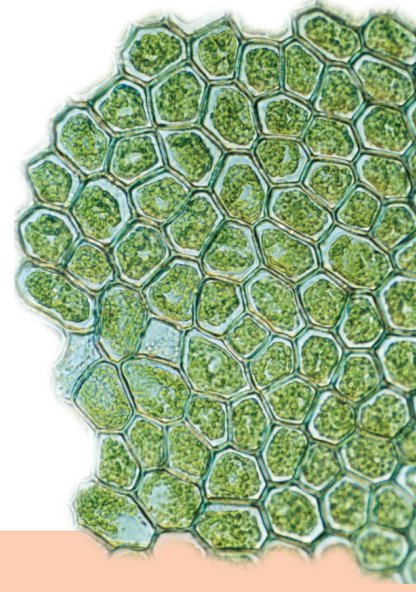
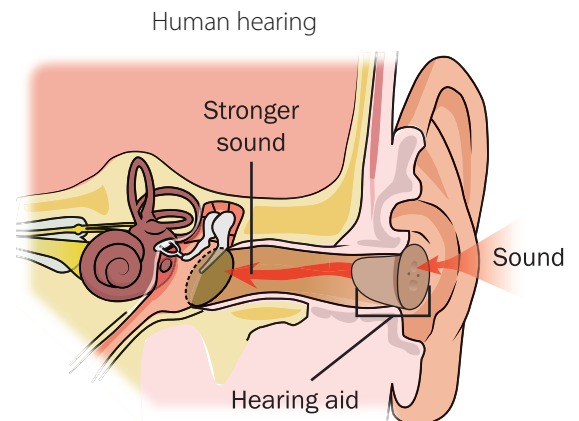


Structures and Functions of Living Things

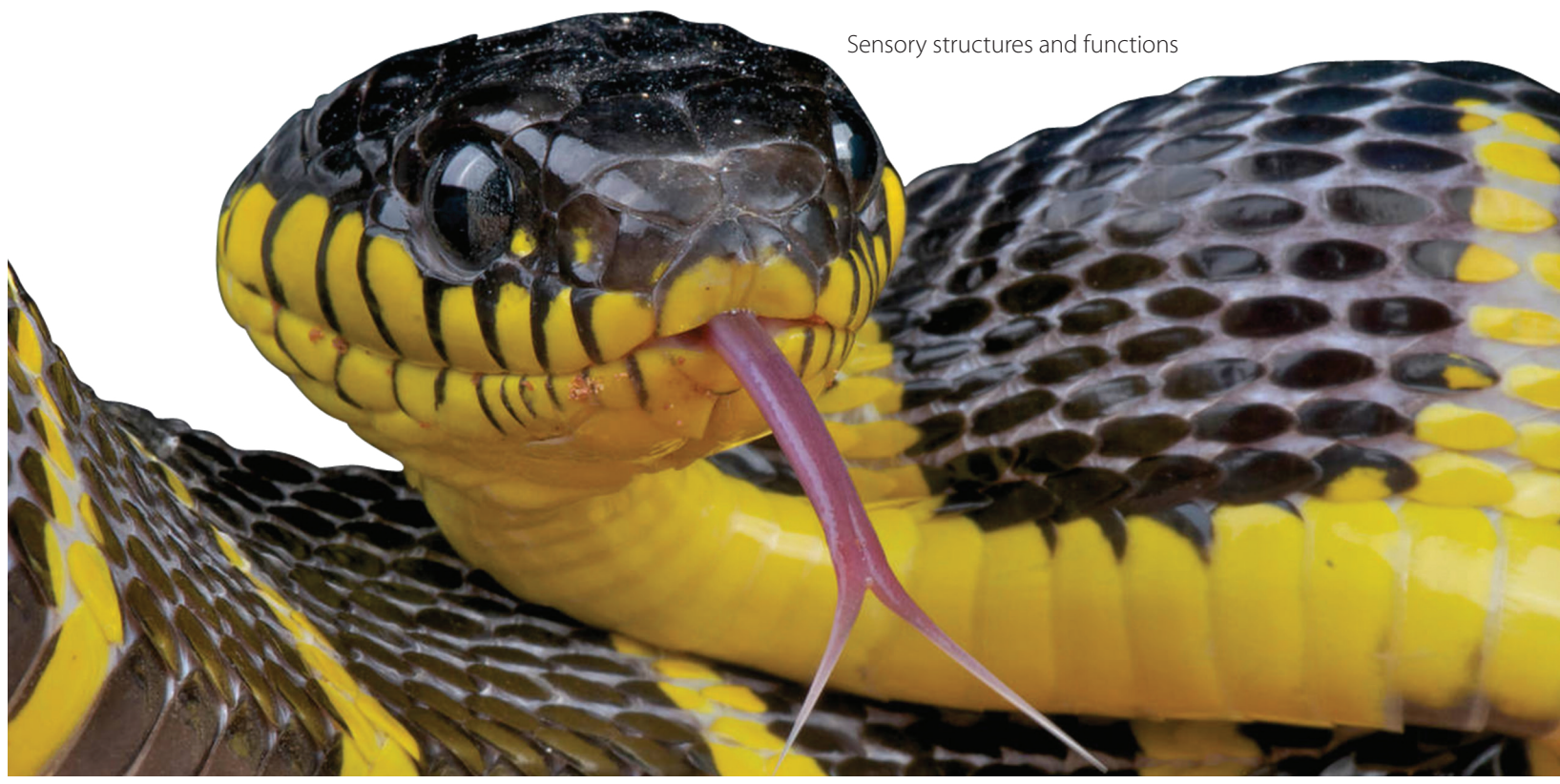
Teacher Guide



Tissues, organs,
and organ systems



Sensory structures and functions



Structures and Functions of Living Things

Teacher Guide



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ISBN: 978-1-68380-523-6

Structures and Functions of Living Things

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Structures and Functions of Living Things

Teacher Guide

Core Knowledge Science™ 4

UNIT 3

Introduction

ABOUT THIS UNIT

The Big Idea

This unit focuses on the scientific concept that organisms are made up of structures that function to support survival.

A key concept in biology is that structure is related to function. The structure of a bird's wing is related to the function of flying. The bright color associated with a flower's structure is related to the function of attracting insects for pollination as part of reproduction. All plants and animals have both external and internal structures that work together as systems that enable organisms to survive, grow, and reproduce. The structure-function relationship holds true for the fundamental unit of life, the cell. Groups of cells make up tissues, groups of tissues make up organs, and groups of organs are organ systems. At all levels, structure is related to function.

Organisms have sensory organs that detect different kinds of information about the environment (such as temperature, odor, sound, and light). In these sensory organs, the interaction of structure and function always supports the survival of the organism. Consider, for example, the structure and function of the eyes and ears of a cat, fox, or human being. The many structures that make up the eye and the ear, with each structure performing its particular function, help to detect and/or transmit information. Nerve signals alert the brain to the outside world. The brain supports survival, signaling immediately or storing the information as memory.

Note to Teachers and Curriculum Planners

This unit introduces Grade 4 students to real-world examples and fundamental concepts that will be explored in greater depth in later grades. Students will learn about tissues, organs, and organ systems, with a particular emphasis on visual and auditory sensory systems. The following are preliminary considerations for planning and instruction relative to this unit:

- While students explore visual and auditory sensory structures, at this level they are not expected to comprehend the cellular mechanisms of vision or how the retina works.
- Students are introduced to the concepts of stimulus and response; however, they are not expected to learn the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.

- Students explore many examples of biological structures, but memorization of components of organ systems is not expected. Assessment is limited to macroscopic structures within plant and animal systems.
- This unit also extends learning about light and sound explored in Grade 4 Unit 3 *Investigating Waves*.

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, in particular, students benefit from not just reading about concepts and ideas, but also 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 *2010 Core Knowledge Sequence*. The result of this effort is the revised *2019 Core Knowledge Science 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.

Online Resources



To download the *2019 Core Knowledge Science Sequence*, use the links found in the Online Resources Guide.

www.coreknowledge.org/cksci-online-resources

This science unit, aligned to the *2019 Core Knowledge Science Sequence* and informed by NGSS, 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
- connecting scientific learning to concepts across various disciplines, such as mathematics and literacy

To see how you can continue to use your current Core Knowledge materials with the 2019 CKSci™ curriculum, please see on the next page an example of how this unit compares to the *2010 Core Knowledge Sequence*.

Examples of content retained from the 2010 Core Knowledge Sequence	Examples of Core Knowledge content in this CKSci unit
Light and Sound (Grade 3) • Vision: How the human eye works • Hearing: How the human ear works The Human Body (Grades 3 and 4) • Skeletal system: skeleton, bones, muscular connections • Nervous system: brain, spinal cord, nerves • Circulatory system: heart, blood • Respiratory system: lungs, taking in oxygen Cells: Structures and Processes (Grade 5) • All living things are made up of cells. • Organization of living things: cells, tissues, etc.	Structure Is Related to Function • Organization of all living things: from cells to systems • At any level of organization, each internal and external structure reflects its function. The Structure and Function of the Ears and Eyes • The auditory and visual systems Stimulus, Response, and Survival • In most animals, sensory organs transmit information to the brain: perceptions and memories • Plants also respond to stimuli. Example: A plant can sense the direction of light and grow toward it. • Response to stimuli helps survival, growth, etc.
For a complete look at how CKSci relates to the 2010 Sequence, please refer to the full Correlation Charts available for download using the Online Resources Guide for this unit: www.coreknowledge.org/cksci-online-resources	

What are the relevant NGSS Performance Expectations for this unit?*

This unit, *Structures and Functions of Living Things*, has been informed by the following Grade 4 Performance Expectations for the NGSS topic *Structure, Function, and Information Processing*. Students who demonstrate understanding can

4-PS4-2 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

For detailed information about the NGSS references, follow the links in the Online Resources Guide for this unit. Use the following link to download any of the CKSci Online Resources Guides:

www.coreknowledge.org/cksci-online-resources

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:

PS4.B: Electromagnetic Radiation

- Grades K–2**
- Objects can be seen only when light is available to illuminate them. Very hot objects give off light (e.g., a fire, the sun). Some materials allow light to pass through them, others allow only some light through, and others block all the light and create a dark shadow on any surface beyond them (i.e., on the other side from the light source), where the light cannot reach. Mirrors and prisms can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.)

PS4.C: Information Technologies and Instrumentation

- Grades K–2**
- People use their senses to learn about the world around them. Their eyes detect light, their ears detect sound, and they can feel vibrations by touch.

LS1.A: Structure and Function

- Grades K–2**
- All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive, grow, and produce more plants.

LS1.B: Growth and Development

- Grades K–2**
- Plants and animals have predictable characteristics at different stages of development. Plants and animals grow and change. Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.

- Grade 3**
- Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

LS1.C: Organization for Matter and Energy Flow in Organisms

- Grades K–2**
- All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.

LS1.D: Information Processing

- Grades K–2**
- Animals have body parts that capture and convey different kinds of information needed for growth and survival—for example, eyes for light, ears for sounds, and skin for temperature or touch. Animals respond to these inputs with behaviors that help them survive (e.g., find food, run from a predator). Plants also respond to some external inputs (e.g., turn leaves toward the sun).

LS2.A: Ecosystems: Interactions, Energy, and Dynamics

- Grades K–2**
- Animals depend on their surroundings to get what they need, including food, water, shelter, and a favorable temperature. Animals depend on plants or other animals for food. They use their senses to find food and water, and they use their body parts to gather, catch, eat, and chew the food. Plants depend on air, water, minerals (in the soil), and light to grow. Animals can move around, but plants cannot, and they often depend on animals for pollination or to move their seeds around. Different plants survive better in different settings because they have varied needs for water, minerals, and sunlight.

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. NGSS References, including Performance Expectations, Disciplinary Core Ideas, and Crosscutting Concepts, are included at the start of each lesson as appropriate.

A. Structure Is Related to Function

LESSONS 1–7

- Describe an example of the relationship of structure and function in a plant.
- Describe an example of multiple organs working together within an animal as a system.
- Create a model that explains the concept of the levels of biological organization.
- Identify the function of specific structures in plants and animals (such as the leaves and roots of a plant, or the human heart and skin).
- Construct an argument that in animals any structural level (such as skin, nerves, and the heart) supports survival, growth, behavior, and reproduction.
- Construct an argument that in plants any structural level (such as leaves, roots, and flowers) supports survival, growth, behavior, and reproduction.

B. Structures and Functions of Eyes and Ears

LESSONS 8–10

- Identify the basic parts of the human auditory system and their functions.
- Develop a model to show that sound waves interact with special organs that allow living things to detect sound.
- Identify the basic parts of the human visual system and their functions.
- Develop a model to show the relationship between light reflecting from objects and specialized organs that allow living things to detect light.
- Make a presentation that explains how different structures, each with different functions, work together as part of systems to support human hearing and seeing.

C. Sensory Structures, Functions, and Survival

LESSONS 11–14 AND UNIT REVIEW

- Give examples of stimuli and responses in an animal.
- Give an example of stimulus and response in a plant.
- Identify examples of different sensory organs in an animal.
- Use a model to describe how an organism's senses help it to survive, grow, reproduce, and behave.
- Diagram and explain examples of stimulus and response in animals and plants.

What Teachers Need to Know

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

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

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

USING THE STUDENT READER

Student Reader



The *Structures and Functions of Living Things* Student Reader has eight 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.

Explore, then read: In the CKSci program, lessons are sequenced to provide active engagement before reading. First, students explore phenomena through hands-on investigations or teacher demonstrations, accompanied by active questioning and analysis; then, students study the informational text provided in the Student Readers. The icon shown at left will signal Core Lesson segments that focus on Student Reader chapters.

CKSci Student Readers extend, clarify, and confirm what students have learned in their investigations. The text helps students develop a sense of the language of science, while images, diagrams, charts, and graphs deepen conceptual understanding. Use of the CKSci Student Readers supports the Science and Engineering Practice “Obtaining, Evaluating, and Communicating Information” as described in *A Framework for K–12 Science Education*.

Independent reading or group read-aloud: While the text in the Student Readers is written for independent reading, we encourage group read-aloud 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 *Structures and Functions of Living Things* unit is one of five units in the Grade 4 CKSci series. To meet NGSS Performance Expectations, we encourage teachers to complete all units during the school year. To be sure all NGSS Performance Expectations are met, each Core Lesson should be completed, and each requires thirty to forty-five minutes of instruction time. The time it takes to complete a lesson depends on class size and individual circumstances.

Within the Teacher Guide, the Core Lessons are divided into numbered segments, generally five or six, with approximate times listed per segment. The final segment is always a Check for Understanding, providing the teacher with an opportunity for formative assessment.

At the end of this Unit Introduction, you will find a Sample Pacing Guide on page 14 and a blank Pacing Guide on pages 15–16, 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 this entire unit and create your pacing guide before teaching the first lesson. As a general rule, we recommend that you spend no more than twenty days teaching the *Structures and Functions of Living Things* unit so that you have time to teach the other units in the Grade 4 CKSci series.

The Core Lessons

- Lesson time: Each Core Lesson constitutes one classroom session of up to forty-five minutes. Understanding that teachers may have less instructional time, we show a time range of thirty to forty-five minutes per lesson. Teachers may choose to conduct all Core Lesson segments, totaling forty-five minutes; may choose to conduct a subset of the lesson segments; or may choose to spend less time per segment.
- Lesson order: The lessons are coherently sequenced to build from one lesson to the next, linking student engagement across lessons and helping students build new learning on prior knowledge.

PART	LESSON	BIG QUESTION
A. Structure Is Related to Function (4-LS1-1)	1. Structure and Function of a Plant	How are structure and function related in a plant process?
	2. Biological Organization	How are cells and tissues related in living things?
	3. Organs and Organ Systems	How do organs work together in systems to perform specific functions?
	4. Functions for Survival (two class sessions)	What functions of living things enable them to survive and grow?
	5. Functions in Animals (two class sessions)	How do some animal structures function?
	6. Functions in Plants	How do some plant structures function?
	7. Structure and Function Report (two class sessions)	How are structure and function related in any one plant or animal?
B. Structures and Functions of Eyes and Ears (4-PS4-2)	8. Hearing and Vision	How does the eye gather light and use it to see?
	9. Human Vision and Hearing	How do humans see and hear?
	10. Modeling the Detection of Sound and Light (two class sessions)	How can I model structures that function to detect sound and light?
C. Sensory Structures, Functions, and Survival (4-LS1-2)	11. Sensing the Environment	Why must plants and animals sense their environments?
	12. Animal Senses	How do animals sense and respond to their environments?
	13. Plant Responses	How do plants sense and respond to their environments?
	14. Stimulus and Response for Survival	How do a(n) _____'s senses help it to survive?
Unit Review and Assessment	Helen Keller and Louis Braille	What have I learned about structures and functions?
	Unit Assessment	What have I learned about structures and functions?

Activity Pages and Unit Assessment

Activity Pages



Black line reproducible masters for Activity Pages and a Unit Assessment, as well as an Answer Key, are included in Teacher Resources on pages 117–163. The icon shown to the left appears throughout the Teacher Guide wherever Activity Pages (AP) are referenced.

- Students' achievement of the NGSS Performance Expectations is marked by their completion of tasks throughout the unit. However, a combined Unit Assessment is provided as a summative close to the unit.
- AP 1.1 Lesson 1—Structure of a Celery Stalk (AP 1.1)
 - AP 1.2 Lesson 1—Celery Investigation (AP 1.2)
 - AP 2.1 Lesson 2—Cells and Tissues Model (AP 2.1)
 - AP 2.2 Lesson 2—Lesson 2 Check (AP 2.2)
 - AP 3.1 Lesson 3—Make a Lung Model (AP 3.1)
 - AP 3.2 Lesson 3—Lesson 3 Check (AP 3.2)
 - AP 4.1 Lesson 4—Organism Research and Concept Map (AP 4.1)
 - AP 4.2 Lesson 4—Lesson 4 Check (AP 4.2)
 - AP 5.1 Lesson 5—Functions in Animals (AP 5.1)
 - AP 5.2 Lesson 5—Classifying Structures (AP 5.2)
 - AP 6.1 Lesson 5—Lesson 5 Check (AP 5.3)
 - AP 6.2 Lesson 6—Functions of Plant Structures (AP 6.1)
 - AP 7.1 Lesson 6—Lesson 6 Check (AP 6.2)
 - AP 7.2 Lesson 7—Research and Writing Discussion (AP 7.1)
 - AP 7.3 Lesson 7—Research and Writing Outline (AP 7.2)
 - AP 8.1 Lesson 7—Report Scoring Guide (AP 7.3)
 - AP 8.2 Lesson 7—Take-Home Guide (AP 7.4)
 - AP 9.1 Lesson 8—The Pupil (AP 8.1)
 - AP 10.1 Lesson 8—Reflection (AP 8.2)
 - AP 10.2 Lesson 9—Sending Signals (AP 9.1)
 - AP 11.1 Lesson 10—Ruler Drop Investigation (AP 10.1)
 - AP 12.1 Lesson 10—Make a Model (AP 10.2)
 - AP 13.1 Lesson 11—Plant Stimulus and Response (AP 11.1)
 - AP 14.1 Lesson 12—What Senses Do Animals Have? (AP 12.1)
 - AP UR.1 Lesson 13—Plant Response Concept Map (AP 13.1)
 - AP UR.2 Lesson 14—Stimulus and Response Diagram (AP 14.1)
 - AP UR.3 Unit Review—Reading Braille (AP UR.1)
 - Unit Review—Vocabulary Crossword Puzzle (AP UR.2)
 - Unit Review—Vocabulary Review (AP UR.3)

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 the Big Question.

At the beginning of each Teacher Guide lesson, you will find a Big Question and Core Lesson segment devoted to encouraging students to think about this question as they are introduced to new science content. Use this opportunity to engage students in conversation, to think about how their own real-world experiences relate to the topic, or to participate in a demonstration that relates to the Big Question.

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.

As a continuous vocabulary-building strategy, have students develop a deck of vocabulary cards, adding a card for each Core Vocabulary term as it is introduced. Students can add illustrations and examples to the cards as their comprehension of terms expands. During instruction, emphasize Core Vocabulary terms and their meanings in context rather than relying on isolated drill for memorization of definitions. Students will be given the opportunity to preview Core Vocabulary words early in the lessons and to engage in Word Work activities toward the end of the lessons. 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 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 definitions in the Word Work lesson segments, as well as in the Glossary on pages 166–167.

Emphasize observation and experience.

Lessons employ various ways for students to learn, including watching, listening, reading, doing, discussing, and writing. To meet the NGSS Performance Expectations, which are multidimensional standards, students must not only gain factual knowledge associated with Disciplinary Core Ideas, but also *use* the content knowledge they acquire.

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.

Core Lesson segments are designed to reinforce the idea of science as an active practice, while helping students meet NGSS Performance Expectations. Each lesson segment is introduced by a sentence emphasizing active engagement with an activity.

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. Refer to the Crosscutting Concepts cited in the lessons, often included in the NGSS References listed at the start of each lesson.

Monitor student progress.

Use verbal questioning, student work, the Check for Understanding assessments at the end of each lesson, and the Unit Assessment at the end of the unit (see pages 153–158) 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

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 168–172, 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

Online Resources



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 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.

Part A: Structure Is Related to Function

Lesson 1

- bunches of celery with leaves (enough for 3 stalks per group)
- food coloring (red, blue, yellow per group)
- large clear plastic cups (3 per group)
- water
- knife (for teacher use)
- paper towels or other cleanup materials

Lesson 2

- plastic building blocks of assorted sizes and colors (a large number)
- index cards for student vocabulary deck (2 per student)
- internet access and the means to project images/video for whole-class viewing

Lesson 3

- plastic bottle
- plastic straw
- elastic band
- balloons (2)
- modeling clay
- scissors
- index cards for student vocabulary deck (5 per student)
- internet access and the means to project images/video for whole-class viewing

Lesson 4

- sticky notes (6 colors, plus yellow)
- colored paper (6 pieces, same colors as sticky notes, except yellow)
- pin board (or whiteboard)
- pins (or sticky tape)
- string
- scissors

Lesson 5

- images of 10 animals, including various mammals, birds, reptiles, amphibians, fish, and invertebrates
- pin board (or whiteboard)
- pins (or sticky tape)
- sticky notes (5 colors)
- index cards for student vocabulary deck (4 per student)

Lesson 6

- index cards for student vocabulary deck (1 per student)
- internet access and the means to project images/video for whole-class viewing

Lesson 7

- writing and recording materials, such as paper and writing utensils
- internet access, books, magazines, and other research materials

Part B: Structures and Functions of Eyes and Ears

Lesson 8

- mirrors (1 per pair of students)
- index cards for student vocabulary deck (2 per student)
- internet access and the means to project images/video for whole-class viewing

Lesson 9

- scissors (1 pair per group)
- index cards for student vocabulary deck (1 per student)

Lesson 10

- rulers (1 per pair of students)
- scissors
- glue sticks

Part C: Sensory Structures, Functions, and Survival

Lesson 11

- craft feathers (1 per pair of students)
- internet access and the means to project images/video for whole-class viewing

Lesson 12

- drumstick
- index cards for student vocabulary deck (1 per student)
- internet access and the means to project images/video for whole-class viewing

Lesson 13

- index cards for student vocabulary deck (1 per student)
- internet access and the means to project images/video for whole-class viewing

Lesson 14

- resource catalogue and/or reference materials
- internet access and the means to project images/video for whole-class viewing

Unit Review

- packs of small beads
- glue
- internet access and the means to project images/video for whole-class viewing

SAMPLE PACING GUIDE

The sample Pacing Guide suggests use of the unit's resources across a twenty-day period. However, there are many ways that you may choose to individualize the unit for your students, based on their interests and needs. You may elect to use the blank Pacing Guide on pages 15–16 to reflect alternate activity choices and alternate pacing for your class. If you plan to create a customized pacing guide for your class, we strongly recommend that you preview this entire unit and create your pacing guide before teaching the first lesson.

Online Resources



For a yearlong pacing guide, please use the link found in the Online Resources Guide for this unit. This yearlong view of pacing also includes information about how this CKSci unit relates to the pacing of other programs, such as CKLA and CKHG in the *Core Knowledge Curriculum Series™*.

www.coreknowledge.org/cksci-online-resources

TG–Teacher Guide; SR–Student Reader; AP–Activity Page

Week 1

Day 1	Day 2	Day 3	Day 4	Day 5
<i>Structure and Function of a Plant</i> TG Lesson 1 AP 1.1, 1.2	<i>Biological Organization</i> TG Lesson 2 SR Chapter 1 AP 2.1, 2.2	<i>Organs and Organ Systems</i> TG Lesson 3 SR Chapter 2 AP 3.1, 3.2	<i>Functions for Survival</i> DAY 1 TG Lesson 4 AP 4.1	<i>Functions for Survival</i> DAY 2 TG Lesson 4 AP 4.1, 4.2

Week 2

Day 6	Day 7	Day 8	Day 9	Day 10
<i>Functions in Animals</i> DAY 1 TG Lesson 5 SR Chapter 3 AP 5.1	<i>Functions in Animals</i> DAY 2 TG Lesson 5 AP 5.2, 5.3	<i>Functions in Plants</i> TG Lesson 6 SR Chapter 4 AP 6.1, 6.2	<i>Structure and Function Report</i> DAY 1 TG Lesson 7 AP 7.1, 7.2, 7.4	<i>Structure and Function Report</i> DAY 2 TG Lesson 7 AP 7.2, 7.3

Week 3

Day 11	Day 12	Day 13	Day 14	Day 15
<i>Hearing and Vision</i> TG Lesson 8 AP 8.1, 8.2	<i>Human Vision and Hearing</i> TG Lesson 9 SR Chapter 5 AP 9.1	<i>Modeling the Detection of Sound and Light</i> DAY 1 TG Lesson 10 AP 10.1	<i>Modeling the Detection of Sound and Light</i> DAY 2 TG Lesson 10 AP 10.2	<i>Sensing the Environment</i> TG Lesson 11 AP 11.1

Week 4

Day 16	Day 17	Day 18	Day 19	Day 20
<i>Animal Senses</i> TG Lesson 12 SR Chapter 6 AP 12.1	<i>Plant Responses</i> TG Lesson 13 SR Chapter 7 AP 13.1	<i>Stimulus and Response for Survival</i> TG Lesson 14 AP 14.1	<i>Helen Keller and Louis Braille</i> TG Unit Review SR Chapter 8 AP UR.1, UR.2, UR.3	Unit Assessment AP Unit Assessment

PACING GUIDE

Twenty days have been allocated to the *Structures and Functions of Living Things* unit to complete all Grade 4 science units in the *Core Knowledge Curriculum Series™*. If you cannot complete the unit in twenty consecutive days of science instruction, use the space that follows to plan lesson delivery on an alternate schedule.

Week 1

Day 1

Day 2

Day 3

Day 4

Day 5

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Week 2

Day 6

Day 7

Day 8

Day 9

Day 10

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Week 3

Day 11

Day 12

Day 13

Day 14

Day 15

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Week 4

Day 16

Day 17

Day 18

Day 19

Day 20

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Week 5**Day 21****Day 22****Day 23****Day 24****Day 25**

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Week 6**Day 26****Day 27****Day 28****Day 29****Day 30**

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Week 7**Day 31****Day 32****Day 33****Day 34****Day 35**

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Week 8**Day 36****Day 37****Day 38****Day 39****Day 40**

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PART A

Structure Is Related to Function

OVERVIEW

Lesson	Big Question	Advance Preparation
1. Structure and Function of a Plant	How are structure and function related in a plant process?	Gather materials for a student investigation. (See Materials and Equipment, page 12.)
2. Biological Organization	How are cells and tissues related in living things?	Read Student Reader, Chapter 1.
3. Organs and Organ Systems	How do organs work together in systems to perform specific functions?	Read Student Reader, Chapter 2.
4. Functions for Survival (2 days)	What functions of living things enable them to survive and grow?	Schedule time for library access, and gather materials for whole-class activity. (See Materials and Equipment, page 12.)
5. Functions in Animals (2 days)	How do some animal structures function?	Read Student Reader, Chapter 3. Schedule time for library access, and gather materials for whole-class activity. (See Materials and Equipment, page 12.)
6. Functions in Plants	How do some plant structures function?	Read Student Reader, Chapter 4.
7. Structure and Function Report (2 days)	How are structure and function related in any one plant or animal?	Schedule time for library access for student research.

Part A: What's the Story?

Structure and function are related in all living things. Living things are made up of parts that work together to carry out a function. Although this may seem simple enough, students may not yet understand the ways in which these parts, these structures, are organized or how they come together in a system.

In this section, students learn about cells, tissues, organs, and organ systems and how they function to support life in animals and plants.

In Lesson 1, we start by engaging students in a hands-on activity in which students work with celery petioles, the stalk that joins the leaf to stem, to explore both structure and function in a plant. They investigate the transport of water through this part of the plant and develop an early explanation of the relationship between the structures that promote the function.

In Lesson 2, we introduce students to cells and tissues, emphasizing that cells are the smallest unit of life and that collections of cells make up tissues. While students intuitively understand what it means to be alive, the goal here is to focus on the fact that life cannot be possible without these very basic structures, which are responsible for carrying out vital functions for all organisms. Students are exposed to the term *biological organization*.

In Lesson 3, students are introduced to organs and organ systems. Specifically, they extend their learning about tissues and learn that organs work together in systems to perform specific functions. These functions support life for all animals and plants. Students build on their knowledge of cells and tissues to learn about parts of organs. Then they learn about organ systems. By the end of this lesson, students understand that there is a hierarchy and pattern of biological organization in all living things.

In Lesson 4, students delve more deeply into the functions that living things perform, applying what they already know about cells, tissues, organs, and organ systems. In this two-day lesson, students research organisms and build a class concept map in which they identify structures that support specific functions.

In Lesson 5, building on their understanding of structure and function, students focus on animals and begin to research how specific structures work to support survival, growth, behavior, and reproduction. The goal of this two-day lesson is to convey that, in nature, survival to reproduction is always the “end game”; growth and all behavior are supporting functions for survival, and reproduction is the biological trophy for winning the survival game.

In Lesson 6, students shift their focus to plants and their structural levels—including common structures such as leaves, roots, stems, and flowers. The lesson emphasizes that plants have unique structures that support survival, growth, behavior, and reproduction.

In Lesson 7, students conduct research to make a claim about the *most* important structure of an animal or plant and explain why in a written report. They will use class time for library or media center research, as well as for outlining their reports. Then, they will write their reports either in additional class sessions or as homework. This lesson gives students an opportunity to construct an argument using evidence that they gather from their research.

So, to repeat, **living things are made up of structures that carry out important functions. These structures and functions are necessary for survival, growth, behavior, and reproduction.** The key concept for students to grasp is that there is a biological order, a pattern, in which the structures of living things are organized, which is necessary for them to function properly together as a system. Support your students as they work toward this understanding, and you will help them to meet the NGSS Performance Expectation 4-LS1-1.

LESSON 1

Structure and Function of a Plant

Big Question: How are structure and function related in a plant process?

AT A GLANCE

Learning Objective

- ✓ Describe an example of the relationship of structure and function in a plant.

Lesson Activities

- observation
- discussion and writing

NGSS References

Disciplinary Core Idea LS1.A: Structure and Function

Crosscutting Concept: Systems and System Models

Science and Engineering Practices: Engaging in Argument from Evidence

Engaging in Argument from Evidence is necessary to support an explanation about the concept of biological levels of organization. In this lesson, students use everyday materials to investigate water transport in plants. Students' observations lead to discussion of the structure of plant stems at different scales of biological organization.

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

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in blue below. During instruction, expose students repeatedly to these terms, which are not intended for use in isolated drill or memorization.

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 166–167 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

function
leaf

organism
root

stalk
stem

structure

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary terms designated in blue on the previous page.

Instructional Resources

Activity Pages



AP 1.1

AP 1.2

Activity Pages

Structure of a Celery Stalk
(AP 1.1)

Celery Investigation (AP 1.2)

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

Materials and Equipment

Collect or prepare the following items:

- bunches of celery with leaves (enough for 3 stalks per group)
- food coloring (red, blue, yellow per group)
- large clear plastic cups (3 per group)
- water
- knife (for teacher use)
- paper towels or other cleanup materials

Advance Preparation

For Celery Investigation (AP 1.2), separate students into pairs or small groups. Have the water and cups on hand, and place them in an area of the classroom where unintended spills will be less of a problem. Be sure to have the paper towels and other cleanup materials nearby. It is also important to have extra celery on hand should anything happen to the pieces that have already been cut. The activity will take two days.

THE CORE LESSON 45 MIN

1. Focus student attention on the Big Question.

10 MIN

How are structure and function related in a plant process? Engage students by asking them to look closely at a bunch of celery and describe differences that they see in the visible parts. Remind students that celery is not just a familiar snack; it is part of a plant. When connected to the entire celery plant, it needs water to survive and grow. Students should know that plants absorb water through roots. The celery bunch does have roots, though when part of the plant has lost its connections to roots, it is still able to transport water. Prompt discussion about how plant structures promote the function of getting water to move:

- » What direction does water move through plants? (*upward, from roots to stems/stalks to leaves*)
- » How can we investigate how water moves through plants? (*Put a plant in some water, and see what happens.*)

SUPPORT—Use the materials as a prop for students to brainstorm how they could investigate water movement through plants. Remind students that the celery stalks are living organisms, so a stalk is undergoing the life process of water transport, even though it does not have roots. (See **Know the Science** for support with this analysis.)

Ask students to write a summary of the procedure of their celery stalk investigation, for example, in a science notebook if used in your classroom. If needed, guide students to describe the basic steps of the activity.

Ask students if they have ever planted a seed or plant. Ask the following:

- » What happens if the seed or plant is not watered? (*It will wilt and/or die.*)
- » What happens when a wilted plant is watered? (*If conditions are right, it will likely become healthy again.*)
- » Why does the plant respond this way? (*It receives a need for its survival: water.*)

Discuss with students how water could move through plants. To help them prepare to explain their observations during the activity, ask the following:

- » How does water move in your house? (*through pipes*)
- » What happens when you wet one edge of a piece of cloth or paper? (*The water moves through the material.*)
- » What happens to water as you drink it through a straw? (*The water rises in the straw.*)

SUPPORT—If needed, allow students to brainstorm how water might move through plants. Encourage them to focus on the ideas of water moving through pipes and water moving through a material such as paper or cloth.

Know the Science

What structures enable water to move through the plant? Water-conducting tubes! The celery stalk is made, like all organisms, of cells. Specialized cells form tubes called primary xylem, which run the length of the stalk. At maturity, many of the cells die, but the tube wall remains. When the stalk is placed in water, water moves up through the tubes. The plant does not use energy to move the water. Instead, capillary action allows the water to move. This physical force is the same as that by which water moves through a material such as cloth or paper. Because of water's tendency to adhere to surfaces, it will move up a narrow tube, such as the water transport cells of plants. Capillary action allows water to overcome gravity to travel up the narrow tubes. Additionally, as water is lost through leaves due to transpiration, more water will move through stalks when the leaves are not removed.

2. Preview and facilitate the investigation.

20 MIN

Activity Pages



AP 1.1
AP 1.2

Distribute and go over Structure of a Celery Stalk (AP 1.1) and Celery Investigation (AP 1.2). Explain to students that they will use the first Activity Page to help them understand the parts of a celery stalk. They will use the second as instructions to complete an investigation and as a recording sheet to note what they observe. Go over the directions with students without discussing the objective or outcome. Explain that the activity will help them think about how living structures are made of cells and tissues, which they will be learning in the next lesson.

Preview Core Vocabulary Terms

Write these Core Vocabulary words on the board or chart paper. Tell students to pay special attention to these words during the investigation.

function **structure**

Provide students with introductory definitions of these terms so they can effectively engage in discussion about the investigation. However, students will prepare Core Vocabulary cards and do Word Work with the terms in Lesson 3.

- **structure:** (n. the arrangement of parts that make up something)
- **function:** (n. the way that something works to achieve a task or serve a purpose)

Structure: First, have students look closely at an entire celery bunch. Direct them to Structure of a Celery Stalk (AP 1.1). Have them complete the page, determining where the stem is, where the leaves are, and where the roots are (or were). Have them clearly define what part of the plant is the celery stalk. Write the terms *leaf stalk* and *petiole* on the board or chart paper. Make sure they understand that what they call celery is the petiole of the plant and that each petiole connects the short, compact stem to the leaf blades.

Then have students make a cross section of the petiole and draw what they see. A hand lens or microscope can help but is not necessary.

After students have completed this activity, have them complete the first page of Celery Investigation (AP 1.2).

Function: Provide each group with a set of the materials. Use the knife to prepare the stalks by removing the bottom so that stalks are separate. Line up the stalks so that the leafy ends align, and cut the bottom ends off so that each stalk is about the same length. Lead a discussion about the procedure for the Activity Page. Then be sure that students are clear on the procedure, as follows:

1. Fill each cup with water until about half full.
2. Add 10 drops of each of the food colorings to one cup each, with only one color in each cup.
3. Place the bottom end of one stalk in each of the cups.
4. Record observations at the end of this day's lesson.

After students have conducted the activity, ask them to brainstorm about the results of their experiment. If needed, prompt students with these questions:

- » What do you predict will happen to the colored water by the end of the lesson? *(It will rise and get soaked up by the plant.)*
- » What do you predict will happen to the colored water by the following day? *(It will start rising into the bottom of the stalk.)*
- » What difference would you observe if you cut the leaves off before starting? *(The water may rise more slowly.)*

3. Summarize and discuss.

10 MIN

Have students return to the experiment the following day and record observations once again. This should allow more time for the capillary action to move the colored water throughout the celery. If you collected Celery Investigation (AP 1.2) on the previous day, return it to students now. Have students complete the second page. Then discuss their findings as a whole class.

4. Check for understanding.

5 MIN

Activity Pages



AP 1.1

AP 1.2

Answer Key

Formative Assessment Opportunity

Collect the completed Structure of a Celery Stalk (AP 1.1) and Celery Investigation (AP 1.2). Review students' questions, and identify any that remain unanswered. See the Activity Page Answer Key for correct answers and sample student responses. Have students summarize what they have learned about how plant structures enable water movement. Ensure that students use information from the investigation as evidence.

LESSON 2

Biological Organization

Big Question: How are cells and tissues related in living things?

AT A GLANCE

Learning Objective

- ✓ Create a model that explains the concept of the levels of biological organization.

Lesson Activities

- student observation
- reading, discussion, writing
- vocabulary instruction
- teacher demonstration

NGSS References

Disciplinary Core Idea LS1.A: Structure and Function

Crosscutting Concept: Systems and System Models

Science and Engineering Practices: Engaging in Argument from Evidence

Engaging in Argument from Evidence is necessary to support the explanation that all living things are made of cells. Evidence is also necessary to show that a particular type of tissue is made from the same or similar types of cells. In this lesson, students create a simple model of tissues to show how different tissues are made from different types of cells. In this way students create a model that starts to explain the concept of biological organization.

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

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in blue below. During instruction, expose students repeatedly to these terms, which are not intended for use in isolated drill or memorization.

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 166–167 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

biological organization
cell

multi-
tissue

uni-

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary terms designated in blue above.

Instructional Resources

Student Reader



Ch. 1

Activity Pages



AP 2.1
AP 2.2

Student Reader, Chapter 1
“Biological Organization”

Activity Pages
Cells and Tissues Model (AP 2.1)
Lesson 2 Check (AP 2.2)

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

Materials and Equipment

Collect or prepare the following items:

- plastic building blocks of assorted sizes and colors (a large number)
- index cards for student vocabulary deck (2 per student)
- internet access and the means to project images/video for whole-class viewing

THE CORE LESSON 45 MIN

1. Focus student attention on the Big Question.

5 MIN

How are cells and tissues related in living things? Engage students by asking if they have ever thought about what animals and plants are made of. Explain that *all* living things are made of cells.

Online Resources



Show students an introductory video on cells. 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

After watching the video, use the following questions to guide a brief discussion:

- » What is a cell? (*the basic structure of life*)
- » Are there different types of cells? What are some examples of different cells in your body? (*yes; skin cells, muscle cells, blood cells*)
- » If we're made of cells, why can't we see them? (*They are very small.*)
- » How many cells are plants and animals made of? (*Larger plants and animals are made of trillions of cells.*)

CHALLENGE—Ask students how cells work together to help living things stay alive. (*Plants and animals have many types of cells that serve different purposes: muscle cells work with neurons [nervous system cells] to receive signals from the brain to move an animal, etc.*)

Prompt students to think about the Big Question as they read today's reading selection.

2. Encourage discussion.

5 MIN

Have students turn to a neighbor and discuss the answer to the following question: What do you think would happen if you did not have any cells? Allow partners to discuss for one to two minutes, and then ask for volunteers to share their ideas with the whole class. Support students as they consider examples of things that do not have cells (nonliving objects) and examples of things that do (all living things). Ask for one or two students to summarize their thinking about what a cell is, and capture key words used by the student(s) on the board or chart paper for future reference.

3. Read and discuss: "Biological Organization."

15 MIN

Student Reader



Ch. 1

Read together, or have students read independently, "Biological Organization," Chapter 1 in the Student Reader. The selection reinforces the principles that all organisms are made of cells and that cells form tissues. It also introduces the concepts that tissue is a group of similar cells joined together and that plants and animals have many types of tissues.

Preview Core Vocabulary Terms

Before reading, write the following terms on the board or chart paper. Have students identify the words as they read. Stop and discuss the meaning of each term in context.

cell **tissue**

Ask students to recall the word *structure* (first introduced in Lesson 1). Explain that this is a word that frequently comes up in science but also often appears in discussions outside of science. Prompt students to consider these guiding questions:

- » Do you think there is a structure to how plants and animals are formed? (yes)
- » What are some examples of structures of plants and animals? (*A plant has roots, a stem, and leaves. Some animals have bones and muscles.*)
- » Why do you think it is important to study structures in science? (*Structures help us figure out how things work.*)

Make Frequent Connections

Help students to understand that structure and function are closely related. How something functions depends on its structure. This is as true for living organisms as it is for technological advancements. For example, a house is a structure that functions to provide shelter from natural elements such as precipitation, wind, and sunlight. It also provides privacy and refuge from other people. Organisms similarly contain structures that operate to fulfill specific functions. As students read Chapter 1, have them look for specific structures and identify what functions those structures carry out.

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, discuss the idea that cells are the smallest building blocks of living organisms. Emphasize that all living things are made of cells. Later, students will learn that cells have smaller structures inside them. But in the sense of biological organization (considering all things that are alive), the cell is the basic unit of all life.

SUPPORT—Tell students that cells are responsible for all of the functions that animals and plants are able to carry out. For extra support, name animal or plant activities, and ask students to tell whether or not those activities could be carried out without cells.

Page 2

Prompt students to think about the different roles of cells. Ask: What evidence shows that living things are made from cells? (*Images of cells are evidence that living things are made of cells.*)

SUPPORT—If needed, remind students that organisms must carry out complex functions to survive. The various parts of organisms that enable them to survive are made from different types of cells.

CHALLENGE—Have students come up with other types of cells that they think are found in animals, besides the ones mentioned on the page. (*cells that make teeth, fingernails, and lungs*) If time permits, have students research an interesting type of animal cell and tell what it does in the body.

Page 3

Discuss with students the celery experiment from the previous lesson. Ask: What evidence did you observe that plants are made of cells? (*Water moved up through the celery stalk to the leaves, suggesting tiny tubes. These tubes, which make up the xylem, are not made of living cells but were formed by living cells. Cells of the phloem, which carry water and nutrients, are, indeed, made of living cells.*) (See **Know the Science 1** for support with this analysis.)

SUPPORT—If needed, ask students to return to their completed Activity Pages, Structure of a Celery Stalk (AP 1.1) and Celery Investigation (AP 1.2), specifically noting the parts of the celery plant: roots, stalk (stem), and leaves. Emphasize that each of these parts is made of (or from) different kinds of cells.

Have students summarize their thinking by asking what is similar and different about animal and plant cells. Students should be able to recognize that both animals and plants are made up of many types of cells and that in both, certain cells carry out specific functions. They should also be able to understand that animals and plants have different kinds of cells. Ask students to identify, using the Chapter 1 text, different functions that cells perform in plants. (*They carry food from one place to another in the plant, they make or store food, and they allow the plant to get the air it needs to survive.*)

Page 4

Remind students that most individual cells are so tiny they cannot be seen with the unaided human eye. Have them think about the width of a strand of hair and then consider that the average individual cell is about one-third that size. Ask students to name the device that enables them to see cells. (*microscope*) Generally, the only time that a person can see cells without the aid of a microscope is when they are clumped together into groups. These groups often form tissues. Avoiding discussing actual organs, explain that when cells are grouped together as tissues, these can perform a function. For example, muscles are made up of tissues that are strong and durable. These tissues help many organisms to move. Have students come up with other examples from the page.

Have students examine parts of a plant's leaf under a microscope to see how cells are structured. Or if there is not time for a hands-on examination, show students images from the internet or books that reveal what a plant's cells look like and/or how they are grouped into structures under a microscope. Students should understand that microscopes magnify tiny objects that cannot be seen with the unaided human eye so that people can actually see them.

Know the Science

1. What kind of structures support carrying water and nutrients in plants? The xylem and the phloem. Xylem are tubular structures that carry water and nutrients up from the roots into the body of the plant. Phloem are tubular structures that carry sugar and other products from a plant's leaves into its body. Because capillary action involves water moving up into the plant, it is most associated with the xylem rather than the phloem.

4. Teach Core Vocabulary.

5 MIN

Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary words (displayed on the board or chart paper 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).

cell **tissue**

Word Work

Prompt students to write definitions in their own words for the two terms. Remind students to refer back to the Student Reader chapter or Glossary if they need to.

- **cell:** (n. the smallest unit of life)
- **tissue:** (n. a group of similar cells joined together)

5. Demonstrate examples and guide discussion.

10 MIN

Choose one of the following or a similar example to stimulate further discussion. (If time permits, use both.)

Activity Page



AP 2.1

Option 1: Distribute Cells and Tissues Model (AP 2.1). Review the Activity Page together. Explain to students that they will complete the Activity Page based on models that they make in groups. (See **Know the Science 2** for support with the analysis.)

Know the Science

2. Why do scientists study cells and tissues? *Studying cells and tissues helps scientists understand how plants and animals function when things work normally and abnormally.* Most people are healthy most of the time. But when we get sick, our lives change. When our pets get sick, the result can be distressing. When farm animals get sick, the results can be disastrous. Most diseases begin at the cellular level. Cancer is a disease of cells. As cancer cells multiply, they begin to affect tissues. At some point, the entire body may be affected. You can choose from plenty of examples. To engage students, ask them about common ailments they may have experienced. (Be sure to respect student privacy when addressing medical issues.) For example, influenza (the “flu”) is caused by viruses that attack individual cells. Cell biology and related disciplines such as histology (study of tissues) enable scientists to track down causes of illness and disease. Once the cause is known, scientists can work on cures, rather than just treating symptoms. You don’t need to go into this level of detail with students. However, it may help to engage students if they understand the reasons why scientists study cells and tissues.

Ask students to work in small groups. Give each group an approximately equal number of the assorted plastic blocks. Ensure that each group gets a good mix of colors. Describe the procedure each group should follow:

1. Sort the blocks into different colors.
2. Sort each set of colored blocks into different sizes.
3. Use each set of colored blocks to build a structure. (Any type of structure is fine so long as the same color is used throughout.)

Tell students to answer the questions on the Activity Page after they sort the colored blocks.

SUPPORT—If needed, prompt students with these questions:

- What do the plastic blocks represent? (*cells*)
- What do the structures you built represent? (*a tissue*)

Explain to students that scientists often recreate models of cells and tissues to better learn about how living things work. (See **Know the Science 3.**)

Option 2: Show a video that describes the structure and organization of living things. 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

Ask how animals are organized. Note that the video contains information that is not in this lesson but that will be part of the next lesson. Use the video in class to enhance student knowledge but also to presage future learning.

- » What is the smallest unit in a living thing? (*cell*)
- » What do those cells come together to make? (*tissues*)
- » Are all cells the same? (*no*)

Use additional guiding questions to help students link details in this analysis discussion back to the reading selection.

- » Did you read about any of these examples in the article? (*We have skin cells, hair cells, and many other types of cells.*)
- » What are some other examples of cells that make up animals or plants? (*We have cells that make our eyes and ears work.*)

Distribute Cells and Tissues Model (AP 2.1), and allow students to complete it as a take-home assignment.

Online Resources



Know the Science

3. Why are we using blocks to make models? To show how cells and tissues are organized. The takeaway of this activity is that the plastic blocks represent cells. The structures built from the same color blocks represent tissues because the same types of cells make up tissues.

6. Check for understanding.

5 MIN

Activity Pages



AP 2.1

AP 2.2

Answer Key

Formative Assessment Opportunity

After students have completed the activity, collect the completed Cells and Tissues Model (AP 2.1) pages. Review student questions, and identify any that remain unanswered.

- Distribute Lesson 2 Check (AP 2.2), and ask students to complete it independently. Once they are finished, collect the assessment, and before the start of Lesson 3, check students' answers to identify concepts that need further clarification and to provide the support needed.
- See the Activity Page Answer Key for correct answers and sample student responses.
- Prompt students to ask any new questions they may have, and hold a class discussion to further clarify any misunderstanding or misconception.

LESSON 3

Organs and Organ Systems

Big Question: How do organs work together in systems to perform specific functions?

AT A GLANCE

Learning Objectives

- ✓ Describe an example of multiple organs working together within an animal as an organ system.
- ✓ Create a model that explains the concept of the levels of biological organization.

Lesson Activities

- student observation
- reading, discussion, writing
- vocabulary instruction
- teacher demonstration

NGSS References

Disciplinary Core Idea LS1.A: Structure and Function

Crosscutting Concept: Systems and System Models

Science and Engineering Practices: Engaging in Argument from Evidence

Systems and System Models are necessary to demonstrate the connection between cells, tissues, organs, and organ systems and how they function together and interact. In this lesson, students create a model lung as scaffolding for conceptualizing how cells, tissues, organs, and organ systems function together to maintain organism survival.

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

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in blue below. During instruction, expose students repeatedly to these terms, which are not intended for use in isolated drill or memorization.

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 166–167 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

function
nerve

organ
organ system

oxygen
structure

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary terms designated in blue on the previous page.

Instructional Resources

Student Reader



Ch. 2

Student Reader, Chapter 2
"Organs and Organ Systems"

Activity Pages

Make a Lung Model (AP 3.1)

Activity Pages



AP 3.1

AP 3.2

Lesson 3 Check (AP 3.2)

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

Materials and Equipment

Collect or prepare the following items:

- plastic bottle
- plastic straw
- elastic band
- balloons (2)
- modeling clay
- scissors
- index cards for student vocabulary deck (5 per student)
- internet access and the means to project images/video for whole-class viewing

Review Step 3, "Demonstrate examples and guide discussion," which occurs at the end of this lesson, as well as the Activity Page 3.1, and plan in advance whether you think there will be enough time for students to make their own models during your class session. If you think that time will be an issue, make one model ahead of time, and show it to the entire class for them to study and analyze.

THE CORE LESSON 45 MIN

1. Focus student attention on the Big Question.

5 MIN

How do organs work together in systems to perform specific functions?

Engage students by asking them to take a deep breath. Explain that as they breathe, several structures in the body work together. Remind students that they already learned about the body being made up of cells and tissues. Explain that groups of tissues come together to make organs. Organs carry out specialized functions in the body. Tell students that the lungs—which we use to breathe—are examples of organs found in many types of animals. They are also part of a respiratory system that is made of many organs.

Online Resources



Show students a video on cells, tissues, organs, and organ systems. 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

After students watch the video, ask the following questions:

- » What is the structure of organs? (*They are made of tissues working together.*)
- » What do organs do? (*carry out specific functions*)

Tell students that they will learn more about organs and organ systems in their reading selection today.

2. Read and discuss: “Organs and Organ Systems.”

15 MIN

Student Reader



Ch. 2

Read together, or have students read independently, “Organs and Organ Systems,” Chapter 2 in the Student Reader. The selection introduces several organs and the concept that organs are composed of tissue. It also reinforces the concept that organs work together in systems to perform specific functions, with respiration and movement as examples.

Preview Core Vocabulary Terms

Before reading, write the following terms on the board or chart paper. Have students identify the words as they read. Stop and discuss the meaning of each term in context.

function
nerve

organ
organ system

structure

Ask students to recall the word *structure* (first introduced in Lesson 1 and discussed again in Lesson 2). Explain to students that structure is still an important concept in this lesson, as it relates to how living things are formed.

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 5

After reading, discuss the examples that were on the page of how the body does things to keep us alive. Ask: What other types of things does the body do to keep us alive? (*example: gets rid of waste*)

SUPPORT—Be sure to address any misconceptions arising at this stage. For example, students may believe that organ systems function independently rather than relying on other systems to work.

CHALLENGE—Ask students what they think would happen if one part of the body no longer does the job it’s supposed to. (*It could affect the other parts and how they do their jobs.*)

Pages 6–7

Ask students to think about other organ systems. Ask: What is the evidence that animals have multiple organ systems? (*Animals perform multiple functions.*)

Use this opportunity to compare the words *structure* and *function*. Ask a volunteer to describe the difference between them using his or her own words. Tell students that people often study living things and the parts that keep them alive in terms of the structure and function of those parts. Most of the time, structure and function are studied together so that we can get a better understanding of how things work together to support life.

SUPPORT—If needed, remind students that organisms must carry out complex functions to survive. The various organs work together as systems to enable animals to survive.

SUPPORT—If necessary, have students tell what animal organs and plant organs have in common. Then have them tell how they might be different.

CHALLENGE—If time permits, have students pair with a neighbor and discuss what they think would happen if a particular organ did not have the proper structure it is supposed to have. Do they think the organ would be able to function just as well? Why or why not? If necessary, use the example on the page of the heart. Have students consider what would happen if, for instance, the blue whale’s heart were too small or the mouse’s heart were too big.

Pages 8–10

Begin by discussing the word *system* and what it means: a series of connected things working toward a common goal. Explain that we use models of systems to help us understand the systems better. For example, by looking at a diagram of a machine, which is a system of parts that work together, we can understand the machine better. The same is true for organic systems, such as the different parts of plants or animals. Discuss with students the examples from the Student Reader. Ask: What is the evidence organ systems work together to enable animals to survive? (*If one of the systems stops working, the body cannot survive.*)

SUPPORT—If needed, prompt students to think some more about breathing. If any of the systems involved in breathing stops working, the body cannot survive.

Tell students that there are eleven organ systems in the body. Focus on the nervous system, excretory system, respiratory system, circulatory system, digestive system, skeletal system, and muscular system. Explain that the Student Reader focuses on certain functions, such as respiration and movement. However, organ systems carry out more functions than just those. But the one thing they all have in common is that they use energy from the body in order to function.

CHALLENGE—Challenge students to think about the several different organ systems. (See **Know the Science** for support with this analysis.) To focus their thinking, ask the following question: What would happen if one of the organ systems stopped working? Use simple examples of how the body would be unable to survive if an organ system failed:

- Nervous system: The brain could not send or receive signals.
- Respiratory system: The body would not be able to take in air to breathe.
- Circulatory system: Blood would be unable to reach all parts of the body.
- Digestive system: The body could not process food for energy.
- Skeletal system: Parts of the body could not move or would be unprotected.
- Muscular system: Parts of the body could not move.

3. Demonstrate examples and guide discussion.

15 MIN

Activity Page



AP 3.1

Distribute Make a Lung Model (AP 3.1). Tell students that they will create a model to show how the lungs work and then answer the questions on the Activity Page. Be sure that students understand that this is basically an extension of the modeling they have learned in the previous lesson. They are moving from cells and tissues to include organs and organ systems.

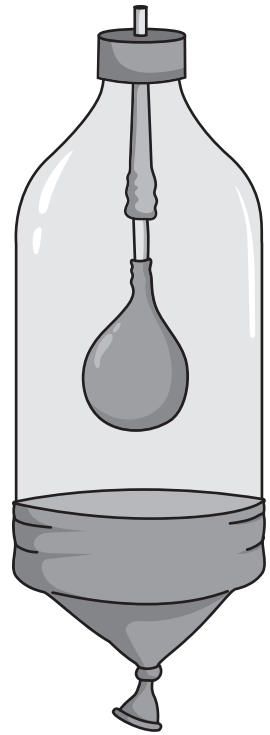
Ideally, students will create the model themselves. However, if time is short, you could make the model beforehand and then use it to demonstrate how the lung works. Explain that the activity will help them think about how the lung works and how it works with other organ systems.

Assign students to work in small groups. Give each group a set of the materials. Describe the steps, one at a time, and perform them together as a class. You can model the steps up front while students follow along.

Know the Science

Why do scientists study organs, organ systems, and their functions? *Studying organs, organ systems, and their functions helps scientists understand how plants and animals work.* From before we're born, our organs and organ systems function to keep us healthy. When an organ stops working well, we usually get sick. For example, many older people have heart disease. When the heart stops functioning, the body cannot survive. There are many other such organs. The liver, kidneys, lungs, skin, and brain are all essential organs. By understanding how organs work within organ systems and how organ systems work together, scientists can help doctors treat illness more effectively. Research in this area can help people (and animals) to live healthier lives and to live longer. You don't need to go into this level of detail with students. However, it may help to engage students if they understand the reasons why scientists study organs, organ systems, and their functions.

1. Use the scissors to cut the bottom off of the plastic bottle.
 2. Tie a knot in the neck of one balloon, and cut that balloon about an inch from the top of the large part of the balloon.
 3. Stretch the part of the balloon with the knot over the bottom (cut) end of the bottle so that the knot is facing out.
 4. Insert the straw partway into the neck of the other balloon.
 5. Tie the elastic band tightly around the neck so that it is secured to the straw. Blow through the straw to ensure the balloon inflates and that no air is lost through the neck except through the straw.
 6. Push the balloon with the straw through the top of the bottle so that all the balloon is just inside the bottle.
 7. Use the modeling clay to seal the straw around the top of the bottle. Blow through the straw to ensure that no air can escape through the top of the bottle.
 8. To demonstrate how the lung works, pull on the knot of the balloon at the bottom of the bottle. The balloon inside the bottle will expand. Push the balloon at the bottom of the bottle, and the balloon inside will shrink.
- Give students time to answer the questions on their Activity Pages.



4. Teach Core Vocabulary

5 MIN

Prepare Core Vocabulary Cards

Refer students to the Core Vocabulary terms displayed on the board or chart paper earlier in the lesson. Have students prepare new cards by writing each term in the upper left corner of a card and underlining it (one term per card).

function
nerve

organ
organ system

structure

Word Work

- **function:** (n. the way that something works to achieve a task or serve a purpose) Have students write on their cards a short sentence that includes both the words *function* and *organ system*. (*Organs function together as organ systems.*)
- **organ:** (n. a body part made up of related tissues that perform a specific function) Have students list on their cards as many examples of organs as they can think of. (*Sample answers: heart, brain, lung, stomach*)
- **organ system:** (n. a group of organs that work together to carry out certain functions) Have students list on their cards as many examples of organ systems as they can think of. (*Sample answers: digestive system, respiratory system, skeletal system*)
- **nerve:** (n. a bundle of cells that send and receive messages between the brain and other body parts) Have students write a sentence that includes both the words *nerve(s)* and *function(s)*. (*Nerves allow the brain to control the function of organs.*)
- **structure:** (n. the arrangement of parts that make up something) Have students write on their cards a short sentence that includes both the words *structure* and *organ*. (*An organ is a body structure.*)

5. Check for understanding.

5 MIN

Activity Pages



AP 3.1
AP 3.2
Answer Key

Formative Assessment Opportunity

After students have completed the activity, collect the completed Make a Lung Model (AP 3.1). Review student questions, and identify any that remain unanswered.

- Distribute Lesson 3 Check (AP 3.2), and ask students to complete it independently. Once they are finished, collect the assessment, and before the start of Lesson 4, check students' answers to identify concepts that need further clarification and to provide the support needed.
- See the Activity Page Answer Key for correct answers and sample student responses.
- Prompt students to ask any new questions they may have, and hold a class discussion to further clarify any misunderstanding or misconception.

LESSON 4

Functions for Survival

Big Question: What functions of living things enable them to survive and grow?

AT A GLANCE

Learning Objective

- ✓ Identify the function of specific structures in plants and animals (such as the leaves and roots of a plant, or the human heart and skin).

Lesson Activities (2 days)

- concept mapping
- research
- discussion and writing

NGSS References

Disciplinary Core Idea LS1.A: Structure and Function
Crosscutting Concept: Systems and System Models
Science and Engineering Practices: Engaging in Argument from Evidence

Engaging in Argument from Evidence is necessary to support an explanation about the function of specific structures in plants and animals. In this two-day lesson, students create a concept map of functions that living things perform. Students classify functions by considering how each contributes to organism survival, growth, behavior, and reproduction.

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

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in blue below. During instruction, expose students repeatedly to these terms, which are not intended for use in isolated drill or memorization.

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 166–167 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

behavior
growth

reproduce
survive/survival

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary terms designated in blue on the previous page.

Instructional Resources

Activity Pages



AP 4.1

AP 4.2

Activity Pages

Organism Research and Concept Map (AP 4.1)

Lesson 4 Check (AP 4.2)

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

Materials and Equipment

Collect the following items:

- sticky notes (6 colors, plus yellow)
- colored paper (6 pieces, same colors as sticky notes, except yellow)
- pin board (or whiteboard)
- pins (or sticky tape)
- string
- scissors

Advance Preparation

Day 1: Schedule access to the library or a computer lab in advance so that the class can do their research there.

Day 2: On each of the six pieces of colored paper, write the six basic functions that all living organisms use to live and grow: grow, move, respire, get energy, produce waste, and reproduce. Match the words to the colored paper as follows:

- grow: green
- move: gray
- respire: blue
- get energy: orange
- produce waste: tan
- reproduce: pink

(The exact colors do not matter, so long as you use a different color to represent each function.) Do not show these to students until prompted to do so.

THE CORE LESSON TWO DAYS, 45 MIN EACH

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

5 MIN

What functions of living things enable them to survive and grow? Remind students that they learned about cells, tissues, organs, and organ systems.

Ask students to identify a daily routine that they perform without much thought. Students may come up with ideas such as eating, drinking, doing chores, and playing sports. Emphasize the fact that all of these activities are made possible because of the structure and function of the parts inside them, from the cells to the organ systems of their bodies.

Tell students that today they will do research on an organism of their choice and learn about something it must be able to do to survive, as well as the structures in the body that support that function.

2. Preview the investigation.

10 MIN

Activity Page



AP 4.1

Distribute Organism Research and Concept Map (AP 4.1). Review the Activity Page with students. Tell students they will use the Activity Page to guide their research at the library (or computer lab) as they choose an organism to learn more about. This is found under Day 1 of the Activity Page. Explain that on Day 2, students will come together as a class to make a concept map based on the information they research on their organisms. Make sure students understand that they do not have to complete the Day 2 section of the Activity Page yet. They will be prompted to do so when the time is right.

Help students to understand why they are conducting research. Explain that research is one way that people learn about a subject. It is common for people in different fields to obtain information, combine what they have learned and know, and come up with new ideas. They can then make a claim about a subject and back it up with evidence, something that students will do at greater length in Lesson 7.

Preview Core Vocabulary Terms

Display these Core Vocabulary words on the board or chart paper. Tell students to pay special attention to these words during their research.

behavior
growth

reproduce
survive/survival

Provide students with introductory definitions of these terms so they can effectively engage in discussion about the investigation. However, students will prepare Core Vocabulary cards and do Word Work with the terms in Lesson 5.

- **behavior:** (n. the ways in which an organism acts)
- **growth:** (n. the life process of becoming bigger and stronger)
- **reproduce:** (v. to make new, young individuals of the same type)
- **survive/survival:** (v. to stay alive/n. the state of continuing to live)

3. Facilitate the research.

25 MIN

As students perform their research at the library, move about the area and provide support. Ensure students understand the difference between structure and function, as well as how structures are organized within the body of the organism they chose.

SUPPORT—If needed, encourage students to consider unusual plants or animals. Try to ensure that at least some students choose a plant as their organism for library research.

SUPPORT—If needed, prompt students with questions to help them learn more about their organism:

- What organism will you choose? (*If students struggle to choose an organism, provide a suggestion, or ask the second question first. Students may find that it helps to start with an animal or plant that they already know about.*)
- What do you already know about that organism?
- What structures of your organism help it to live and grow?
- What kind of functions does the organism do in order to live and grow?

CHALLENGE—Challenge students to think about how they could organize information about functions of living things. Ask: How can we classify the functions of living things? (See **Know the Science** for support.)

Give students time to complete their research and fill out the answers to the Activity Page.

4. Check for understanding.

5 MIN

Activity Page



AP 4.1 and
Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key for correct answers and sample student responses. After students have completed the part for Day 1, collect the Organism Research and Concept Map (AP 4.1). Review student questions, and identify any that remain unanswered.

1. Day 2: Refocus student attention on the Big Question.

5 MIN

What functions of living things enable them to survive and grow? Remind students that in the previous class session, they researched an organism of their choosing and its structures and functions. Tell students that in today's class, they will build a concept map together.

Know the Science

Why study the biological organization of living things? Classification and organization of information helps scientists to better understand the nature of life. One reason for classifying the functions and structures of living things is to better understand the nature of life. Such understanding may be applied in fields as diverse as medicine and astrobiology. Consider particles such as viruses. They have attributes of living things, such as being able to reproduce. However, they also have properties of nonliving things, such as the ability to form crystals. If we ever discover what appears to be life on other worlds, that life may be very different from that on Earth. Understanding and defining life as we know it may help scientists study life beyond Earth.

2. Support the research.

10 MIN

Activity Page



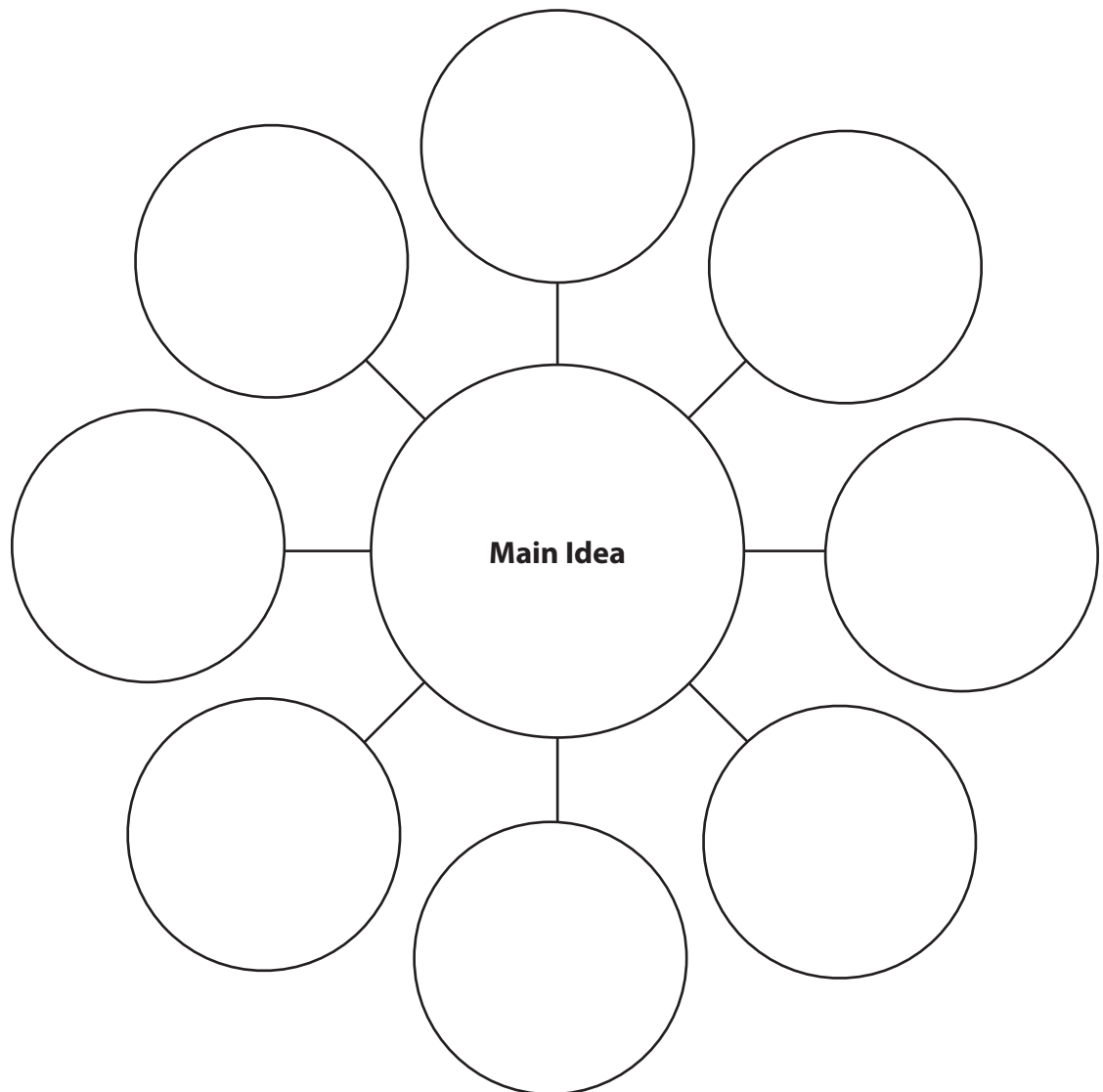
AP 4.1

Have students take out Organism Research and Concept Map (AP 4.1). Tell students that today they will complete the part of the Activity Page under Day 2. Review the directions with students, ensuring they are clear on what they are doing and how to use the materials.

Discuss what a concept map is with students. Explain that a concept map is a type of graphic organizer that can be used to help organize information on a subject. They usually begin with a main idea and then branch out from there to show how that main idea can be broken down into other smaller, or more specific, topics.

SUPPORT—If necessary, draw an example of a concept map on the board or chart paper as you describe what it is.

Below is an example of a web-style concept map.



3. Facilitate the activity.

20 MIN

Provide students with yellow sticky notes. Ask students to write each of the basic functions of living things on a yellow sticky note.

Then perform the following steps:

1. Show your colored pieces of paper to students, briefly explaining each function.
2. Pin or tape your colored pieces of paper to the pin board or whiteboard.
3. Have students come up and place their yellow sticky notes on the piece of colored paper with the word that is closest to the one they wrote. For example, if they wrote “breathe” on their yellow sticky note, they would place their note on your blue piece of paper.

Give students time to complete their Day 2 sections of the Activity Page and place all of their yellow sticky notes on the pin board or whiteboard. Facilitate the connection of concepts with string.

4. Summarize and discuss.

5 MIN

Once students have had time to conduct their investigations and complete their Activity Page, bring the class back together for a whole-class discussion to summarize what students discovered based on their class concept map.

Have students study the concept map and tell what they observe. Ask them to think about what is similar about the different structures and functions and what is different. Students should be able to explain observations and support them with evidence.

Elicit from students that specific structures carry out specific functions.

5. Check for understanding.

5 MIN

Activity Page



AP 4.2 and
Answer Key

Formative Assessment Opportunity

Distribute Lesson 4 Check (AP 4.2), and ask students to complete it independently. Once they are finished, collect the assessment, and before the start of Lesson 5, check students’ answers to identify concepts that need further clarification and to provide the support needed.

See the Activity Page Answer Key for correct answers and sample student responses. Prompt students to ask any new questions they may have, and hold a class discussion to further clarify any misunderstanding or misconception.

LESSON 5

Functions in Animals

Big Question: How do some animal structures function?

AT A GLANCE

Learning Objective

- ✓ Construct an argument that in animals any structural level (such as skin, nerves, and the heart) supports survival, growth, behavior, and/or reproduction.

Lesson Activities (2 days)

- reading, discussion, writing
- vocabulary instruction
- student research

NGSS References

Disciplinary Core Idea LS1.A: Structure and Function
Crosscutting Concept: Systems and System Models
Science and Engineering Practices: Engaging in Argument from Evidence

Engaging in Argument from Evidence is necessary for students to reason what function is supported by a specific structure. In this two-day lesson, students classify various structures of different animals into whether that structure supports survival, growth, behavior, and/or reproduction. Instead of direct instruction regarding examples, students are encouraged to infer a structure's function by reasoning about its purpose.

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

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

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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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 166–167 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

behavior
function

growth
reproduce

survive/survival
voluntary/involuntary

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across unit as a part of Word Work. The deck will include the Core Vocabulary terms designated in blue on the previous page.

Instructional Resources

Student Reader



Ch. 3

Activity Pages



AP 5.1

AP 5.2

AP 5.3

Student Reader, Chapter 3 "Functions in Animals"

Activity Pages

Functions in Animals (Day 1)
(AP 5.1)

Classifying Structures (Day 2)
(AP 5.2)

Lesson 5 Check (AP 5.3)

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

Materials and Equipment

Collect the following items:

Day 1

- images of 10 animals, including various mammals, birds, reptiles, amphibians, fish, and invertebrates
- index cards for student vocabulary deck (4 per student)

Day 2

- pin board (or whiteboard)
- pins (or sticky tape)
- sticky notes (5 colors)

Advance Preparation

Prepare ahead of time by posting the images and T-charts for Step 1 (Day 1 and Day 2) around the classroom before the lesson begins.

Schedule time for the class to do research in the library on Day 2.

For the activity, assign each of the five colors of sticky notes a key function animals use to live and grow: growth, movement, eating or hunting, avoiding predators, and reproduction. Match the words to the sticky note colors as follows:

- growth: green
- movement: yellow
- eating or hunting: red
- avoiding predators: orange
- reproduction: pink

(The exact colors do not matter, so long as you use a different color to represent each function.) Do not show these to students just yet.

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

10 MIN

Online Resources



How do some animal structures function? Engage students by showing them images of a variety of animals, some familiar (e.g., dog, cat, horse, pigeon, goldfish) and others less familiar (e.g., mole, tapir, hummingbird, angelfish). 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

Explain to students that even though these animals may look very different, they share many life processes. The differing structures of the animals function in various ways, but all enable them to survive.

Use the following questions to brainstorm about the functions of different kinds of animal structures:

- » What structures do animals that live on land and in water use to take in air? (*lungs, gills*)
- » What structures do animals have to move blood to parts of the body? (*heart*)
- » What structures do animals use to take in energy? (*mouth, digestive system*)
- » Can you think of other activities (functions) that animals do to survive and grow? (*hunt for food, avoid predators*)

Activity Page



AP 5.1

Discuss with students the fact that animals survive to reproduce and have young. In this way, they continue their species. Use this idea to encourage students to connect the concepts of survival and reproduction. As a reminder to why structure and function are important, refer to the **Know the Science** boxes on pages 36 and 49.

Distribute Functions in Animals (AP 5.1), and go over the directions. Then have students complete the activity. When they are done, collect the pages.

2. Read and discuss: “Functions in Animals.”

25 MIN

Student Reader



Ch. 3

Read together, or have students read independently, “Functions in Animals,” Chapter 3 in the Student Reader. The selection reinforces the idea that animal structures function in specific ways to support growth, survival, and reproduction.

Preview Core Vocabulary Terms

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

behavior

growth

reproduce

survive/survival

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 11

After students have read the page, ask them if they have ever had a pet, such as a cat or a dog, or known someone who has had a pet. Ask the following:

- » What are the most important things a pet owner has to do? (*provide food, clean up waste*)
- » What are the main functions of an animal such as a cat or a dog? (*eat, move, produce waste*)
- » What structures enable an animal to carry out these functions? (*jaws, legs, tail*)

SUPPORT—Ensure students understand the term *survival*. Guide students to consider a range of functions that they carry out every day (eating, sleeping, moving, etc.) that allow them to survive.

Page 12

After students have read the page, discuss the term *growth* to ensure understanding. Probe for understanding of the key idea that animal structures support growth. Ask the following:

- » What does an animal need to grow? (*food, water, and air*)
- » What are the main functions of systems that support growth in animals' bodies? (*chewing and digesting food for energy, breathing, ridding the body of waste*)

Page 13

Probe for understanding of the term *behavior*. Focus on the key idea, that animal structures enable behavior, by asking the following:

- » How do legs enable behavior? (*Legs enable an animal to move voluntarily, which is a behavior.*)
- » How do the legs work as part of a system? (*Muscles and the nervous system work together to move the animal's body, including the bones, to carry out a behavior such as walking.*)

SUPPORT—If needed, demonstrate a behavior (such as putting a hand up or laughing). Ask students to recall their learning about organs and organ systems as they discuss other examples of behaviors.

Page 14

Building on the discussion from earlier in the lesson, emphasize that the goal of surviving is to reproduce and that animal structures support reproduction. Point out to students that animals can survive without reproducing but that an animal has to survive to adulthood to reproduce. Explain that a species can only survive if its individuals succeed in reproducing.

SUPPORT—Probe for understanding of the key word. Ensure that students understand that the capacity to reproduce is a basic function of all life-forms. So that students grasp the meaning of the word, challenge them to consider nonliving things that reproduce, such as fire and crystals.

3. Teach Core Vocabulary.

5 MIN

Prepare Core Vocabulary Cards

Refer students to the Core Vocabulary terms displayed on the board or chart paper earlier in the lesson. Have students prepare new cards by writing each term in the upper left corner of a card and underlining it (one term per card).

behavior

growth

reproduce

survive/survival

Word Work

Emphasize the connections between these terms as students address them. Growth and behavior are functions that are critical to the survival of individuals, and reproduction is a function that is critical to the survival of species. Have students write a short sentence to define each term.

- **behavior:** (n. the ways in which an organism acts) (*Sample sentence: What an animal does is its behavior.*)
- **growth:** (n. the life process of becoming bigger and stronger) (*Sample sentence: Growth changes puppies into adult dogs.*)
- **reproduce:** (v. to make new, young individuals of the same type) (*Sample sentence: When parents have offspring, they reproduce.*)
- **survive/survival:** (v. to stay alive/n. the state of continuing to live) (*Sample sentence: When all of an animal's structures function well, the animal survives longer.*)

Know the Science

1. Why research the functions of animal structures? Understanding the functions of animal structures helps scientists to explain how animals work. One reason for understanding animal structures is to explain how animals look and behave the way they do. Such understanding may be applied in fields as diverse as veterinary medicine and engineering. For example, to increase efficiency of milk production, farmers want to know what features of dairy cows contribute to producing milk. They can use this knowledge to breed animals that yield more milk per animal. Engineers study animal structures to learn how to improve devices and materials. For example, scientists studied how limpets, aquatic snails, stick to rocks and developed a strong glue similar to what the organism creates for its survival. Research into spider silk has resulted in fibers that, weight for weight, are stronger than steel. In another example, researchers looked at the honeycomb of bees to build a type of strong insulating glass. This field, called biomimicry, is an effective way to engage students' interest in the function of animal (and plant) structures.

You don't need to go into this level of detail with students. However, it may help to engage students if they understand the purpose of evaluating the functions of animal structures.

4. Check for understanding.

5 MIN

Activity Page



AP 5.1 and
Answer Key

Formative Assessment Opportunity

After students have completed Functions in Animals (AP 5.1), have them brainstorm more examples. Engage in a short class discussion, and invite volunteers to share their examples. Have students compare their examples with other students' examples.

Collect the completed Functions in Animals (AP 5.1). Review student questions, and identify any that remain unanswered.

1. Day 2: Refocus student attention on the Big Question.

5 MIN

How do some animal structures function? Remind students that in the previous class, they read about animal structures and functions. Tell them that today they will participate in activities and research to help them learn more about the structures and functions of animals.

Post the images from the previous day's lesson around the class. Post a T-chart next to each image with one column labeled "Structure/Function" and the other column labeled "Questions."

Structure/Function	Questions

Tell students to bring a pencil and walk around the gallery of images. Encourage students to study the images and fill out the "Structure/Function" column. Then have them discuss questions they have about each image and write those into the "Questions" column. Allow enough time for students to perform this gallery walk for all of the images you post.

2. Preview the investigation.

5 MIN

Activity Page



AP 5.2

Distribute Classifying Structures (AP 5.2). Tell students they will complete the Activity Page based on library research and on what they have learned so far in this lesson. Go over the directions with students. Explain that the activity will help them to relate animal structures to functions.

Lead a discussion about the procedure for the Activity Page. Be sure that students are clear on the procedure. Tell students that they will conduct the first half of the activity (the research and tables) in the library. They will then complete the second half of the activity (using the pin board or whiteboard) in the classroom. If needed, prompt students with these questions:

- » What structures of that organism can you identify? (*Student responses may include number of legs, size, shells, backbones, gills, etc.*)
- » How do structures you identify relate to the functions of your organism? (*The structures help the organism swim, walk, crawl, breathe, and get food.*)

SUPPORT—Prompt students to consider animals with unusual structures, such as elephants (tusks and large ears), rhinoceroses (horns), or deer (antlers). Try to ensure that at least some students choose an animal with a structure that is related to reproduction (e.g., male deer use their antlers in fighting for females).

3. Facilitate the research.

15 MIN

Assign students to work in small groups. Divide the animal images up so that each group has three or four different animals. Tell each group that they will identify the various structures they can see in the images of a couple of the animals (e.g., eagle: wings, elephant: ears, ant: jaws, fish: fins, owl: eyes, etc.). Then, they will use their research time in the library to learn more about the function of those structures.

SUPPORT—Direct student attention to the tables on the Activity Page, and if necessary, model for students how to fill out the tables for the structures and their associated functions.

Circulate around the area as students complete their research, providing any support as necessary.

4. Summarize and discuss.

15 MIN

Bring students back to the classroom to complete the second half of the activity.

Give each group different-colored sticky notes. Tell the groups to post their images plus the list of structures on the pin board or whiteboard. It may be necessary to model for students how to pin their images and lists onto the pin board using the pins or to make sure there is enough tape as an alternative.

Assign (or allow groups to choose) one of the animal images other than the ones they have recorded. Each group uses the colored sticky notes to classify each of the structures as related to one of the key functions (e.g., eagle wings: movement). A structure may be allowed more than one sticky note color (e.g., eagle wings: movement, eating or hunting). After a group has classified all of the structures for a particular animal, assign them another animal image to work on. (See **Know the Science 2** for support with this analysis.)

5. Check for understanding.

5 MIN

Activity Pages



AP 5.2

AP 5.3

Answer Key

Formative Assessment Opportunity

After students have completed the activity, collect the completed Classifying Structures (AP 5.2). Review student questions, and identify any that remain unanswered.

- Have students summarize in their notebooks what they have learned about how animal structures are related to functions, asking them to consider the Big Question: **How do some animal structures function?** Ensure that students use information from the activity as evidence. You may also want to discuss with them how animal structures contribute to animal behaviors.
- Distribute Lesson 5 Check (AP 5.3), and ask students to complete it independently. Once they are finished, collect the assessment, and before the start of Lesson 6, check students' answers to identify concepts that need further clarification and to provide the support needed.
- See the Activity Page Answer Key for correct answers and sample student responses. Prompt students to ask any new questions they may have, and hold a class discussion to further clarify any misunderstanding or misconception.

Know the Science

2. What main function does the interaction of structure and function support in all living things? *Reproduction*. It is important to help students understand that various functions in organisms are not divorced from each other. They all serve one purpose: to help the organism reproduce. For the organism to reproduce, most have to grow. Therefore, it has structures that help it to grow. For an organism to reproduce, it has to take in food. Therefore, it has structures that help it take in food.

Continue this activity until structures on all the images have been classified. Circulate around the room, and address any structures that were categorized incorrectly. Hold a discussion about why the structure was incorrectly categorized, and ask the class to help categorize it correctly.

LESSON 6

Functions in Plants

Big Question: How do some plant structures function?

AT A GLANCE

Learning Objective

- ✓ Construct an argument that in plants any structural level (such as leaves, roots, and flowers) supports survival, growth, behavior, or reproduction.

Lesson Activities

- student observation
- reading, discussion, writing
- vocabulary instruction
- teacher demonstration

NGSS References

Disciplinary Core Idea LS1.A: Structure and Function

Crosscutting Concept: Systems and System Models

Science and Engineering Practices: Engaging in Argument from Evidence

Engaging in Argument from Evidence is important to this lesson because it provides students with an opportunity to support an explanation for the function of plant structures. In this lesson, students explore examples of functions in plants and the structures that serve them. Instead of direct instruction regarding examples, students are encouraged to infer a structure's function by reasoning about its purpose.

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

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in blue below. During instruction, expose students repeatedly to these terms, which are not intended for use in isolated drill or memorization.

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 166–167 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

bark **response**

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary term designated in blue on the previous page.

Instructional Resources

Student Reader



Ch. 4

Activity Pages



AP 6.1

AP 6.2

Student Reader, Chapter 4
"Functions in Plants"

Activity Pages

Functions of Plant Structures
(AP 6.1)

Lesson 6 Check (AP 6.2)

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

Materials and Equipment

Collect or prepare the following items:

- index cards for student vocabulary deck (1 per student)
- internet access and the means to project images/video for whole-class viewing

Advance Preparation

Prepare in advance for this lesson by asking students to bring in one part of a plant, such as a flower, fruit, vegetable, or leaf, and to be prepared to discuss their sample's structure and function with the class. Students should have their object ready and in hand to discuss at the beginning of this lesson.

THE CORE LESSON 45 MIN

1. Focus student attention on the Big Question.

5 MIN

How do some plant structures function? Prior to the lesson, ask students to bring in one object that is part of a plant (such as a flower, fruit, vegetable, etc.). Engage students by going around the room and asking them to name the plant of which their object was part (e.g., rose bush, apple tree, potato plant, etc.). Next, ask students to name the part of the plant that their object came from (e.g., stem, root).

SUPPORT—If needed, prompt students to recall the three main plant parts: roots, stem, and leaves.

2. Encourage discussion.

5 MIN

Have students pair up with a neighbor.

Use the following questions to prompt students to discuss the structures of plants that enable them to survive, grow, respond, and reproduce:

- » What is the function of roots? (*take in water*)
- » What is the function of stems? (*help the plant reach for light*)
- » What is the function of leaves? (*use the sun's energy to make food*)
- » Can you think of other things plants need to survive and grow? (*good soil, no predators*)
- » What needs of plants are like those of animals? (*They need water, energy, and to avoid being eaten.*)

SUPPORT—Encourage students to focus on the plant structure that they brought into class and use it to answer the question prompts.

CHALLENGE—Challenge students to think about how they could organize the structures of plants. To focus their thinking, ask: How can we classify the structures of plants? Use students' plant objects as a prop for students to brainstorm how they could classify the structures of plants. The aim is to broaden students' concepts of plant structures so that they can argue from evidence about the role of a specific structure.

Let students know that they will be learning more about the function of these structures later in the lesson, after they have completed their reading of Chapter 4.

3. Read and discuss: "Functions in Plants."

20 MIN

Student Reader



Ch. 4

Read together, or have students read independently, "Functions in Plants," Chapter 4 in the Student Reader. The selection reinforces the idea that plant structures function in specific ways to support growth, survival, and reproduction.

Preview Core Vocabulary Term

Before students read, write **response** on the board or chart paper. Instruct students to write the word in the upper left corner of a card and underline it. Encourage students to pay special attention to this term as they read.

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

After students have read the page, ask them if they have ever grown a houseplant, or know someone who grows houseplants. Ask the following:

- » What are the most important things that a houseplant needs to grow? (*water, soil, enough light*)
- » What happens if you forget to water the plant? (*It wilts; it dies.*)

Page 16

After students have read the page, discuss the fact that plants cannot move to find what they need to live. From the moment a seed sprouts, the plant must meet its needs by growing and responding to the environment in which it lives. Then, discuss various stages of growth. Probe for understanding of the key idea that plant structures support growth. Ask the following:

- » What are the main functions of systems of structures in a plant? (*absorb sunlight and use its energy, take in water, move water, exchange gases with the air around it*)

CHALLENGE—Ask students to brainstorm examples of structures of a plant that have more than one function. (*Roots absorb water, and they also support the plant and ground it in the soil. Stems transport water and nutrients, and they also help to support the leaves of the plant to reach light. Leaves absorb light, and modified leaves serve other purposes, such as defense or support.*)

Page 17

Discuss with students the function of leaves. The key idea is that leaves absorb light and use its energy to produce food (sugars)—a form of stored chemical energy. Therefore, leaves support the plant as it carries out all its other functions. Ask the following:

- » How does the plant use energy from light? (*to make food*)
- » How does the plant use gases that enter the leaves? (*The plant uses light energy to combine water with the gases to make sugar.*)
- » What is produced as waste by the leaves? (*oxygen and water vapor that escape through holes in the leaves*)

SUPPORT—Ask students to discuss the image of the leaf and the cells. Guide students to consider that there are millions of cells in the leaf and that the leaf functions because of the function of its component cells.

Word Work

Return students' attention to their Core Vocabulary card for **response**.

Page 18

Probe for understanding of the term *respond/response*, and prompt students to write a definition on their card.



If time permits, show a video that demonstrates the main types of tropisms (see **Know the Science 1**): phototropism (response to light), geotropism (response to gravity), hydrotropism (response to water), and thigmotropism (response to touch).

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

www.coreknowledge.org/cksci-online-resources

Students don't need to know these terms, but they should be able to cite examples of each type of response. Focus on the key idea, a tropism is the way that a plant responds to a stimulus, by asking the following:

- » How does a plant grow if you place it by a window? (*It bends toward the light.*)
- » What is the evidence that roots and shoots respond to gravity? (*Roots grow down, and shoots grow up.*)
- » In what situation would you expect roots to not grow down? (*if water is close to the surface*)
- » How does a vine plant (e.g., pea, pumpkin) “know” to grow its tendrils around a bean pole? (*Its tendrils respond to the touch of the bean pole.*)

Page 19

Ensure that students grasp the key concept that plant growth and responses support survival. Emphasize that types of plants differ greatly in how various structures and responses accomplish survival. Ask the following:

- » Why does a redwood tree have very thick bark? (*to resist insects, disease, and fire*)

Page 20

Emphasize that the goal of surviving is to reproduce and that plant structures support reproduction. Point out to students that plants can survive without reproducing but that a plant cannot reproduce if it does not survive long enough. Explain that, like animals, a plant species can only survive if its individuals succeed in reproducing. If necessary, refer back to **Know the Science 2** in Lesson 5.

Know the Science

1. What are phototropism, geotropism, hydrotropism, and thigmotropism? Different ways in which plants respond to stimuli. Tropisms are the ways that plants respond to stimuli in their environments. For example, phototropism is the way that plants respond to light. Most plants get their energy from sunlight. To maximize the amount of energy they receive, they will often move toward the sun throughout the day. If they are out of view of the sun, they will often move toward any opening that contains sunlight. Geotropism occurs when plants respond to gravity. When a plant grows toward gravity, it is called positive geotropism. When a plant grows away from gravity, it is called negative geotropism. Another word for geotropism is *gravitropism*. Plants need water. So when the roots of a plant grow toward a source of water, this is called hydrotropism. Thigmotropism occurs when a plant responds to touch. In some cases, when another organism touches a plant, it will curl up to protect itself. At other times, when a plant is touched by something, it will grow around that object. Tropisms should not be confused with learned behaviors such as we see in animals.

SUPPORT—Ensure that students understand that plants reproduce but in different ways than animals. Introduce students to the idea that most plants can reproduce in two ways, with either two parents (producing seed) or just one parent (vegetative reproduction). If you have access to houseplants that can be used/explored by students during or after this reading, it will help for students to investigate the structures of plants that support reproduction close up.

4. Demonstrate examples and guide discussion.

10 MIN

Have students work with a neighbor to think about how different plant structures support the functions of plants (see **Know the Science 2**). To focus their thinking, ask students to complete a quick poll. Prompt them to hold up their plant object (from the beginning of class) if it is related to the roots of their plant (e.g., vegetables such as carrots or potatoes, or other root structures). Then ask students to hold up their plant object if it is related to stems (e.g., vegetables such as celery or wooden objects from the trunk or bark of a tree). Next, repeat this for those who brought in leaves (e.g., vegetables such as lettuce or cabbage, or leaves from a houseplant or tree). Finally, ask students to hold up their plant object if it is related to reproduction (e.g., nuts, fruits, or flowers). Then ask the following question:

- » How does the structure of your plant object support its survival, growth, behavior, or reproduction? *(It allows the plant to get the food and nutrients it needs to grow and mature.)*

SUPPORT—Use the plant objects as a prop for students to relate specific structures to specific functions.

Know the Science

2. Why investigate the functions of plant structures? Knowledge and understanding of plant structures can lead to significant benefits to society. One reason for investigating the functions of plants is to benefit society. Such understanding may be applied in fields as diverse as medicine and agriculture. Consider tomatoes. The tomato is the fruit structure of the plant. By understanding how the tomato plant reproduces (via its flower structure) and how the fruit develops, scientists have bred new varieties of tomatoes. The current varieties have longer shelf lives, better flavor, and better pest resistance than the original wild tomato. Researchers are even looking at ways to grow tomatoes that produce edible vaccines! Another useful example for students is the ways in which rice has been bred and genetically engineered to improve plants and feed more people. Scientists have created rice with stronger stems, hence able to support heavier grains. Scientists made a golden variety of rice that has high levels of vitamin A to help reduce widespread vitamin A deficiency in Asia. You don't need to go into this level of detail with students. However, it may help to engage students if they understand the relevance of important scientific investigations of plant structures.



Distribute Functions of Plant Structures (AP 6.1). Tell students that they will answer a variety of questions based on the discussion they had with their neighbor about plant parts. Students should complete this Activity Page independently.

SUPPORT—If a need arises, allow students to complete their Activity Pages with their neighbor.

5. Check for understanding.

5 MIN

Formative Assessment Opportunity

See the Activity Page Answer Key (AP 6.1) for correct answers and sample student responses. Students should have listed the roots, stems, and leaves as the three main structures of plants. They should also have been able to properly identify the function of the roots, stems, and leaves.

- Distribute Lesson 6 Check (AP 6.2), and ask students to complete it independently. Once they are finished, collect the assessment, and before the start of Lesson 7, check students' answers to identify concepts that need further clarification and to provide the support needed.
- See the Activity Page Answer Key (6.2) for correct answers and sample student responses. Prompt students to ask any new questions they may have, and hold a class discussion to further clarify any misunderstanding or misconception.

LESSON 7

Structure and Function Report

Big Question: How are structure and function related in any one plant or animal?

AT A GLANCE

Learning Objective

- ✓ Construct an argument from evidence to support a claim that all structures and functions of an organism are interrelated and essential.

Lesson Activities (2 days)

- student research
- student writing

NGSS References

Disciplinary Core Idea LS1.A: Structure and Function

Crosscutting Concept: Systems and System Models

Science and Engineering Practices: Engaging in Argument from Evidence

Engaging in Argument from Evidence is necessary to support an explanation about the function and necessity of specific structures in plants and animals. In this two-day lesson, students will research and write about how specific structures and functions in an organism's systems are interrelated and essential.

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

www.coreknowledge.org/cksci-online-resources

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. No new Core Vocabulary terms are introduced during this lesson.

behavior	nerve	response
cell	organ	structure
function	organ system	survive/survival
growth	reproduce	tissue

Instructional Resources

Activity Pages



AP 7.1
AP 7.2
AP 7.3
AP 7.4

Activity Pages

Research and Writing
Discussion (AP 7.1)

Research and Writing Outline
(AP 7.2)

Report Scoring Guide (AP 7.3)

Take-Home Guide (AP 7.4)

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

Materials and Equipment

Collect or prepare the following items:

- writing and recording materials, such as paper and writing utensils
- internet access, books, magazines, and other research materials

Advance Preparation

Prepare in advance for this class by scheduling time at the school library or computer lab, as students will need to conduct research on their assigned (or chosen) organism. If you have enough computers for each student in your classroom, the research for Day 1 can be conducted in the classroom.

On Day 1, students will conduct research on a plant or animal that they encountered in real life (such as a pet or an animal at the zoo) or saw in a nature video.

On Day 2, students will write a report on their findings using paper or computers.

Online Resources



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

www.coreknowledge.org/cksci-online-resources

THE CORE LESSON TWO DAYS, 45 MIN EACH

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

10 MIN

How are structure and function related in any one plant or animal? Remind students that in previous lessons they learned about the interrelated and essential structures and functions of living things. Engage students by asking them if they have ever been in a forest or to the zoo, looked after a pet, or had another firsthand experience with a plant or animal. Ask them to write down one plant or animal that they remember from their personal experience. Then ask students to write down what structures and functions were involved in that one plant or animal. Use the following questions to brainstorm about the functions of different structures of their organism:

- » How does the plant or animal move? (*animals: legs, wings, muscles; plants: tropisms*)
- » How does the plant or animal get the sources of energy it needs to survive? (*animals: eating plants or other animals; plants: make their own food from sunlight and exchanging gases*)

- » What is the most important structure of a plant or animal, and why? (*There is no single “most important structure.” Structures are parts of interrelated essential systems with structures and functions that work together to support the plant’s or animal’s survival, growth, and reproduction. However, each structure is important because without it, the other structures would not work or most organisms could not survive in their environment.*)

Encourage students to brainstorm the various structures and functions of their plant or animal and to discuss these in pairs or small groups. To address the final question above, ask students to discuss a specific structure (such as an organ, limb, etc.) in context of other structures.

SUPPORT—If necessary, probe understanding by asking students for examples of interrelatedness of systems. For example, the brain (nervous system) cannot work without the heart (circulatory system) and vice versa.

Activity Pages



AP 7.1

AP 7.4

Distribute Research and Writing Discussion (AP 7.1). Explain that these questions will help students guide the research that they will be doing throughout the lesson. Remind them that if they get stuck on a question, they can brainstorm answers with each other. Also distribute the Take-Home Guide (AP 7.4). These tips will allow family members to support student research throughout the lesson.

2. Preview the research investigation.

5 MIN

Activity Page



AP 7.2

Distribute Research and Writing Outline (AP 7.2). Review the Activity Page with students, and explain that they will use the outline to guide their writing. Remind students that they will work on researching the relationship between structure and function for a specific plant or animal during Day 1 and writing their reports on Day 2.

When reviewing the questions on the Activity Page for Day 1, tell students that they need to describe the plant or animal being studied, with background on its name, classification, geographic location, etc. Tell students that they also need to research one way in which their specific plant’s or animal’s structure and function is part of a system (see **Know the Science**).

Know the Science

Why do scientists study the structures and functions of plants and animals? Studying structures and functions of plants and animals gives insight into their biology as systems. Plants and animals are made of interrelated systems of structures with specific functions. We can identify a structure and its function. For example, the heart functions to pump blood. A root functions to absorb water. Studying structures and functions helps us to recognize that these are parts of systems that support survival, growth, or reproduction. For example, the heart is part of the circulatory system. A root is part of the root system. A biological organization approach in turn helps scientists to better understand the biology of plants and animals. Such understanding can, in turn, be applied to benefit society. For example, study of how the heart muscle works as part of the circulatory system can help doctors to treat heart conditions. Study of how a root system grows can help plant breeders grow varieties of crops that resist drought or soil pests.

Review the paragraph descriptions with students to make sure they understand what they need to focus on for their reports. Specifically, reports must meet these expectations:

- introduce the plant or animal being studied
- identify and describe evidence that supports how at least one structure and one function are interrelated and essential to growth, survival, and/or reproduction
- identify the sources used for the research
- consist of five paragraphs:
 - Paragraph 1 introduces the plant or animal and a specific structure and function.
 - Paragraphs 2–3 describe evidence of the structure and function and their interrelated role in supporting growth, survival, and/or reproduction.
 - Paragraph 4 describes evidence of how the structure and its function are part of a system.
 - Paragraph 5 is a conclusion to demonstrate the connection between the structure, its function as part of a system, and the system’s role in growth, survival, and/or reproduction.

3. Facilitate the research.

25 MIN

Online Resources



Have students conduct their research independently. They can use library books or online resources (or both) to obtain and combine information.

SUPPORT—Provide students with online resources for where they can research their plants or animals. Use this link to download the CKSci Online Resources Guide for this unit, where specific links to these resources may be found:

www.coreknowledge.org/cksci-online-resources

Use Science Practices

Remind students that in science and engineering, it is important for researchers to evaluate their sources of information. They first have to determine that their sources are unbiased and contain facts and findings that have been peer reviewed. They have to evaluate them, or determine their trustworthiness. *Peer reviewed* means that people in the same scientific field have studied the findings and determined that they are indeed true. As students conduct their own research, they will have to do the same thing: carefully evaluate their sources to determine whether they are trustworthy and can be used as the basis for an argumentative report. When students read and synthesize information, which they will be continually doing throughout this activity, they also will be continually evaluating those sources.

Circulate around the room as students conduct their research. As students answer the questions on the Activity Page, provide some additional guiding questions, such as the following:

- » How is the structure of your plant or animal related to its function? (*Sample response: Fish have gills so they can breathe in water.*)

- » How does that function support growth, survival, and/or reproduction? (*Fish use their gills to get oxygen from the water.*)
- » What evidence can you find that the function is essential to growth, survival, and/or reproduction? (*Without the ability to breathe, fish will die.*)
- » How is that structure and function part of a system? (*The respiratory system includes gills for fish and lungs for people for breathing.*)
- » How is that system related to other systems? (*The respiratory system takes air to the circulatory system, brain, and organs.*)

SUPPORT—If necessary, remind students about examples of interrelated structures and functions. For example, the leaf of a plant is a structure that functions to absorb light energy and use it to make food. This food in turn is sent to other plant systems in the roots, stem, and flowers. These systems of structures function to support the plant’s growth, survival, and reproduction.

If necessary, remind students that a plant or animal can grow and survive without having to reproduce. However, reproduction is not possible unless the plant or animal grows and survives until mature adulthood.

If students struggle to identify structures that are related to specific functions, provide the following suggestions: for animals—legs, wings, eyes, jaws, tails, and organs such as the heart or lungs; for plants—leaves, roots, stems, and flowers or fruit.

NOTE—If your school has a specific policy or preference for citing research resources, tell students how you prefer for them to format their resources, or tell them what kind of information to include, such as author name, publication date, journal title, and page number. Remind them of the importance of evaluating their sources before determining whether to use them, to ensure that they are factually accurate and free of bias. This will better help them to present a well-argued and reasoned report.

Remind students that they need to research at least two pieces of evidence to support an explanation about the function of specific structures in plants and animals. They also need to provide evidence that a specific structure is part of a system and how that system supports the organism’s growth, survival, or reproduction. They will write about each piece of evidence in their reports.

4. Check for understanding.

5 MIN

Activity Page



AP 7.1 and
Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key for correct answers and sample student responses. Collect the completed Research and Writing Discussion (AP 7.1). Review students’ questions, and identify any that remain unanswered.

- Have students summarize what they have learned about how to conduct an evaluation into whether sources are trustworthy. Ensure that students

understand that they should use factual information from the research as evidence in their reports to support their argument about which structure is the most important in a plant or animal.

- Ask students how their research went. If students had any issues (such as not understanding what makes a source trustworthy), work with them to resolve those issues.

1. Day 2: Refocus student attention on the Big Question.

5 MIN

How are structure and function related in any one plant or animal? Remind students that they already conducted research on their plant or animal and collected evidence on how a specific structure is related to its function that is essential for growth, survival, and reproduction. Tell students that today they will use the Activity Pages that they started on Day 1 of the lesson to organize what they want to discuss in their written reports. Then they will write their five-paragraph reports using paper or a computer.

2. Preview the writing part of the investigation.

5 MIN

Activity Page



AP 7.3

Distribute Report Scoring Guide (AP 7.3). Review the report criteria with students to make sure they understand what they need to write about. Specifically, reports must meet the following criteria:

- clearly and concisely introduce the plant or animal being studied
- accurately identify and describe evidence that logically supports how at least one structure and one function are interrelated and essential to growth, survival, and/or reproduction
- clearly identify the sources used for the research
- consist of five paragraphs:
 - Paragraph 1 introduces the plant or animal and a specific structure and function.
 - Paragraphs 2–3 describe evidence of the structure and function and their interrelated role in supporting growth, survival, and/or reproduction.
 - Paragraph 4 describes evidence of how the structure and its function are part of a system.
 - Paragraph 5 is a conclusion to demonstrate the connection between the structure, its function as part of a system, and the system's role in growth, survival, and/or reproduction.

3. Facilitate the writing part of the investigation.

25 MIN

Circulate around the room as students work independently on their written reports. Explain to students that each paragraph should meet the criteria and that their report should clearly explain how the structure and function of their plant or animal are interrelated and essential to growth, survival, and/or reproduction.

SUPPORT—If necessary, remind students to focus initially on the specific structure and function of the part of their plant and animal. They should focus only on one piece of evidence in each of the report’s paragraphs. They should introduce the evidence first and then use a logical connection to explain how the structure is related to its function. The evidence they are using should make sense to the reader in the context of the paragraph.

If necessary, remind students to focus next on how a specific structure and function of their plant and animal are part of a system. They should introduce the evidence first and then use a logical connection to explain how the structure and its function are parts of a system.

This step is an opportunity to let students write multiple drafts of their work. For example, after having written an outline on Day 1, they can now write a first draft on Day 2 and then revise their drafts further should you decide to add class sessions for this activity.

As you move about the room, ask students to talk briefly about their findings as they conduct the research, such as the following:

- » What is the plant or animal that you chose? (*Sample response: a grapevine*)
- » What structure and function of that plant or animal are you focusing on? (*Sample response: how the structure results in making grapes*)
- » How is that structure and function part of a system? (*The plant must have roots and shoots to produce fruit.*)
- » What kind of evidence did you find? (*The grapes grow when the amount of water is just right. The vines will not produce grapes if they do not get the water they need.*)

Give a five-minute warning for students to finish up their reports and write their concluding paragraphs.

4. Summarize and discuss.

5 MIN

Lead a class discussion about students’ findings. Ask volunteers to share the plant or animal they focused their research on and the specific structure and function and how these are part of a system that is essential to growth, survival, and/or reproduction.

Ask the class follow-up questions, such as the following:

- » What evidence showed your plant’s or animal’s structure and function were part of a system? (*Sample response: The grapevine has roots and shoots.*)
- » What evidence showed this system is essential to your plant’s or animal’s growth, survival, and/or reproduction? (*If the water is cut off or the roots are pulled up, no fruit will grow.*)
- » If time allows, ask a challenging extension question, such as the following: Can you think of a benefit of studying this structure and function in your plant or animal? (*Yes. I like to eat grapes.*)

5. Check for understanding.

5 MIN

Activity Pages



AP 7.2

AP 7.3

Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key for correct answers and sample student responses. After students have completed their reports, collect and review the completed Research and Writing Outline (AP 7.2), checking for completeness. If you told students to use a specific format for citing resources, make sure those formats were followed. Collect and review students' reports, checking for all of the required criteria per the rubric on Activity Page 7.3.

PART B

Structures and Functions of Eyes and Ears

OVERVIEW

Lesson	Big Question	Advance Preparation
8. Hearing and Vision	How does the eye gather light and use it to see?	Gather materials for a student investigation. (See Materials and Equipment, page 13.)
9. Human Vision and Hearing	How do humans see and hear?	Read Student Reader, Chapter 5.
10. Modeling the Detection of Sound and Light (2 Days)	How can I model structures that function to detect sound and light?	Gather materials for a student investigation. (See Materials and Equipment, page 13.)

Part B: What's the Story?

Seeing and hearing are two important senses that animals, including humans, use to monitor their surroundings. Students may already intuitively understand that they can see and hear, but they may not yet understand the processes involved. In this section, students learn about the visual and auditory systems and how they work with other body parts to monitor environments.

In Lesson 8, we start by engaging students in a hands-on activity in which students use mirrors to study their eyes and how their pupils react to light when it bounces off of objects and enters the eye. The goal is to get students to recognize that the reflection of light and light entering the eye is what enables humans to see.

In Lesson 9, students build on their knowledge of light waves and sound waves to learn about the basic parts of the human visual and auditory systems and how they function. Students will learn that in processing sights and sound, visual and auditory systems keep us safe.

In Lesson 10, students focus on how the visual and auditory systems work together in a process that supports stimulus and response. The goal of this two-day lesson is to convey that human processes depend on the interrelationship of multiple systems. This lesson gives students an opportunity to participate in a hands-on demonstration of stimulus and response, as well as create models that support the Performance Expectation.

So, to repeat, **the visual and auditory systems are important sensory systems that humans use to monitor the world**. In each system, structure is related to function at every level. The key concept for students to grasp is that these systems are complex and depend on a variety of structures and functions for them to work properly.

LESSON 8

Hearing and Vision

Big Question: How does the eye gather light and use it to see?

AT A GLANCE

Learning Objectives

- ✓ Observe and describe how the eye gathers light.
- ✓ Draw a diagram to explain reflection.

Lesson Activities

- student activity and discussion
- develop a model

NGSS References

Disciplinary Core Idea PS4.A: Wave Properties

Crosscutting Concept: Cause and Effect

Science and Engineering Practices: Developing and Using Models

Developing and Using Models is important to this lesson because students will gather information to develop a model showing how light reflects from an object and enters the eye so that information can be understood by the brain.

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

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in blue below. During instruction, expose students repeatedly to these terms, which are not intended for use in isolated drill or memorization.

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 166–167 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

pupil
reflect

sense
vision

visual system

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary terms designated in blue above.

Instructional Resources

Activity Pages



AP 8.1
AP 8.2

Activity Pages

The Pupil (AP 8.1)

Reflection (AP 8.2)

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

Materials and Equipment

Collect or prepare the following items:

- mirrors (1 per pair of students)
- index cards for student vocabulary deck (2 per student)
- internet access and the means to project images/video for whole-class viewing

THE CORE LESSON 45 MIN

1. Focus student attention on the Big Question.

10 MIN

Online Resources



How does the eye gather light and use it to see? Open this lesson with a brief video that shows the eye and gives a quick explanation for how it gathers light to see. This will build background knowledge about vision and the visual system that students will be able to build on as they make observations and complete their model. 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

Use the following questions to prompt discussion:

- » What is necessary so that the eye can function to see objects? (*light*)
- » How does light get to the eye? (*by reflecting from objects*)
- » What happens to the light once it enters the eye? (*It is bent, or refracted, and ultimately travels to the optic nerve. The signal is then sent along the nerve to the brain.*)

Tell students to keep the video in mind as they continue the remainder of the lesson.

Preview Core Vocabulary Terms

Write each of these words on the board or chart paper. Have students pay special attention to these words as they work through the lesson activity.

sense

visual system

Point out that students will complete Core Vocabulary cards for these terms by the end of today's lesson.

Notes About Safety

Before beginning the activity, review the following safety precautions:

- Mirrors are made of glass with a coating of silver or other reflective substance. Tell students to be sure to remain seated and hold the mirror over the table when they are using it. Review the classroom procedure students should follow if one of the mirrors were to break.
- Warn students never to reflect light from the sun into their own or anyone else's eyes.

After reviewing the safety precautions, distribute a mirror to each pair of students. Write the word *reflection* on the board or chart paper. Explain to students that light reflects off a mirror and back toward their eye when they look into it. Explain why it is said that when you look into a mirror, you see your reflection.

Instruct students to look into the mirror and observe their eye. Draw their attention to the dark middle part of their eye. Explain that this is called their pupil.

SUPPORT—Some students may have very dark eyes that make it difficult to observe the pupils. They can observe their partner's eyes.

Turn off or dim the classroom light. Wait twenty seconds, and then turn the light back on. Ask the following:

- » What happened to your pupils when the lights went off? (*They grew larger.*)
- » Why do you think they got larger? (*They were trying to let more light into the eye because the eye needs light to see.*)

SUPPORT—You may have to dim the lights several times for students to see the pupil change shape, since it happens so quickly. If there is no way to dim or turn off classroom lights, students can also try closing their eyes for twenty seconds and then opening them.

Have students recall what they saw in the video at the beginning of class, and if necessary, play it again. Review how vision works. (See **Know the Science**.)

Know the Science

How do we see objects? The sun is a source of light, but for most objects to be seen, the light must be reflected from the object, and that light must enter the eye. It is important to remember that the brain plays an important part in vision because it processes the information. The importance of the brain relative to sight can be highlighted using optical illusions.

1. Light reflects from a surface and enters the eye through the pupil.
2. Light goes through the lens and is refracted and received by the optic nerve.
3. The signal travels along the nerve to the brain, where the image is interpreted.
4. A reaction can happen.

Tell students that their eye is part of the visual system. Ask the following:

- » What other parts of the body work with the visual system to help you see? (*nerves, brain*)
- » What other senses work with vision to get information about the world around you? (*touch, hearing, smell, and taste*)
- » Why can't you see when you close your eyes? (*because your eyelids keep light from entering your pupils*)

3. Teach Core Vocabulary.

5 MIN

Prepare Core Vocabulary Cards

Have students begin preparing cards for their Core Vocabulary decks for the terms you emphasized on the board or chart paper. Instruct students to write each term in the upper left corner of a card and underline it (one term per card), reserving space on the card for notes.

sense **visual system**

Word Work

- **sense:** (v. to detect a stimulus) In this lesson specifically about vision, students should consider what their familiar five senses are without yet needing to understand stimuli. (*Stimulus* is addressed as Core Vocabulary later, in Lesson 12.) For the time being, give students the transitional definition for *sense*: to gather information from the environment.
- **visual system:** (n. the set of cells, tissues, and organs in the eyes and brain that make vision possible) Emphasize that vision is just one of the senses, made possible by structures that function to detect light. Have students list parts of a visual system. (*eyes, nerves, brain*)

Have students write any other important information or draw sketches if they wish in order to help them remember the meaning of the words.

4. Facilitate the investigation and drawings.

10 MIN

Activity Pages



AP 8.1
AP 8.2

Distribute The Pupil (AP 8.1). Tell students that they will be drawing a model of their eyes in the drawing box and labeling the pupil. Read each of the questions aloud before students begin. You may choose to have students complete the page individually, or with a partner.

SUPPORT—Students may continue to use the mirrors for Activity Page 8.1 if necessary.

Distribute Reflection (AP 8.2), and review the directions together. Tell students they will be adding to the picture on the page to show how light from the flashlight can reflect from the mirror. Read the questions aloud to students before they begin. Have them compare their sketches with one another. Point out that when the light bounces off the mirror, it can bounce off in any direction and still be a reflection.

SUPPORT—Encourage students to use their Core Vocabulary cards as a resource for Activity Page 8.2, if necessary.

5. Summarize and discuss.

5 MIN

Once students have had time to complete their Activity Pages, bring the class back together for a whole-class discussion to summarize what students discovered. Students should be able to explain their drawings. Alternatively, you can have students work with neighbors to compare their drawings and hold a partner discussion about what they drew.

Elicit from students that the pupil enables people to see and that reflection is a way the eye interprets and sees light. Ask if students have any questions about the activities, and address any misunderstandings.

6. Check for understanding.

5 MIN

Activity Pages



AP 8.1
AP 8.2
Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key for correct answers and sample student responses. Collect the completed The Pupil and Reflection (AP 8.1 and AP 8.2). Scan the models that students made. If models contain errors, such as the pupil not being properly labeled or the light from the flashlight not bouncing off the mirror, engage in further discussion.

LESSON 9

Human Vision and Hearing

Big Question: How do humans see and hear?

AT A GLANCE

Learning Objectives

- ✓ Identify the basic parts of the human visual system and their functions.
- ✓ Identify the basic parts of the human auditory system and their functions.

Lesson Activities

- reading and discussion
- hands-on activity and discussion

NGSS References

Disciplinary Core Idea PS4.B: Electromagnetic Radiation

Crosscutting Concept: Cause and Effect

Science and Engineering Practices: Developing and Using Models

Developing and Using Models is important to this lesson and the following lesson because students will learn how the structure of organs determines how they function. Students will be developing a type of model to explain how signals are sent from the ear to the brain by placing descriptions in the correct order.

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

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in blue below. During instruction, expose students repeatedly to these terms, which are not intended for use in isolated drill or memorization.

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 166–167 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

auditory system sense **visual system**

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary terms designated in blue above.

Instructional Resources

Student Reader



Ch. 5

Student Reader, Chapter 5
"Human Vision and Hearing"

Activity Page



AP 9.1

Activity Page
Sending Signals (AP 9.1)

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

Materials and Equipment

Collect or prepare the following items:

- scissors (1 pair per group)
- index cards for student vocabulary deck (1 per student)

Look ahead at the Activity Page, and decide whether you want to cut out the sentence strips before this lesson to save groups time during the activity.

THE CORE LESSON 45 MIN

1. Focus student attention on the Big Question.

5 MIN

How do humans see and hear? Walk to the back of the classroom so that students will need to turn to see you. Clap your hands in a random pattern. Ask the following:

- Why did you look at me? (*because you made noise/clapped your hands*)

Explain that hearing and vision are two body systems and that, like all other body systems, they work together. When you hear something, you look to see what it is. Next, your brain interprets what you saw and decides what to do next. This is a reaction, or response. Explain that in this lesson, students will learn more about the structures of the visual and auditory systems and how they function.

2. Read and discuss: "Human Vision and Hearing."

20 MIN

Student Reader



Ch. 5

Read together, or have students read independently, "Human Vision and Hearing," Chapter 5 in the Student Reader. The selection explains the structures of the visual system and auditory system and how they function.

Preview Core Vocabulary Terms

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

auditory system visual system

Instruct students to locate their Core Vocabulary card for *visual system* from the previous lesson, and have them prepare a new card for *auditory system* by writing the word in the upper left corner of a card and underlining it.

Review the meaning of the word *structure* and the word *function* from previous lessons. Remind students that structure is the form something has and function is the job that it does. Explain that as you read, students should look for the structures and functions of each of these systems.

Preview the meaning of the words *auditory* and *visual*. Explain that *auditory* refers to the sense of hearing and *visual* refers to the sense of sight. Have students think of where they may have heard these terms used in everyday life. Use questions as prompts such as, "Have you ever heard of an auditorium? Have you ever heard the phrase *visual aid*?"

Guided Reading Supports

- Page 21** After students have read the page, ask students to point to the organs that help them see and hear.
- Ask the following:
- » What do we mean when we say that seeing and hearing are involuntary? (*You cannot help seeing and hearing things around you.*)
 - » What are some other organs that help you sense the world around you? (*hands, nose*)
- Page 22** Prompt students to reflect on their hands-on activity from Lesson 8 related to their eyes and reflection. Ask them to compare what they saw to the picture on the page. Have students circle the structures of the eye described on the page. Explain that these structures make up the visual system.
- Page 23** Discuss with students the different ways that animals see. Ask students to name some animals with forward-facing eyes on the front of their heads (*people, dogs, cats, eagles, owls, alligators, snakes*) and some with sideways-facing eyes on the sides of their heads (*chickens, horses, cows, fish*). Have students explain how they think the position of the eyes helps each animal named to survive. (*Students should be able to note that animals with eyes on the sides of their heads are prey and that animals with eyes on the front of their heads are usually predators.*)
- Page 24** After reading this page, have students circle the structures in the ear described on the page. Explain that these structures make up the auditory system.
- Page 25** After reading this page, ask students to turn and talk to a partner to describe the difference between the inner ear and the outer ear.
- Then ask the following:
- » How can technology help people who cannot hear well? (*with hearing aids and implants*)
- Page 26** After reading this page, explain that the brain is part of both the auditory and visual systems, as well as other systems. Have students observe the photo on the page. Let students take turns naming the things that they see and hear that would allow them to cross safely.

3. Facilitate the investigation.

10 MIN

Activity Page



AP 9.1

Divide the class into small groups. Distribute one copy of Sending Signals (AP 9.1) to each group of students. Tell students that they will be working in groups to arrange the steps to show how sound reaches the brain through the auditory system. (See **Know the Science.**) Read the directions to them. Give each group of students scissors to cut the statements out. Circulate among the groups as students work on placing the statements in the correct order.

Encourage groups to select one person who will be responsible for cutting out the statements.

SUPPORT—If needed, help students by directing them back to the information on page 24 of the Student Reader. Reread the page aloud if needed, or encourage groups to reread the page together. Have students observe the picture on the page. To save time, you may wish to cut out the statements ahead of time.

4. Teach Core Vocabulary.

5 MIN

Word Work

- **visual system:** (n. the set of cells, tissues, and organs in the eyes and brain that make vision possible)
- **auditory system:** (n. the set of cells, tissues, and organs in the ears and brain that enable hearing)

Instruct students to describe the function of each system on the front of the card.

Have students turn the card over and draw a quick sketch or write a brief description of the structures of each system on the back of the card.

Establish a Scientific Mindset

Encourage students to think about ways that their visual and auditory systems work together to send signals in their everyday life. Ask guiding questions such as, “How do your eyes and ears work together when you hear a fire drill?” Ask students to share other examples of these systems working together every day. Discuss examples that students share.

Know the Science

What is the relationship between structure and function in hearing? The form of an object supports the job that it does! For example, you use a spoon to eat soup. In the auditory system, the outer ear is structured like a funnel so that it can function to move sound waves along it toward the inner ear to be changed to electrical signals. The nerves that send these electrical signals can quickly move them from the ear to the brain.

5. Check for understanding.

5 MIN

Activity Page



AP 9.1 and
Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key for correct answers and sample student responses. When students raise their hand, circulate around the room, and check that they have placed the statements in the correct order.

LESSON 10

Modeling the Detection of Sound and Light

Big Question: How can I model structures that function to detect sound and light?

AT A GLANCE

Learning Objectives

- ✓ Conduct an investigation to gather information about how the senses work together to send information to the brain.
- ✓ Construct a model to show how eyes and ears work together to detect information.

Lesson Activities (2 days)

- student investigation
- create a model
- student presentations

NGSS References

Disciplinary Core Idea PS4.B: Electromagnetic Radiation

Crosscutting Concept: Cause and Effect

Science and Engineering Practices: Developing and Using Models

Developing and Using Models is important to this two-day lesson because students will develop a model to show the interrelationship of structure and function associated with senses. On Day 1, students will conduct a hands-on investigation involving a ruler drop. On Day 2, students will work on modeling the processes that took place to allow them to use their eyes and ears to sense their surroundings during the ruler-drop activity.

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

www.coreknowledge.org/cksci-online-resources

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. No new Core Vocabulary terms are introduced in this lesson.

hearing sense vision

Instructional Resources

Activity Pages



AP 10.1
AP 10.2

Activity Pages

Ruler Drop Investigation
(Day 1) (AP 10.1)

Make a Model (Day 2) (AP 10.2)

Make copies for your students
prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

Day 1

- rulers (1 per pair of students)

Day 2

- scissors
- glue sticks

THE CORE LESSON TWO DAYS, 45 MIN EACH

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

10 MIN

How can I model structures that function to detect sound and light? Be sure that students are looking at you, and then walk over and close the classroom door so it makes a noise. Ask the following:

- » How did you know that the door to the classroom is closed? (*I heard it; I saw you close it.*)
- » What parts of the body helped me close the door? (*brain, muscles, bones, eyes*)

Explain that the brain receives signals from our senses and that the brain sends signals to the body to respond to those signals.

2. Preview the investigation.

10 MIN

Activity Page



AP 10.1

Distribute Ruler Drop Investigation (AP 10.1) to each pair of students. Tell students that they will be dropping a ruler under different conditions and measuring response time. Review the directions for the activity.

Demonstrate how to conduct the investigation by explaining that you will pretend to be Partner A. Choose a volunteer to be Partner B.

1. Have the student sit on a chair in an area of the classroom where all students can see.
2. Point out that the ruler is above the student's open thumb and finger and that you are holding it so that the zero centimeter mark is just above the opening.
3. Allow the student to keep his or her eyes open.
4. Tell the student to catch the ruler when you drop it.
5. Drop the ruler for the student to catch.
6. Model how to read the measurement on the ruler, rounding to the nearest centimeter.

3. Facilitate the investigation.

15 MIN

Group students into pairs. Provide each pair with a ruler. As students work to complete the investigation, circulate around the room to assist with any questions or problems that students may have. As students complete the investigation, remind them to record their data on the data table. (See **Know the Science.**)

Give students time to complete the investigation and record observations on their worksheets.

4. Summarize and discuss.

10 MIN

Once students have had time to conduct their investigation and complete their Activity Page, bring the class back together for a whole-class discussion to summarize what students discovered. Students should be able to describe patterns they saw in the data.

SUPPORT—If needed, help students understand that if their data does not follow the pattern, that is all right. Explain that this is why they compared data with two other groups, so they would be able to find overall patterns.

- » Ask the following: How was your investigation similar when I closed the door at the beginning of the lesson? (*Information was taken in by the senses, sent to the brain, and interpreted, and then the brain sent a signal to the body to react.*)

Collect the Activity Page.

1. Day 2: Refocus student attention on the Big Question.

5 MIN

How can I model structures that function to detect sound and light? Remind students of the investigation they performed in the previous class with the ruler. Ask what body structures the students relied on to catch the ruler. (*eyes, ears*)

Know the Science

Why is it important to conduct more than one trial? *To have more accurate results!* By conducting multiple trials, the students are getting more reliable data. This allows them to be able to find patterns more easily and to eliminate outliers.

2. Preview the investigation.

5 MIN

Activity Page



AP 10.2

Distribute Make a Model (AP 10.2), and go over it with students. Tell students that today they will be constructing a flowchart to explain how signals are sent and received in their body.

SUPPORT—If needed, review how to interpret a flowchart as shown on the Activity Page. Explain that the arrows point in the direction in which information flows in the diagram. Tell students that a flowchart shows how a process works, starting from the first step and going to the last step.

Establish a Scientific Mindset

Discuss with students the importance of using models in science. Explain that scientists use models to help explain certain phenomena and processes, such as why things work the way they do. Using models helps people visualize a particular process so that they can better understand it. Explain that there are many different types of models that people can use to explain scientific phenomena. Flowcharts are just one type of modeling diagram.

3. Support the investigation.

20 MIN

Give each student a pair of scissors and a glue stick so that students can create their models. Have students work individually to complete the Activity Page.

SUPPORT—If needed, have all students stand up to act out what occurred in the third type of ruler drop on Day 1. Have them point to their eyes and their ears. Have them point to their brain. Have them open and close their fingers.

Circulate around the room to support students as they complete their model. Give students time to complete the Activity Page.

4. Present and discuss.

10 MIN

Have students convene with their partner from Day 1. Have them compare their completed models. Have each pair briefly stand and present their model to the class.

5. Check for understanding.

5 MIN

Activity Page



AP 10.2 and
Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key for correct answers and sample student responses. Collect the completed Make a Model (AP 10.2). Scan the models that students made. If models contain missing labels, engage in further discussion, emphasizing the path that signals take from the stimulus to the response.

PART C

Sensory Structures, Functions, and Survival

OVERVIEW

Lesson	Big Question	Advance Preparation
11. Sensing the Environment	Why must plants and animals sense their environments?	Gather materials for a demonstration. (See Materials and Equipment, page 13.)
12. Animal Senses	How do animals sense and respond to their environments?	Read Student Reader, Chapter 6.
13. Plant Responses	How do plants sense and respond to their environments?	Read Student Reader, Chapter 7.
14. Stimulus and Response for Survival	How do a(n) _____'s senses help it to survive?	Schedule time for library access or computer research, and gather materials. (See Materials and Equipment, page 13.)

Part C: What's the Story?

By now in this unit, students have already learned that humans have ways of sensing the world around them through sight and sound. This next series of lessons leads students through observations, readings, and discussions that explore how animals and plants use specific structures and processes to sense and respond to their environments.

Lesson 11 begins by engaging students in a video that shows stimulus and response. Students also explore stimulus and response through a brief activity in which they get firsthand experience responding to a stimulus. They also view a video of stimulus and response in plants to see that this is a phenomenon of all living things. This leads to a discussion and diagramming activity that gives students a glimpse of the importance of monitoring and responding to the environment.

Lesson 12 extends the concept of stimulus and response to animals through examples in a reading selection. Students explore and discuss evidence that animals use their senses to respond to the environment, thus increasing the animals' chances of survival.

In Lesson 13, students build on their understanding of stimulus and response by looking at plants and the unique ways in which they sense and respond to the world around them. Students become familiar with a number of tropisms. Students study more deeply in a reading selection and by watching a series of videos that show a variety of plant behaviors.

In Lesson 14, students apply what they learned about stimulus and response in animals and plants to work on a modeling activity. Students will select an organism to research and will diagram how stimulus and response applies to that organism. Students will satisfy the NGSS Performance Expectation 4-LS1-2 by showing how animals receive different types of information through their senses, which can be used to influence their behaviors or store information as memories.

So, to repeat, **animals and plants are organisms that use their senses to respond to environmental stimuli, which helps them survive in their surroundings**. The key concept for students to grasp is that the sense and response process—which is a cause-and-effect relationship—involves the work of many different structures to help guide behaviors.

LESSON 11

Sensing the Environment

Big Question: Why must plants and animals sense their environments?

AT A GLANCE

Learning Objective

- ✓ Describe the relationship between stimulus and response.

Lesson Activities

- student activity
- student video observation
- vocabulary instruction

NGSS References

Disciplinary Core Idea LS1.D: Information Processing

Crosscutting Concept: Systems and System Models

Science and Engineering Practices: Developing and Using Models

Systems and System Models are important to this lesson because students will be introduced to the concepts of stimulus and response, which are processes that are based on how living things receive and interpret different types of information through their senses. In this lesson, students watch videos and participate in activities that act as models to help them understand the cause-and-effect nature of stimulus and response.

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

www.coreknowledge.org/cksci-online-resources

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. No new Core Vocabulary terms are introduced in this lesson.

sense/sensory

Instructional Resources

Activity Page



AP 11.1

Activity Page

Plant Stimulus and Response
(AP 11.1)

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

Materials and Equipment

Collect or prepare the following items:

- craft feathers (1 per pair of students)
- internet access and the means to project images/video for whole-class viewing

THE CORE LESSON 45 MIN

1. Focus student attention on the Big Question.

15 MIN

Why must plants and animals sense their environments? Open the lesson with a whole-class discussion in which you ask students to discuss the following scenarios:

- » What happens when you touch something that is too hot? (*You pull your hand away.*)
- » What do you do when you smell something yummy? (*You get hungry; you start salivating.*)
- » What happens when you step on something sharp? (*You jump away from it.*)
- » What happens when you hear something that is too loud? (*You cover your ears.*)
- » What happens when a bright light shines in your face? (*You close your eyes.*)

Explain that all living things sense their environment. Animals sense things according to what they see, hear, taste, touch, and smell. Ask the following:

- » Why do you think it is important to sense things in your surroundings? (*so you can know how to react; so you can stay safe*)

Online Resources



Show students a video to introduce them to the concept of stimulus and response. 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

After watching the video, ask the following questions:

- » What is an example of a stimulus that you saw in the video? (*one example: the thorn pricking the foot*)
- » What is an example of a response that you saw in the video? (*one example: the foot being lifted off the thorn*)

SUPPORT—If necessary, further explain to students the definitions of *stimulus* and *response*. Tell students that a stimulus is something that causes a response and that a response is a reaction to something.

2. Demonstrate examples and guide discussion.

20 MIN

Choose the following or similar examples to stimulate further discussion. Analyze the cause-and-effect nature of stimulus and response.

Option 1: Have students pair up with a neighbor. Distribute the craft feathers so that each pair of students has one feather. Tell students to take the following steps (see **Know the Science 1**):

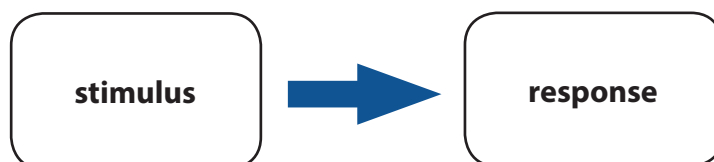
1. One student holds the craft feather. The other student places his or her hand on the desk, palm facing up.
2. The student with the feather lightly touches the inside of the other student's palm.
3. As the feather touches the student's hand, have both students pay attention to how the student's hand reacts to the feather.

Give students enough time to take turns so that each student gets a chance to use the feather and be tickled by the feather. After the students have taken their turns, ask them to describe the experience using the following prompts:

- » How did it feel when the feather was touching your hand? (*It tickled.*)
- » What did you do when the feather touched your hand? (*I pulled my hand away; I starting laughing; I curled my fingers.*)

As students describe their responses to the feather touching their hand, write down the responses on the front board or chart paper. Draw student attention to the similarities of the responses. Explain that in all instances, students responded in some way to the feather.

Draw the following diagram on the board or chart paper with the labels “stimulus” and “response”:



Review the diagram with students. Call on a volunteer to tell why the diagram is set up this way. (*A stimulus causes a response.*)

Know the Science

1. Why are students touching each other with feathers? Stimulus and response! In this activity, students are experiencing a stimulus and response in which the feather tickling is the stimulus and the response to the tickling—such as pulling a hand away—is the response. This activity allows students to see how very basic the concept of stimulus and response is.

SUPPORT—If necessary, take more time to break down the diagram for students so that they can tell why it looks the way it does. Start with the stimulus box, and remind students of the meaning of *stimulus*. Then focus on the arrow. Talk about why the arrow is pointing from stimulus to response. Then discuss the response box and why it is placed where it is on the diagram.

SUPPORT—If helpful, explain to students that stimulus and response is a cause-and-effect relationship. Remind students of what cause-and-effect relationships are. Have students come up with examples of cause-and-effect relationships.

Now draw the same diagram on the board or chart paper underneath your first diagram, but leave the stimulus and response boxes blank. Ask students how to fill in the blank boxes.

- » Based on the activity you just did with the feather, what do you think was the stimulus, and what do you think was the response? (*stimulus: feather; response: laughing*)

Activity Page



AP 11.1

Option 2: Distribute Plant Stimulus and Response (AP 11.1). Go over the directions with students. Tell students that you will play a short clip of a video for them two times. After watching the video, you will give them time to fill out the Activity Page based on what they observed.

SUPPORT—On the Activity Page, make sure students understand the meaning of the word *stimuli*. Explain that *stimuli* is the plural form of the word *stimulus*. The first question on the Activity Page is asking students to name more than one example of a stimulus that they saw from the video.

SUPPORT—Draw student attention to the diagram at the bottom of the Activity Page. Remind students that they just saw how diagrams are filled in to show the relationship between stimulus and response. Tell students that this time they will fill out the diagrams themselves based on what they watch in the video.

Know the Science

2. Why are students watching a video about plants? Plants are living things that respond to stimuli in their environments. Students do not need to memorize the terms related to tropism that they hear in the video just yet. They will learn more about tropism in an upcoming lesson. Rather, the purpose of showing this video is to engage students and get them to learn that plants, as well as animals, have ways of responding to things in their environment.

Know the Standards

A full explanation of the mechanisms of how sensory receptors in plants and animals function is not an expectation or target for Grade 4 students.



Show a video of how stimulus and response occur in plants. (See the Online Resources for a link to a suggested video.) Play the video two times so students can absorb the information. (See **Know the Science 2** and **Know the Standards** on the previous page.)

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

www.coreknowledge.org/cksci-online-resources

As students work on their Activity Pages, circulate around the room, and provide support as needed.

SUPPORT—If necessary, help students correctly identify the stimuli and responses. These need to be correctly identified for students to fill out the diagram correctly.

Give students time to complete their Activity Pages.

3. Summarize and discuss.

5 MIN

Once students have had time to complete their Activity Pages, bring the class back together for a whole-class discussion to summarize what students discovered. Students should be able to describe the stimuli and responses that they listed. Ask whether plants respond to stimuli in their environments. (yes)

- » How do you know plants respond to the stimuli in their environments? (*based on plant behaviors, like how they grow*)
- » What is an example of a behavior that a plant has in response to stimuli? (*sample: growing toward light; growing around an object*)

Elicit from students that stimulus and response is a cause-and-effect relationship that can be seen in all living things.

Ask whether students have any questions about their observations, and address any misunderstandings.

4. Check for understanding.

5 MIN

Summative Assessment Opportunity



See Activity Page 11.1 Answer Key for correct answers and sample student responses.

Collect Plant Stimulus and Response (AP 11.1), and review students' answers. Make sure students understand the difference between a stimulus and a response. Students should be able to identify the types of stimuli as discussed in the video (light, gravity, and touch). They should also be able to tell the ways in which plants respond to the stimuli in terms of how the plants grow (growing toward light, growing roots down into the ground, growing around objects).

Review the diagrams that students filled in on their Activity Pages, and check for proper understanding of the cause-and-effect relationship of stimulus and response.

LESSON 12

Animal Senses

Big Question: How do animals sense and respond to their environments?

AT A GLANCE

Learning Objectives

- ✓ Give examples of stimuli and responses in an animal.
- ✓ Identify examples of different sensory organs in an animal.

Lesson Activities

- reading and discussion
- vocabulary instruction
- diagramming activity

NGSS References

Disciplinary Core Idea LS1.D: Information Processing

Crosscutting Concept: Systems and System Models

Science and Engineering Practices: Developing and Using Models

Systems and System Models are important to the topic of animal senses, as stimuli and responses are part of an intricate system that allows living things to process and interpret information in their environments. In this lesson, students read Chapter 6 in the Student Reader, which discusses the types of senses animals have that allow them to survive. Students will also learn about how certain animal responses to stimuli are voluntary or involuntary. Throughout the lesson, look for opportunities to have students use the language of systems and system models to describe the relationships between stimulus and response.

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

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in blue below. During instruction, expose students repeatedly to these terms, which are not intended for use in isolated drill or memorization.

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 166–167 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

sense stimulus

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary terms designated in blue above.

Instructional Resources

Student Reader



Ch. 6

Activity Page



AP 12.1

Student Reader, Chapter 6
“Animal Senses”

Activity Page
What Senses Do Animals Have?
(AP 12.1)

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

Materials and Equipment

Collect or prepare the following items:

- drumstick
- index cards for student vocabulary deck (1 per student)
- internet access and the means to project images/video for whole-class viewing

THE CORE LESSON 45 MIN

1. Focus student attention on the Big Question.

5 MIN

How do animals sense and respond to their environments? In the previous lesson, students learned that all living things have ways of sensing and responding to stimuli in their environments. Remind students that they talked about the cause-and-effect nature of stimulus and response by watching videos, using craft feathers, and working with diagrams.

SUPPORT—Ask students to tell the meaning of *stimulus* and *response* in their own words based on what they learned in the previous lesson. Tell students that they will learn more about the specific definitions of *stimulus* and *response* in today’s reading.

CHALLENGE—Challenge interested students to give examples of stimuli and responses. For example, call on one student to name a stimulus, such as touching a hot object. Then call on a second student to name a response to that stimulus, such as quickly moving your hand.

Explain that like humans, other animals have many structures that enable them to detect their surroundings, process information, and respond to their environment. All these sensory structures that help them to survive are part of a system that works to support an animal. (See **Know the Science.**) Tell students they will learn more about the specific sensory parts of animals in Student Reader Chapter 6.

2. Read and discuss: “Animal Senses.”

20 MIN

Student Reader



Ch. 6

Read together, or have students read independently, “Animal Senses,” Chapter 6 in the Student Reader. This chapter emphasizes the ways in which animals sense things in their environments and how those sensory processes inform their behaviors and actions to support survival.

Activity Page



AP 12.1

Distribute What Senses Do Animals Have? (AP 12.1). Go over the directions with students. Tell students that they will fill out the table on the Activity Page as they read pages 28–32 of the Student Reader. Explain that the table allows students to capture information about animal senses. Review each of the column headings. Make sure students understand what kind of information to put in each part of the table. Emphasize that the last column asks for examples that are not discussed in the Student Reader.

Preview Core Vocabulary Terms

Before students read, write these terms on the board or chart paper. Remind students that they have already prepared a Core Vocabulary card for *sense*, and encourage them to add notes to that card.

sense **stimulus**

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 27

Focus on developing student understanding of the term *stimulus*. Explain that the term *stimuli* is the plural form of *stimulus*. When the term *stimuli* is used, it means that there is more than one thing causing a response.

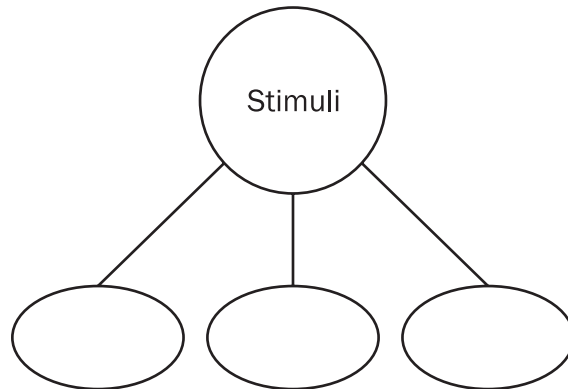
Know the Science

How do sensory structures work? Animals have different receptors that are specialized to sense and interpret particular kinds of information. The animal’s brain then processes the information, which allows the animal to interpret what it is sensing. Animals can use their perceptions and memories of sensory information to guide their actions, which enables their survival.

Word Work

Have students prepare a Core Vocabulary card for **stimulus**. Also, have students update their card for **sense** so that the definition includes the word *stimuli*. Invite students to use the word *stimulus* or *stimuli* in a verbal sentence. For example, *The stimulus made the lion run.*

SUPPORT—Draw a vocabulary concept map on the board or chart paper for the class. Write *stimuli* in a bubble at the center of the map. Draw three more bubbles below it and connect them to the top bubble.



Tell students that in any given environment, there are many things that can cause responses. Ask: What are three types of stimuli? (*Sample examples: something that is hot, something that tickles, something that is bright*) Write these answers in the three blank bubbles.

Some students may not be familiar with concept maps. If necessary, explain that the bubbles are ideas and the lines between the bubbles show how the ideas are connected to each other.

Draw student attention on the page to the words *voluntary* and *involuntary*. Discuss with students that there are two different types of responses: voluntary and involuntary. Tell them that voluntary responses are those that animals have control over. For example, running away from danger is a voluntary response. Explain that involuntary responses are those that animals cannot control. Your heart beating faster and you sweating in the face of danger are involuntary responses. This is because you cannot always control how fast your heart beats or whether you sweat.

SUPPORT—Focus student attention on the image and caption on the page. Ask: When a cat's fur grows thicker as days get shorter, is that a voluntary or involuntary response? (*involuntary*)

Page 28

After reading page 28, have students take out their Activity Page and work on their tables. Emphasize that this page focuses on animals and their sense of sight.

Draw student attention to the section of the page that discusses what happens when animals do not have good eyesight. Clarify that this means they must use other senses besides eyesight and other structures.

SUPPORT—It may be necessary to help students identify specific structures that support the sense of sight. Have students tell what body part they see mentioned on the page. Students should be able to recognize that eyes are mentioned on the page. Therefore, they would write this structure into the table.

CHALLENGE—If time allows, have students research interesting animals that do not use their eyes for sight. Students should tell how that particular animal can survive in its environment without eyesight.

Page 29

Some students may be under the mistaken impression that an elephant's ability to detect vibrations is a kind of hearing. Point out that they are, in fact, using their sense of touch, which will be discussed further on page 31. Have students identify other animals and ways that they use their hearing to survive in their environments.

Based on their reading, have students add more information to their table on the Activity Page.

Page 30

After reading the page, prompt students to fill out the sense of smell portion of their Activity Page tables. Ask students to name some of the structures of the body that animals use for smell. (*nose, tongue*)

Focus student attention on the image and caption on the page. Ask a volunteer to guess or explain why the forked structure of the tongue helps a snake smell more than it would if the tongue were not forked. (*because the parts of the tongue go in separate directions to detect different smells*)

Online Resources



SUPPORT—If time allows, show a video of snake senses. (See the Online Resources for a link to a suggested video: www.coreknowledge.org/cksci-online-resources.) Ask about the snake's senses:

- » What do snakes detect when they snap their tongues? (*chemicals*)
- » Is this something that animals can normally smell? (*Some may smell it, and others can't.*)
- » How does this sense influence the snake's behavior? (*It tells the snake where to look for food or how to avoid danger.*)

Then discuss the following question: What do you think animals need to smell in their environments to survive? (*Students should acknowledge that animals need to smell food, the scent of predators, and odors such as smoke.*)

CHALLENGE—Have students focus on animals that have unusual ways of smelling, and describe the structures that they use for this sense. If there is time, allow them to conduct research into animals with an unusual sense of smell.

Page 31

After reading the page, ask students to look at the tables on their Activity Pages. Have students tell where they think vibrations would fall as a type of sense. (*Students should select touch.*)

SUPPORT—If necessary, explain to students why vibrations can be considered something that animals feel. Vibrations can be felt because, as they travel, they come into contact with other things that can transfer the vibration.

SUPPORT—It may be tricky for some students to understand how detecting vibrations is a sense. If time allows, demonstrate for students how vibrations can communicate information to an animal. Turn the lights off in the classroom, and ask students to close their eyes and place their hands on their desk. Go around the room, and tap on each desk with a drumstick (or something similar) hard enough to produce a vibration that students can feel moving through the desk. Students should be able to feel the vibration in their hands. As you move about the room, ask students to describe what they sense. Emphasize that many types of animals have sensitive structures that can pick up on vibrations miles away!

Allow students time to complete their tables.

Page 32

A taste bud is a structure that detects certain chemicals, which the brain interprets. Make sure students understand that not all animals' sense of taste is located in their mouths. An octopus, for example, may have up to 10,000 taste buds on each sucker. These suckers are not in the octopus's mouth but all over its tentacles. The tentacles sense and seize prey for the octopus to eat. Ask students if they can think of any other examples of animals with taste buds not located in their mouths. If students do not know of any other examples, have them then describe animals with taste buds in their mouths.

Draw student attention to the image and caption on the page. Ask students why they think most of the catfish's taste buds are located in its whiskers. (*The whiskers are located near the mouth. Because they contain taste buds, they detect sources of food for the catfish, which it then eats with its mouth.*)

Summarize the Student Reader by explaining to students that sense receptors—such as eyes, ears, or tiny hairs—send information about an animal's surroundings to the brain. Information that is transmitted to the brain can then be processed immediately as perception of the environment. This tells an animal how to react in the moment. The information can also be stored as memories so the animal knows how to react to the same stimulus in the future.

Based on their reading, have students add more to their tables on Activity Page 12.1.

3. Demonstrate examples and guide discussion.

15 MIN

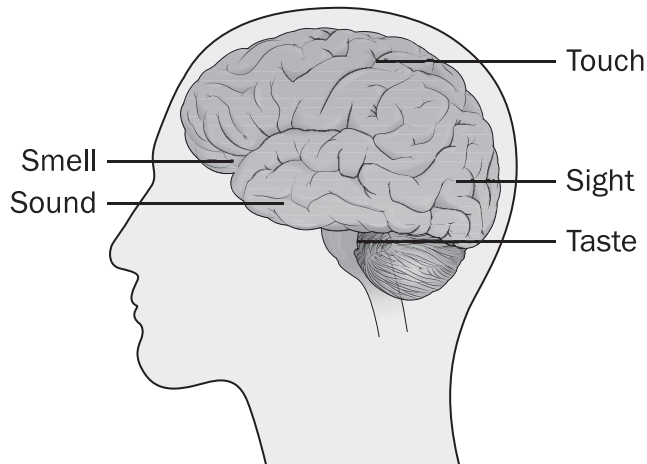
Choose one of the following or a similar example to stimulate further discussion. (If time permits, use all three.)

Option 1: Draw a T-chart on the front board or chart paper with the labels "Voluntary responses" and "Involuntary responses" as shown below.

Voluntary responses	Involuntary responses

Draw student attention to the T-chart on the board or chart paper. Remind them that in their Student Reader selection, they read that some types of responses are voluntary and others are involuntary. Call on students to give examples of voluntary responses, and make a list under the “Voluntary responses” column. Then do the same for the “Involuntary responses” column. Correct any misunderstandings—such as which responses are voluntary and which are involuntary—as students discuss the types of response. Encourage students to think of other examples of voluntary and involuntary responses that they did not read about in the Student Reader pages.

Option 2: Make a simple drawing of a brain on the front board or chart paper.



Tell students that most animals have a brain but that brains come in different shapes and sizes. You can explain that the brain you are drawing does not represent any particular animal.

All around the brain, write the words *smell*, *touch*, *sight*, *sound*, and *taste*. Tell students that as an animal senses something in its environment, the information gets sent to the animal’s brain. Go through each of the senses written on the board or chart paper. Use the following as a guide for discussion:

- Animals smell things in their environment. When the animal smells something, that information gets sent to the brain. Then the animal knows how to react to that smell.
- Animals touch things in their environment. When the animal touches something, that information gets sent to the brain. Then the animal knows how to react to what it touched.
- Animals see things in their environment. When the animal sees something, that information gets sent to the brain. Then the animal knows how to react to what it saw.
- Animals hear things in their environment. When the animal hears something, that information gets sent to the brain. Then the animal knows how to react to that sound.
- Animals taste things in their environment. When the animal tastes something, that information gets sent to the brain. Then the animal knows how to react to that taste.

As you work through each type of sense, draw a line that goes from the word on the board or chart paper back to the brain to reiterate that the information is sent to the brain.

Discuss the terms *input* and *output* with students. Explain that *input* and *output* are terms often used in science when discussing how information is processed. Tell students that *input* refers to the stimulus, because the stimulus is giving the animal information to process in its brain. Then explain that *output* refers to the response, because the response is a way in which the animal is acting based on how its brain interprets the information.

Have students turn to a partner and discuss how sensory information influences animal behaviors. (*Students should show understanding that sensory information can allow the animal to use information to make decisions in its environment, such as whether to eat something, whether to run and hide, or whether to attack another animal.*)

Online Resources



Option 3: Show a video of shark senses. (See the Online Resources for a link to a suggested video: www.coreknowledge.org/cksci-online-resources.) Ask about the shark's senses:

- » What senses does the shark use? (*sight, sound, touch, smell*)
- » How do the senses influence the shark's behavior? (*They tell the shark where to hunt for food and what to eat.*)

Use additional guiding questions to help students link details in this analysis back to the reading selection.

- » Did you read about any of these examples in the chapter? (*The animals in the chapter used sight, sound, and touch to hunt for food and stay safe from predators.*)
- » What are some other examples of ways that animals sense their environments? (*Some animals can smell danger, such as sensing fire or nearby predators.*)

Challenge students to brainstorm ways they could use their knowledge of animal senses to learn more about animal behaviors, such as observing them at a zoo or park.

4. Check for understanding.

5 MIN

Activity Page



AP 12.1 and
Answer Key

Formative Assessment Opportunity

See the Activity Page 12.1 Answer Key for correct answers and sample student responses.

Collect the completed What Senses Do Animals Have? (AP 12.1). Scan students' tables, looking for accuracy and completeness.

Choose one or two examples that students struggled with to discuss with the class. Use the discussion to reinforce the main ideas (how each sense helps an animal to survive in its environment) and correct misconceptions (such as the idea that all animals' sense organs are used only for one thing; for example, an elephant not only hears with its ears, but it also cools down with them).

LESSON 13

Plant Responses

Big Question: How do plants sense and respond to their environments?

AT A GLANCE

Learning Objective

- ✓ Discuss examples of stimulus and response in a plant.

Lesson Activities

- reading and discussion
- vocabulary instruction
- concept mapping

NGSS References

Disciplinary Core Idea LS1.D: Information Processing

Crosscutting Concept: Systems and System Models

Science and Engineering Practices: Developing and Using Models

Systems and System Models are important to the topic of how plants sense and respond to their environments, as students learn about the components that contribute to a plant's ability to pick up stimuli and behave in certain ways in response. In this lesson, students read Chapter 7 and learn about a phenomenon known as tropism, as well as the ways in which plants can respond to stimuli in their environments.

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

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in blue below. During instruction, expose students repeatedly to this term, which is not intended for use in isolated drill or memorization.

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 166–167 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

behavior

response

stimulus

tropism

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary term designated in blue on the previous page.

Instructional Resources

Student Reader



Ch. 7

Activity Page



AP 13.1

Student Reader, Chapter 7
“Plant Responses”

Activity Page

Plant Response Concept Map
(AP 13.1)

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

Materials and Equipment

Collect or prepare the following items:

- index cards for student vocabulary deck (1 per student)
- internet access and the means to project images/video for whole-class viewing

THE CORE LESSON 45 MIN

1. Focus student attention on the Big Question.

5 MIN

How do plants sense and respond to their environments? In the previous lesson, students learned how animals sense and respond to their environments. Remind students of the cause-and-effect nature of stimulus and response, and tell them that plants are other types of organisms that can sense and respond to their environments.

- Ask students to recall their learning from the previous lesson about animal senses. Prompt volunteers to share what kinds of senses animals use to survive in their environments. Ask them to describe how animals respond to the stimuli that they sense. (*Animals change their behaviors based on certain stimuli or store information about stimuli as memories.*)
- Explain that in this lesson, students will be looking at the ways in which plants respond to stimuli in their environments. They will learn about what kinds of stimuli can influence the behavior of plants. (See **Know the Science.**)

Know the Science

How do plants respond to their environments? Often through phenomena known as tropisms!

When plants have movement responses to their environments, this is known as tropism. Students will read about tropism in “Plant Responses,” Chapter 7 in the Student Reader. There are many different types of tropisms, but students will be introduced to the term generally. For example, phototropism refers to a plant’s behavioral response to light, whereas geotropism refers to plant growth in response to gravity. Students will not need to know the individual types of tropisms but, rather, will learn about the different stimuli—such as light and gravity—that affect how plants grow.

- Make a class list of questions students can ask themselves, such as “How can I tell whether a plant responds to a stimulus in its environment?” and “Why is it important to study the reasons plants respond to stimuli?” Encourage students to think about these questions as they work through the lesson.

2. Read and discuss: “Plant Responses.”

20 MIN

Student Reader



Ch. 7

Activity Page



AP 13.1

Read together, or have students read independently, “Plant Responses,” Chapter 7 in the Student Reader. This chapter emphasizes the ways in which plants sense the things in their environments and respond through specific behaviors that can be seen in how plants grow.

Distribute Plant Response Concept Map (AP 13.1). Go over the directions with students. Tell students that they will fill out the diagram on the Activity Page as they read pages 33–36 of the Student Reader.

SUPPORT—If necessary, tell students that the concept map allows them to capture information about the things that plants respond to (stimuli). The center container represents the main idea of plant responses, and the outer containers each represent a type of stimulus. Students will need to do two things in the outer containers: write the type of stimulus (such as light, gravity, temperature, and touch) and describe how that stimulus influences plant growth behaviors (tropism). Remind students to only put one type of stimulus in each of the outer containers.

Preview Core Vocabulary Term

Before students read, write **tropism** on the board or chart paper. Have students prepare a card for the term, and encourage them to watch for the definition as they read.

Ask students to recall the term *behavior*. Explain that *behavior* is not a science-specific word. It is a word that is used in all areas and in our everyday conversations. However, it is a word that frequently comes up in science when discussing organisms. Prompt students to consider these guiding questions one at a time:

- » What do you think *behavior* means when talking about plants? (*how they respond to the conditions around them*)
- » What kinds of behaviors do you think plants engage in? (*growing toward the light, roots growing toward water*)
- » What do you think influences plant behaviors? (*water, sunlight*)
- » Why do you think scientists study plant behaviors? (*to see how they grow and learn how to make them better*)

Guided Reading Supports

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

Word Work

Page 33

Focus on developing student understanding of the term **tropism**. (n. a plant's growth or movement in response to a stimulus) Invite students to use the word *tropism* in a spoken sentence. For example, *Sunflowers growing toward the sun is an example of a tropism.*

CHALLENGE—Have students research the difference between positive and negative tropisms and tell what they learn. (*A positive tropism is when a plant grows toward the stimulus, and a negative tropism is when a plant grows away from the stimulus.*)

Prompt students to fill out their Activity Page concept maps. Let students know that they can use any of the outer containers; there is no particular order in which they need to put the information into the diagram.

SUPPORT—If necessary, circulate around the room, and make sure that students understand what they should be putting into the supporting container of the concept map. Correct any misunderstandings, such as if students write about tropism in the container rather than writing about light and how plants respond to light (*by growing toward or away from the light*).

Page 34

After reading page 34, have students take out their Activity Pages and work on their concept maps. Emphasize that this page focuses on how plants respond to gravity.

Draw student attention to the section of the page that discusses how plants grow toward or away from the pull of gravity. Clarify that a plant's roots grow down toward the pull of gravity, even if the roots start out growing in a different direction (such as sideways). Tell students that the shoots of a plant grow up, away from the pull of gravity. In this way, two different parts of the plant are growing in two different directions.

Online Resources



SUPPORT—If time permits, show students a video of a pea shoot growing. (See the Online Resources for a link to a suggested video: www.coreknowledge.org/cksci-online-resources.) Emphasize how the roots grow downward while the shoot grows up and out of the pebbles.

CHALLENGE—Have students research how plants grow in space using the guiding question “How do plants know which direction to grow in when there is no gravity, such as in a space station?” Invite students to share what they find out.

Page 35

Use examples of plants responding to temperature that are common in your geographic area. For example, if you are in the desert, focus on hot temperatures, and discuss what happens to plants when temperatures get to be too hot. (*Plants start to droop and dry out.*) If you are in a colder region, discuss how freezing temperatures can freeze plants.

Based on their reading, have students add more information to their concept maps on the Activity Page.

After reading the page, prompt students to fill out their Activity Page concept maps based on plants responding to touch. Ask: How can growing around rocks in soil help a plant survive? *(It doesn't let the rocks limit its growth, so it can grow where it needs to.)* What is the benefit of a vining plant wrapping around and climbing up objects? *(The plant can continue to grow, and its growth potential will be less limited.)*

3. Demonstrate examples and guide discussion.

15 MIN

Online Resources



Choose one of the following or a similar example to stimulate further discussion. (If time permits, use all three.)

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

www.coreknowledge.org/cksci-online-resources

Option 1: Show a video of plant responses to temperature. Ask the following:

- » What did the scientists do in the video to see how temperatures influence plant behaviors? *(The scientists planted seeds in different areas and tracked how they grew.)*
- » What kinds of plant behaviors were the scientists interested in studying? *(how the plants grew, how they flowered, whether they would survive in new climates)*

Option 2: Show a video of plant responses to touch. Read the onscreen text to students. Ask the following:

- » What kind of stimulus is this plant responding to? *(touch)*
- » How did the plant react to the sense that it was being harmed? *(It sent an alert throughout the plant.)*
- » What does this video tell us about plants? *(Different parts of plants can communicate with each other.)*

Option 3: Review with students that there were four stimuli discussed in the Student Reader Chapter 7: light, gravity, temperature, and touch. Tell students that smell was a stimulus that was not discussed. Ask whether students think plants are able to smell and whether scents can influence their behavior. Smelling involves the recognition of a chemical in the environment. Show a video of a vining plant choosing which plant to attach to. Ask the following:

- » Which plant did the vine choose to attach to? *(tomato)*
- » Why did the vine choose this plant? *(It is easier to attach to.)*
- » How did the vine know to choose this plant? *(It smelled the tomato scent.)*
- » What is smell? *(recognizing the presence of some chemical in the environment)*

Use additional guiding questions to help students link details in this discussion back to the reading selection.

- » Did you read about any of these examples in the Student Reader? *(Yes, plants respond to temperature and touch.)*
- » What are some other examples of ways that plants sense and respond to their environments? *(growing toward light and reacting to smells)*

Establish a Scientific Mindset

Encourage students to think about where they see evidence of plant behaviors in everyday life. Ask guiding questions such as “Do you have any indoor plants that grow in the direction of the nearest window? Do you see any plants outside that lean to one side to grow toward the sun? Have you ever seen plant roots that grow up instead of down?” Discuss how these observations are evidence of plants responding to stimuli in their environments.

4. Check for understanding.

5 MIN

Activity Page



AP 13.1 and
Answer Key

Formative Assessment Opportunity

See the Activity Page 13.1 Answer Key for correct answers and sample student responses.

- Collect the completed Plant Response Concept Map (AP 13.1). Scan students' diagrams, looking for accuracy, understanding, and completeness. Students should identify the four stimuli discussed in the Student Reader (light, gravity, temperature, and touch) and put information into the four outer containers on the concept map.
- Choose one or two examples that students struggled with to discuss with the class. Use the discussion to reinforce the main ideas and correct misconceptions.

LESSON 14

Stimulus and Response for Survival

Big Question: How do a(n) _____'s senses help it to survive?

AT A GLANCE

Learning Objectives

- ✓ Use a model to describe how an organism's senses help it survive, grow, reproduce, and behave.
- ✓ Diagram and explain some phenomena of stimulus and response in animals and plants.

Lesson Activities

- modeling activity

NGSS References

Disciplinary Core Idea LS1.D: Information Processing

Crosscutting Concept: Systems and System Models

Science and Engineering Practices: Developing and Using Models

Developing and Using Models is important to this lesson because students will be making diagrams that represent how sense receptors are able to detect different types of information from the environment, and how that information gets sent to, processed by, and interpreted by the brain to influence an organism's actions and memories. Students will describe the relationships between the components in the model to meet the Performance Expectation for this unit.

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

www.coreknowledge.org/cksci-online-resources

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 and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. No new Core Vocabulary terms are introduced during this lesson.

input

output

Instructional Resources

Activity Page



AP 14.1

Activity Page

Stimulus and Response
Diagram (AP 14.1)

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

Materials and Equipment

Collect or prepare the following items:

- resource catalogue and/or reference materials
- internet access and the means to project images/video for whole-class viewing

Prepare for students to conduct print and web research using computers or the library. If your classroom does not have enough computers for students to use, schedule time at the school computer lab or library for this class, or make a variety of materials and sources available to students to use in the classroom. In this lesson, students will be doing brief research on organism stimulus and response processes. Prepare web research resources in advance to share with students so they can learn more about the sensory functions they will be focusing on.

THE CORE LESSON 45 MIN

1. Focus student attention on the Big Question.

5 MIN

How do a(n) _____'s senses help it to survive? Remind students that they learned about the sensory and response processes for animals and plants in the last two class sessions.

Write the Big Question on the board or chart paper.

- Circle the word *senses*, and ask students to recall the types of senses an animal or plant can have. (*sight, hearing, touch, taste, smell*)
- Write the word *hearing*, and ask students to consider how hearing might relate to survival. Remind students that survival is based on a variety of factors, including the ability to eat, find shelter, grow, and reproduce.

Focus student attention on the blank line in the Big Question. Tell students that the line is blank because they will get to select the organism they wish to focus on for this lesson's activity.

2. Preview the investigation.

5 MIN

Activity Page



AP 14.1

Distribute Stimulus and Response Diagram (AP 14.1). Review the Activity Page with students. Tell them that they will investigate how a particular organism responds to stimuli. They will investigate this by doing the following:

- watching videos about different organisms
- picking the organism they wish to focus on to conduct further research
- making a model of how that organism processes information based on stimulus and response
- answering questions to make connections

Tell students that you will play the videos for the whole class and then provide students with sources where they can find additional information on the organisms they chose. Let students know that they will be working on this activity independently.

3. Facilitate the investigation.

10 MIN

Online Resources



Show students several videos of organisms responding to stimuli in their environments. (See the Online Resources Guide for links to suggested videos: www.coreknowledge.org/cksci-online-resources.) As students watch the videos, encourage them to take note of the following:

- name of the organism
- the organism's primary sense (touch, taste, hearing, smell, or sight)
- structures of the body that support that sense

Tell students to choose the organism they wish to focus on for the remainder of the activity and write down the organism's name on their Activity Page. Students can fill out as much information as possible on their Activity Pages as they watch the videos.

4. Support the investigation.

20 MIN

Online Resources



Once students have watched the videos and selected their organisms, have them conduct independent research on their organism. Share web resources with students so that they can look at those sources online using the classroom or library computer. Use the following link to download the CKSci Online Resources Guide for this unit, where a specific link to the resources may be found: www.coreknowledge.org/cksci-online-resources

You can also provide hard copies of sources, such as encyclopedias, to students if computer availability is limited.

As students work on their research and Activity Pages, circulate around the room, and provide support. Tell students that their research on the organism can be brief. Remind students to use their Activity Page questions to guide their research. Emphasize that the focus of the research should be on gathering enough information so that students can properly describe how that animal responds to stimuli in its environment and how those senses and responses enable the animal to survive.

SUPPORT—If necessary, help students figure out how to set up their diagrams. Remind students that they first saw an example of diagrams for stimulus and response in Lesson 11. Without giving students the answers, have them describe the relationship between stimulus and response, and then ask them how to portray this as a model. (*Students should be able to understand that the stimulus occurs first, followed by the response, and that an arrow goes in between, pointing from the stimulus to the response.*) Remind students that stimulus and response is a type of cause-and-effect relationship.

SUPPORT—It may be necessary to remind students of what *input* and *output* mean. Students learned about inputs and outputs in Lesson 12. Use question prompts to help students recall the information. Ask: Does input relate to the stimulus or the response? (*stimulus*) Does output relate to the stimulus or the response? (*response*)

SUPPORT—Remind students that there are several factors that go into an animal's ability to survive in its environment, including finding food, hiding from prey, growing, and reproducing. Encourage students to think about these things as they answer the question about survival.

Let students know that they can take home their Activity Pages to complete them as a homework assignment. Tell students to bring the Activity Pages back the next day to earn credit for their work.

5. Check for understanding.

5 MIN

Activity Page



AP 14.1 and
Answer Key

Summative Assessment Opportunity

See the Activity Page 14.1 Answer Key for correct answers and sample student responses.

- Collect Stimulus and Response Diagram (AP 14.1), and review students' answers. Make sure that students understand the relationship between a stimulus and a response. Students should be able to explain that information in the environment results in specific animal behaviors and that different types of sensory information are relayed to the brains of animals through different types of sensory receptors or structures that allow the brain to perceive the information, store the information as memories, and influence the animal's behavior.
- Review the diagrams that students completed on the Activity Page, and check for proper understanding of the cause-and-effect relationship of stimulus and response.

UNIT REVIEW

Helen Keller and Louis Braille

Big Question: What have I learned about structures and functions?

AT A GLANCE

Learning Objective

- ✓ Discuss functions in organisms and the structures that support those functions.

Lesson Activities

- unit review
- reading and discussion
- vocabulary instruction

NGSS References

This unit addresses the following Grade 4 Performance Expectations for the NGSS topic Structure and Function:

- Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. **(PE 4-LS1-1)**
- Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. **(PE 4-PS4-2)**
- Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. **(PE 4-LS1-2)**

The Unit Review is intended to support students as they summarize their learning about these PEs and prepare for the Unit Assessment. For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

The Big Idea

Living things are made up of working parts. All organisms are composed of specialized structures that carry out various life processes and support the organism's survival. Biological organization describes the hierarchy of structures: cells form tissues; tissues form organs; organs function together in systems.

Among body systems in animals are those that support visual and auditory functions. Sensory functions are not limited to animals, however, as plants also have structures that enable them to detect and respond to their environments.

Structures and their functions enable organisms to behave in ways that improve their survival.

Core Vocabulary

Language of Instruction: During instruction, remind students of their prior exposure to the following terms.

auditory system
behavior
cell
function
growth

nerve
organ
organ system
reproduce

response
sense
stimulus
structure

survive/survival
tissue
tropism
visual system

Core Vocabulary Deck: Students should refer to their full set of Core Vocabulary cards during the review discussion.

Instructional Resources

Student Reader



Ch. 8

Student Reader, Chapter 8
"Helen Keller and Louis Braille"

Activity Pages

Reading Braille (AP UR.1)

Vocabulary Crossword Puzzle
(AP UR.2)

Vocabulary Review (AP UR.3)

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

Activity Pages



AP UR.1
AP UR.2
AP UR.3

Materials and Equipment

Collect or prepare the following items:

- packs of small beads
- glue
- internet access and the means to project images/video for whole-class viewing

Look ahead to Step 3, and decide whether you want to have students participate in the Reading Braille activity. If so, you might want to have students work on gluing their beads first, then show one of the videos to allow time for the glue to dry, and then have students finish the activity by reading the messages at the end.

1. Focus student attention on the Big Question.

5 MIN

What have I learned about structures and functions? During this lesson, students will read a new chapter, but the purpose of the reading is to provide context for a review discussion during which they can apply what they have learned in the unit.

- Review with students what they have learned about throughout this unit:
 - cells, tissues, organs, and organ systems
 - functions of living things (animals and plants)
 - hearing and vision in humans
 - animal and plant senses
 - stimulus and response in living things
 - tropisms

Like all organisms, human beings are composed of structures that function to support survival. Unlike other organisms, humans have developed the ability to design ways to compensate for individual structural and functional limitations. Ask students what they think it would be like to navigate their environment without one of their senses. Use the following question as a guide:

- » What do you think it would be like to not be able to see/hear/smell/taste/touch? (*Accept all responses.*)
- » Would you need to rely on other senses in order to get around? (*yes*)

NOTE—Be sensitive when discussing sensory loss, as some students, their family members, or their friends may have visual or auditory impairments.

Tell students that today they will read a biography about Helen Keller, a woman who was unable to hear or see. Explain that Keller is an example of a person who had to find ways to communicate with, and understand, the world around her. Students will learn how she accomplished this. They will also read about Louis Braille, who invented a reading system for people who are visually impaired.

2. Read and discuss: “Helen Keller and Louis Braille.”

20 MIN

Student Reader



Ch. 8

Prepare to read together, or have students read independently, “Helen Keller and Louis Braille,” Chapter 8 in the Student Reader. This chapter introduces Helen Keller and describes how she was able to navigate her world without the ability to hear or see. It also discusses Louis Braille, who invented a reading system for people who are visually impaired.

Ask students to recall the term *behavior*. Explain to students that living things such as humans often have to change their behaviors to better monitor the world around them. As students read the article, have them think about the following questions:

- » How did Helen Keller need to adapt her behavior to communicate? (*She learned to read using her fingers. She learned to use sign language to communicate, and she touched the hands of others who spoke to her in sign language.*)
- » How has braille influenced the behavior of those who cannot see? (*It provides a way to read and write.*)

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Ask the following questions, and use the following prompts:

Page 37

Focus on developing student understanding of the terms *deafness* and *blindness*. Explain that some people are born deaf or blind. Deafness and blindness are also things that can occur suddenly or over time due to things such as illnesses, injuries, or age.

SUPPORT—If necessary, explain that there is a difference between total deafness and blindness and not being able to see or hear perfectly. Tell students that many people cannot see or hear perfectly. This is why so many people wear eyeglasses or hearing aids. Eyeglasses and hearing aids are devices that are designed to help people see or hear better. Ask students if they think eyeglasses and hearing aids would be able to help people with total deafness or blindness. (*no*)

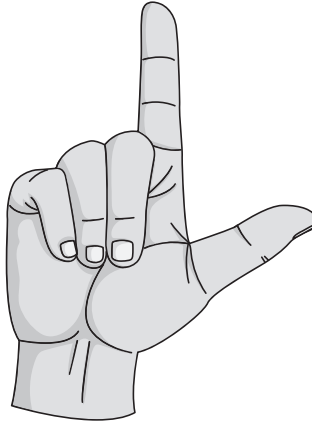
CHALLENGE—Have students research whether it is possible to lack other senses, such as the sense of smell, taste, or touch. Have them report on factors that cause senses such as smell, taste, or touch to be lost. (*Example: Injuries can cause neuropathy or paralysis, which creates numbness and makes it difficult or impossible to feel things through the sense of touch.*)

Page 38

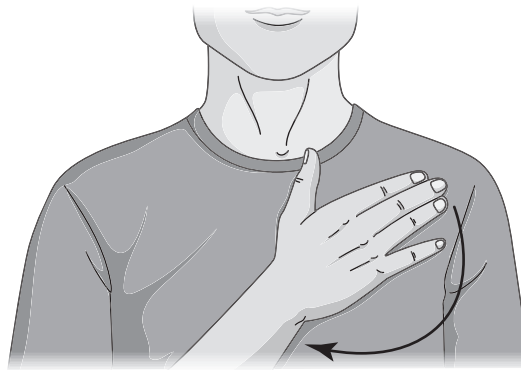
After reading the page, ask students what Helen Keller relied on to “see” and read. (*fingertips*)

SUPPORT—If necessary, discuss what sign language is. Explain that sign language uses the fingers and hands to make signs that represent words or letters. Tell students that there are many different languages of sign language. For example, American Sign Language is different from sign language used in other areas of the world, such as Asia. If possible, demonstrate some sign language for students using the diagrams on the next page.

Tell students that this is the symbol for the letter *L*.



Tell students that this is the symbol for the word *please*.



Explain that sign language includes both symbols that represent letters and symbols that represent words. Using the symbols that represent words makes it easier and quicker than spelling out an entire word.

SUPPORT—If necessary, help students better understand adaptive devices. Ask them to come up with other examples of these devices, such as crutches or even prosthetic limbs. Explain that adaptive devices have been around for centuries but that they have become more and more sophisticated with time and technology.

CHALLENGE—If time permits, have students do research and put together a timeline of adaptive devices that were invented and used over history. For example, their timeline might start with a basic cane and end with modern prostheses.

Page 39

After reading the page, have students think about how Louis Braille invented a new reading system. Ask: What inspired Louis Braille to make a reading system made from raised dots? (*military code*)

SUPPORT—If necessary, help students understand how braille works. Explain that braille involves raised dots on a flat surface, such as a piece of paper. People who learn braille understand the meaning of the different shapes that the dots make. For instance, in braille the letter *A* is one shape while the letter *B* is a different shape. It is necessary to understand the different shapes that the dots make to know the letters in the alphabet.

Explain to students that there are many places where braille is used besides just in books. For example, braille is often seen at banks so that people can make financial transactions. It is also used on telephone keypads, bathroom signs, and elevators in buildings. Tell students that society helps use adaptive systems such as braille to make it possible for people with vision loss to navigate the world around them.

Ask: What is the difference between braille and sign language? (*Students should recognize that braille is a touch-based reading system designed to help people with blindness, whereas sign language is a visual-based system designed to help people with deafness.*)

CHALLENGE—Have students research adaptive devices and practices other than sign language that exist for people who are deaf. Examples may include closed-captioned television shows and movies, closed-captioned telephones, fire alarms that blink lights in addition to making noise, and so on.

3. Demonstrate examples and guide discussion.

15 MIN

Online Resources



Choose one of the following or a similar example to stimulate further discussion. (If time permits, use all four.)

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

www.coreknowledge.org/cksci-online-resources

SUPPORT—If you choose to use Option 4, consider doing this activity first and allowing time for the glue to dry while watching one of the videos.

Option 1: Show a video about modern prosthetics. Ask students why the devices shown in the video are examples of adaptive devices.

- » Why are these hands and arms considered adaptive devices? (*They allow people with missing fingers, hands, or arms to be able to pick things up, hold things, etc.*)
- » What is life like for these people without the adaptive devices? (*Without the adaptive devices, these people are limited in what they can do physically.*)

Option 2: Show a video of Koko the gorilla using sign language to communicate. Ask about how sign language is being used as an adaptive solution:

- » What is sign language allowing Koko the gorilla do? (*talk to humans*)

Option 3: Show a video about Helen Keller. Ask students the following:

- » Did being deaf and blind stop Helen Keller from living a full life? (*no*)
- » How was Helen Keller able to live a full life? (*by finding ways to adapt to her disabilities*)
- » How did Helen Keller's disabilities influence her behavior? (*She had to rely on other senses to communicate.*)

Activity Page



AP UR.1

Option 4: Distribute Reading Braille (AP UR.1). Tell students that they will work with a partner to practice writing and reading braille with one another. Students will take turns writing a message in braille using the beads and glue and reading that message. Review the Activity Page with students, and go over the directions. The purpose of this activity is to expose students to what it feels like to use their fingers to communicate.

Pass out beads and glue to each pair of students. Encourage students to keep their messages short.

SUPPORT—The glue will not be dry in time for students to read the messages using their fingers. Remind students to feel the beads gently so that they do not disturb the order of the beads.

Circulate around the room as students work on this activity. Remind students to use the alphabet guide when writing and reading the messages. Students do not have to close their eyes when reading the message but should focus on the sensation of using their fingers to communicate.

4. Preview take-home activities.

5 MIN

Activity Pages



AP UR.2

AP UR.3

For additional vocabulary reinforcement prior to administering the Unit Assessment, distribute Vocabulary Crossword Puzzle (AP UR.2) and Vocabulary Review (AP UR.3) as take-home assignments.

Teacher Resources

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Name _____

Date _____

Activity Page 1.1

Use with Lesson 1.

Structure of a Celery Stalk

Look closely at your celery bunch. Then, in the box below, draw the bunch. Label the stem, the leaves, and the roots. Then label the stalks and the petioles.



In the box below, draw a cross section of the petiole, including everything you see. You may use a hand lens or microscope if either is available.



Name _____

Date _____

Activity Page 1.2 (Page 1 of 2)

Use with Lesson 1.

Celery Investigation (Day 1)

Setup

Plants require water, so water moves through plant structures. The path of water movement is from the roots up through the stem, and finally up to the leaves.

STEP 1: Fill each cup with water until about half full.

STEP 2: Add 10 drops of each of the food colorings to one cup each, with only one color in each cup.

STEP 3: Place the bottom end of one stalk in each of the cups.

STEP 4: Record observations.

STEP 5: Return to the experiment the following day, and record observations once again.

Draw a picture of your investigation setup. Label each part.



Celery Investigation (Day 2)

Follow-Up

During the previous day's lesson, you should have observed the colored water moving through the celery stalks. Returning to the experiment, record your new observations of the celery stalks.

STEP 6: Summarize your observations. Describe your observations of the celery stalks after a day. Be sure to compare what you observe with what you noted on the previous day.

Answer the questions below.

What evidence does your investigation show about the function of structures in plants?

How could you support an argument that structures enable water to move through the celery stalks?

What evidence could you use to support an explanation that water moves up the stalk and is lost through the leaves?

Name _____

Date _____

Activity Page 2.1

Use with Lesson 2.

Cells and Tissues Model

How are the bricks of a building similar to cells?

How are the structures you made from plastic blocks similar to tissues?

How would you use plastic blocks to model a tissue made of different types of cells?

How are cells and tissues related to living things? Support your answer with evidence from the Student Reader.

Name _____

Date _____

Activity Page 2.2

Use with Lesson 2.

Lesson 2 Check

Consider cells and tissues. Then answer the questions that follow.

Based on the class discussion, answer the following questions.

What evidence supports the following statement: “a brick is to a building as a cell is to the body”?

If a brick structure in a building is like a type of tissue, what other part of a building could be another type of tissue?

Describe an example of how specific cells work together in your body.

In the box below, draw what you think the celery stalk you examined in Lesson 1 might look like under a microscope.



Name _____

Date _____

Activity Page 3.1 (Page 1 of 2)

Use with Lesson 3.

Make a Lung Model

Answer the questions in the lines below.

1. How do the model lungs inhale and exhale? Use evidence from your model to support your answer.

2. Why does the body need lungs to survive?

3. Explain, using evidence, what the straw and bottle of your model represent.

4. Explain, using evidence, what the two balloons of your model represent.

- 5.** How does your model demonstrate organ systems working together?

- 6.** Drawing on what you've learned so far in this unit, explain how each of the following organ systems works. Name at least one organ in each.

Nervous system: _____

Circulatory system: _____

Digestive system: _____

Skeletal system: _____

Muscular system: _____

Name _____

Date _____

Activity Page 3.2 (Page 1 of 2)

Use with Lesson 3.

Lesson 3 Check

Recall what you learned about organs and organ systems. Then answer the questions that follow.

What are organs?

1. Make a list of three organs found in *both* a dog and cat.

2. Explain why the body needs lungs to survive.

What is an organ system?

3. Make a list of three organ systems found in *both* a dog and cat.

4. Describe the function of the muscular system.

How do organs and organ systems work together?

5. What are two organ systems involved in breathing?

6. What are two organ systems involved in movement?

Name _____

Date _____

Activity Page 4.1 (Page 1 of 2)

Use with Lesson 4.

Organism Research and Concept Map

Day 1:

1. What animal or plant did you choose for your library research?

2. What does your animal or plant need to live and grow? Try to include as many different things as possible.

3. What types of functions must be carried out in order for your animal or plant to live and grow?

4. Describe an organ and an organ system within the plant or animal you chose. Tell how it helps the animal to survive.

Day 2:

5. List the basic functions that all living organisms need to live and grow.

6. Write each of your organism's functions on a yellow sticky note. Place the sticky note on the piece of colored paper with the word that is closest to the one you wrote.

Classify each item on your list as one of the six basic functions that all living organisms need to live and grow. Write your notes below.

Write each item on your list on a sticky note. Use a sticky note of the same color as the piece of paper with the same function as you classified your item. Then place your sticky note on the pin board or whiteboard. Use the string to connect any concepts or functions that you think are related.

Name _____

Date _____

Activity Page 4.2

Use with Lesson 4.

Lesson 4 Check

Consider the structures that animals or plants need to live and grow. Then answer each question that follows.

1. Name a structure, such as an organ, found only in plants.

2. What organ system is this structure a part of?

3. What function does this structure perform? How does it help its organ system?

4. Name a structure found only in animals.

5. What organ system is this structure a part of?

6. What function does this structure perform? How does it help its organ system?

Name _____

Date _____

Activity Page 5.1

Use with Lesson 5.

Functions in Animals (Day 1)

All animals have structures that function to help them survive. Think of your favorite animal. What structures does it have that help it survive? After you have come up with an animal, answer the questions that follow.

Name your favorite animal:

Make a list of the structures the animal has that help it to survive. Write the structures on the lines below. Explain what each structure does. The structure can be a tissue, an organ, or an organ system.

Name _____

Date _____

Activity Page 5.2

Use with Lesson 5.

Classifying Structures (Day 2)

Part 1:

1. What are the basic levels of biological organization?

2. What animals did you use for relating structure to functions?

3. Make a list of the structures you identified for each of your animals. You can list any structure of the animals. Try to include as many different structures from the images of your animals as possible. Write the function of the structure in the column next to the structure.

Animal Name _____

Structure	Function

Animal Name _____

Structure	Function

Part 2:

- Write each structure from your list on the correct color sticky note.
- Use a sticky note of the same color as the function that you classified for the structure.
- Place your sticky note on the board next to the animal's image.

Name _____

Date _____

Activity Page 5.3

Use with Lesson 5.

Lesson 5 Check

Consider the main functions of animal structures. Then answer the questions that follow.

1. Choose any example of an animal structure. Cite evidence to show how this structure supports either survival, growth, behavior, and/or reproduction.

2. You're on an Arctic expedition. Your guide points out an arctic hare in the distance. It's difficult for you to see the hare. It has all white fur. But in the summer, the hare is darker and more like the color of a tree's bark. Does the hare's color support survival, growth, behavior, or reproduction? Cite evidence to support your answer.

3. The males in some bird species are very colorful. They sometimes spread their wings and dance to show off their colors. What can you conclude about the color of the male bird's feathers and why it dances?

4. A baby duck hatches from an egg. As soon as it hatches, it will follow the first moving object that it sees, most often its mother. What is the function of this behavior? Cite evidence to support your answer.

Name _____

Date _____

Activity Page 6.1

Use with Lesson 6.

Functions of Plant Structures

1. Based on the class discussion, make a list of three basic structures of all plants.

2. Draw a line to connect the plant structure to its function. You may connect each item more than once.

Roots ☐

☐ Absorb light

☐ Make food

Stems ☐

☐ Carry water to plant parts

☐ Reproduction

☐ Exchange gases

Leaves ☐

☐ Attract insects

☐ Absorb water

☐ Support plant above ground

Flowers ☐

☐ Absorb nutrients

3. Which of the above structures are made up of cells?

4. Explain what biological organization is.

Name _____

Date _____

Activity Page 6.2

Use with Lesson 6.

Lesson 6 Check

Consider how plant structures relate to their functions. Then answer the questions that follow.

1. What structure does a plant use to absorb energy from sunlight to make food?

2. What structure does a plant use to absorb water?

3. Name two structures that a plant uses to reproduce.

4. You're a farmer breeding plants that can survive in dry conditions. Explain why you might need to study how roots grow.

5. Describe an example of a plant responding to its environment.

Name _____

Date _____

Activity Page 7.1

Use with Lesson 7.

Research and Writing Discussion

Before you begin your research to learn more about a specific plant or animal structure and its functions, answer the following questions. These questions will help guide your research.

1. What plant or animal will you research?

2. What is the purpose of your research?

3. What will you do with the information you find?

4. What will be your primary source of information?

5. What websites will you use to research your plant or animal structure?

6. How do you know whether these websites are trustworthy?

7. Where will you find books or magazines for your research?

8. What books or magazines will you use?

Name _____

Date _____

Activity Page 7.2 (Page 1 of 2)

Use with Lesson 7.

Research and Writing Outline

Over the next two days, you will conduct research on a plant or animal and a specific structure and function. You will gather evidence that supports an explanation of how the structure and function are interrelated in supporting growth, survival, and/or reproduction and how they are part of a system.

Day 1

Answer these questions.

1. How helpful were the sources you used in answering the Big Question? Explain your answer.

2. What is the plant or animal you are researching?

3. Describe the specific structure and function you are researching.

4. What sources are you using for your research?

5. What two pieces of evidence show that the structure and function are interrelated in supporting growth, survival, and/or reproduction?

6. What evidence shows that the structure and function are part of a system?

Day 2

Use the five-paragraph outline below to organize your report. Write what you will cover in each paragraph on the lines.

Paragraph 1 (Introduction):

Paragraph 2 (Body):

Paragraph 3 (Body):

Paragraph 4 (Body):

Paragraph 5 (Conclusion):

Report Scoring Guide

Use the following guide as criteria for what your report should contain.

Above Average	It introduces the plant or animal and a specific structure and function.	It identifies and describes solid evidence of the structure and function and their interrelated role in supporting growth, survival, and/or reproduction.	It describes solid evidence of how the structure and its function are part of a system.	The conclusion demonstrates the connection between the structure and its function as part of a system and the system's role in growth, survival, and/or reproduction.
Average	It introduces the plant or animal and a general view of structures and functions.	It identifies and describes some evidence of structure and function and their interrelated role in supporting growth, survival, and/or reproduction.	It describes some evidence of how the structure and its function are part of a system.	The conclusion makes some connection between the structure and its function as part of a system and at least two of the following: the system's role in growth, its role in survival, and its role in reproduction.
Adequate	It introduces the plant or animal but fails to introduce a specific view of a structure and function.	It identifies and describes some evidence of structure and function but not their interrelated role in supporting growth, survival, and/or reproduction.	It makes vague connections between the structure and its function and the system they are a part of.	The conclusion makes only minor connection between the structure and its function as part of a system and the system's role in growth, survival, and/or reproduction.
Inadequate	It does not appropriately introduce a plant or animal and fails to introduce a specific structure and function.	It does not satisfactorily introduce and describe evidence of structure and function and their interrelated role in supporting growth, survival, and/or reproduction.	It makes no connection between the structure and its function and the system they are a part of.	The conclusion fails to make a connection between the structure and its function as part of a system and the system's role in growth, survival, and/or reproduction.

Take-Home Guide

Dear Family Members,

Over the next several days, your child will be researching a plant or animal and a structure specific to that plant or animal that helps it to survive in some way. He or she will examine the role of the structure and the function it performs during the plant's or animal's life cycle; this structure may be tissue (such as muscle), an organ (such as the heart), or an entire organ system (such as the nervous system). He or she will learn how to construct an argument from evidence, in this case writing a report making a case for why the structure and function he or she researched are important to the survival of the plant or animal. He or she will come to understand that all major structures work together to better enable the plant or animal to survive, grow, reproduce, and have offspring.

Below are some suggestions for activities that you may do at home to reinforce what your child is learning about the importance of plant and animal structures and functions.

1. Media Search

Your child will be focusing on a specific structure of a plant or animal. He or she will write a report making a claim about the importance of that structure to the plant's or animal's survival. You may wish to reinforce your child's knowledge of the organism's structures and their functions by working with him or her to find kid-friendly media sources that provide information about specific parts of that organism's structures and how they function. Media sources could include online websites, images, or videos, as well as magazines or journals. You may wish to encourage your child to take notes on the specific parts of the plant's or animal's structures in order for him or her to include a discussion of those structures in the final report, which will include facts gleaned from research and a persuasive argument about why the primary structure researched is important.

2. Words to Use

Below are several of the words that your child has been learning about and using. Try to use these words as they come up in everyday speech with your child.

- *cell*: the smallest unit of life
- *tissue*: a group of similar cells joined together
- *structure*: how the parts of something are organized
- *organ*: a structure in an organism's body that has a certain function and is made up of a group of similar tissues
- *function*: a certain job or purpose
- *organ system*: a group of organs that work together to carry out certain functions
- *nerves*: bundles of cells that send and receive messages between the brain and other body parts
- *survive*: to continue to live
- *survival*: the state of continuing to live

- *growth*: the life process of becoming bigger and stronger
- *behavior*: the voluntary ways in which an animal acts
- *reproduce*: to make new, young individuals of the same type
- *response*: a reaction to a stimulus

3. Vocabulary in a Flash!

Your child has been learning a variety of new vocabulary terms that describe the structures and functions of living organisms. You may wish to reinforce your child's knowledge of the terms by putting together flash cards that ask your child to define a particular structure or function of a plant or animal. Alternatively, you may wish to use the flash cards such that your child identifies the structure or function based on a definition that you read from the card.

4. Real-Life Examples

Your child has been studying the structures and their functions of plants and animals. Plants and animals can be found in most environments, including homes and neighborhoods. You may wish to reinforce your child's comprehension of the structures these organisms contain and the functions those structures carry out. Have your child tell you about the structures of a pet, a plant that is in your house or in your yard, or an animal and/or plant that you come across in your neighborhood. Encourage your child to practice using the correct vocabulary terms when describing the structures and functions of each plant or animal you come across.

Name _____

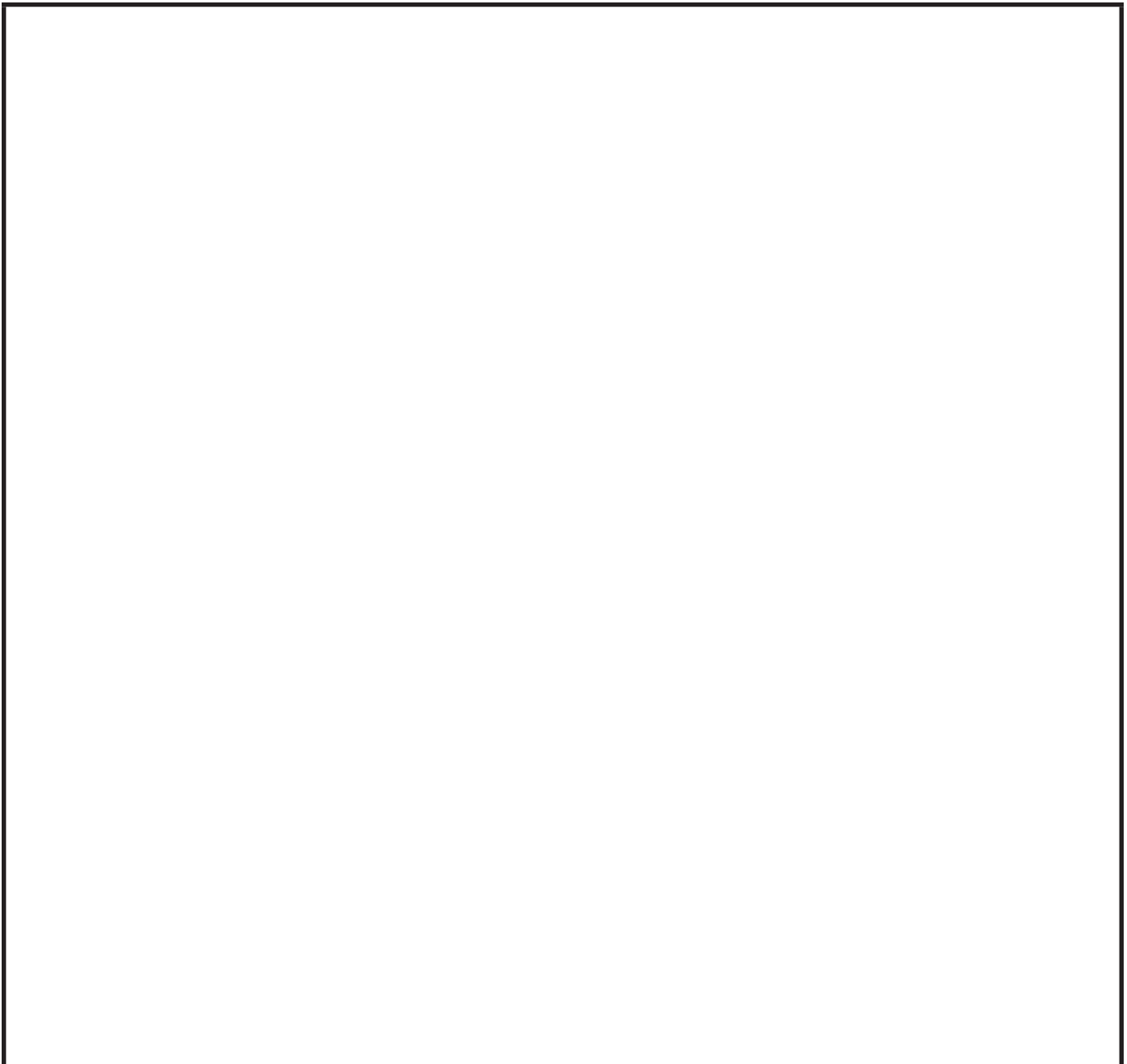
Date _____

Activity Page 8.1

Use with Lesson 8.

The Pupil

1. Draw your eye in the space below, and label the pupil.
2. What is the function of the pupil? _____
3. Why does the pupil change shape? _____
4. What happens if no light gets into the pupil? _____



Name _____

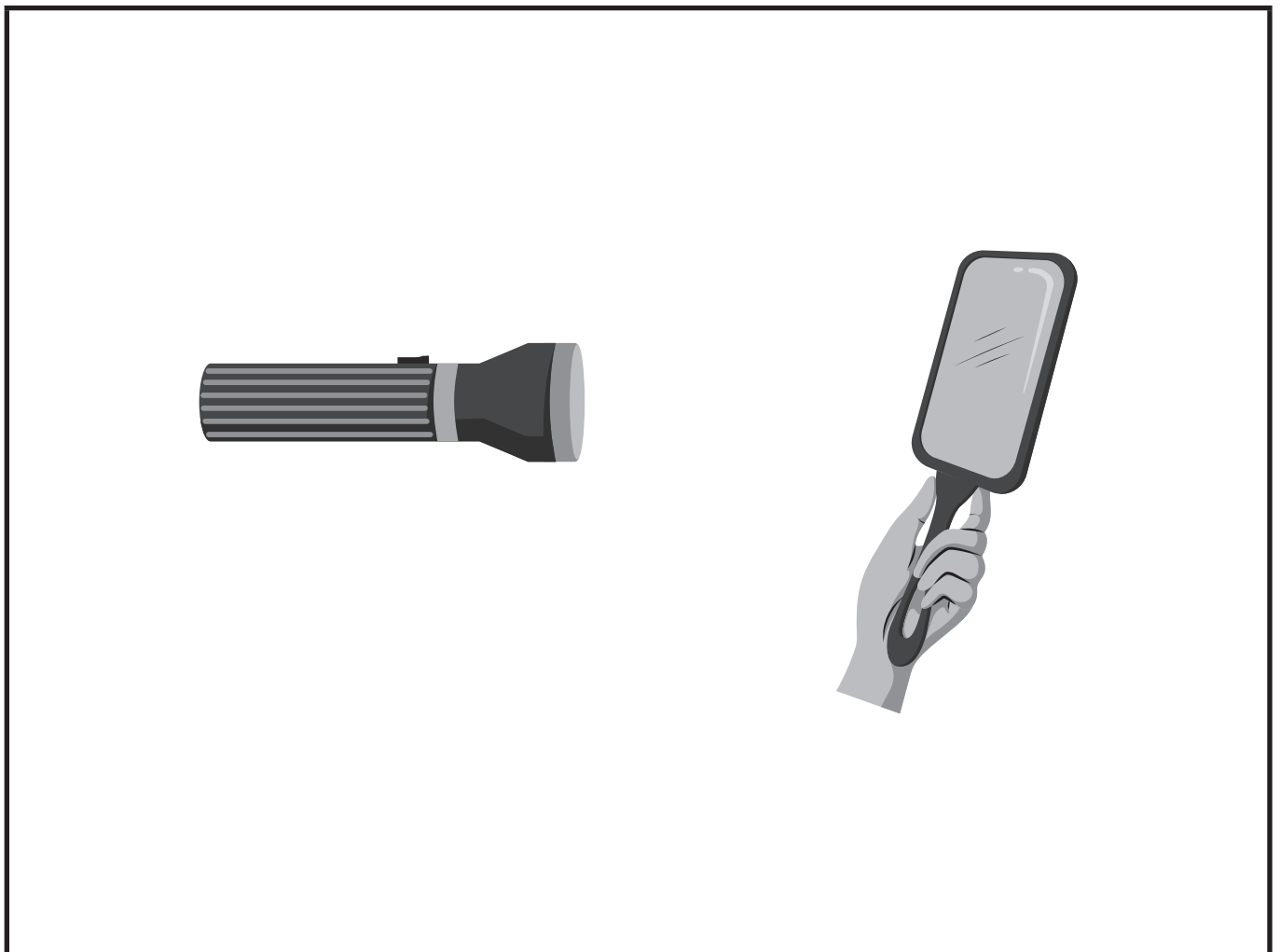
Date _____

Activity Page 8.2

Use with Lesson 8.

Reflection

1. What is reflection? _____
2. Add to the picture below to show how light from the flashlight can reflect from the mirror.
3. Explain what you drew and why.



Name _____

Date _____

Activity Page 9.1

Use with Lesson 9.

Sending Signals

Cut out the boxes below. Put the steps in order to show the path that signals take from the auditory system to the brain. Place the first step at the top. When you have the steps in order, raise your hand so that the teacher can check over your work.

The eardrum and small bones within the ear vibrate.

Electrical signals pass along the auditory nerve to the brain.

Sound waves are produced and travel through the air.

A fluid-filled structure turns the vibrations into electrical signals.

Sound waves enter the outer ear and travel down the ear canal to the eardrum.

Name _____

Date _____

Activity Page 10.1

Use with Lesson 10.

Ruler Drop Investigation

Choose who will be Partner A, the ruler dropper, and who will be Partner B, the ruler catcher. Partner B will hold their thumb and finger open. Partner A will be sure that the end of the ruler that starts with 0 cm is just above the open finger and thumb of Partner B. When the ruler is caught, Partner B should not let go because the measurement (rounded to the nearest centimeter) must be recorded on the table. If they do not catch the ruler at all, leave the trial blank. Complete the data table for each ruler drop.

Type of Drop	Trial 1	Trial 2	Trial 3
Partner A makes a sound and drops the ruler. Partner B has eyes closed.			
Partner A makes no sound before dropping ruler. Partner B has eyes open.			
Partner A makes a sound before dropping the ruler, and Partner B has their eyes open.			

Compare your data to the data from at least two other groups. Describe any patterns that you notice in the data.

Name _____

Date _____

Activity Page 10.2

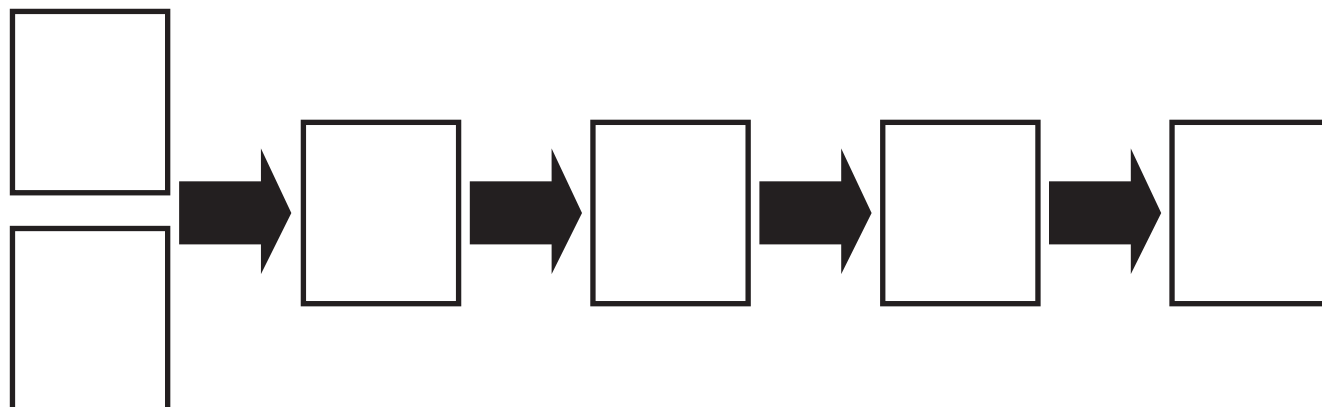
Use with Lesson 10.

Make a Model

Use the data from your ruler dropping investigation to answer the question below.

What parts of the body were working together during the fastest response time?

Complete the diagram. Cut out the words. Glue them in each of the spaces below. The model should show how vision and hearing worked together to make the hand catch the ruler.



nerves

ears

brain

nerves

eyes

hand
muscle

Name _____

Date _____

Activity Page 11.1

Use with Lesson 11.

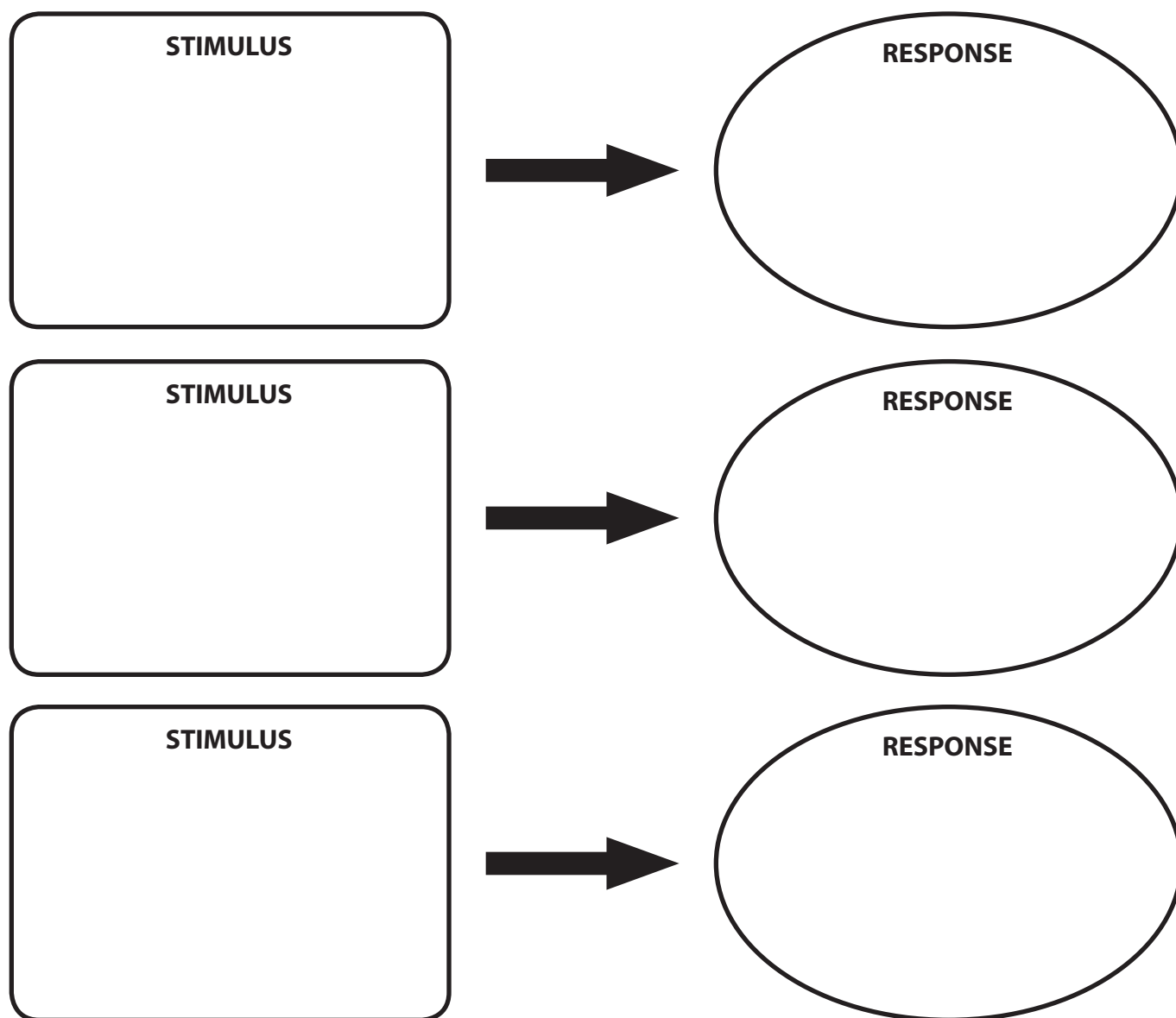
Plant Stimulus and Response

Watch the video, and answer the questions below.

1. Name three different stimuli that affect plants.

2. Name three ways that plants respond to these stimuli.

Use your answers above to **complete** the diagram below based on plant stimuli and responses.



Name _____

Date _____

Activity Page 12.1

Use with Lesson 12.

What Senses Do Animals Have?As you read Chapter 6, complete the table below.

Sense	What kind of structure(s) supports this sense?	Why is this sense important to an animal's survival?	Give your own animal example of stimulus and response for this sense.
Sight			
Sound			
Smell			
Touch			
Taste			

Name _____

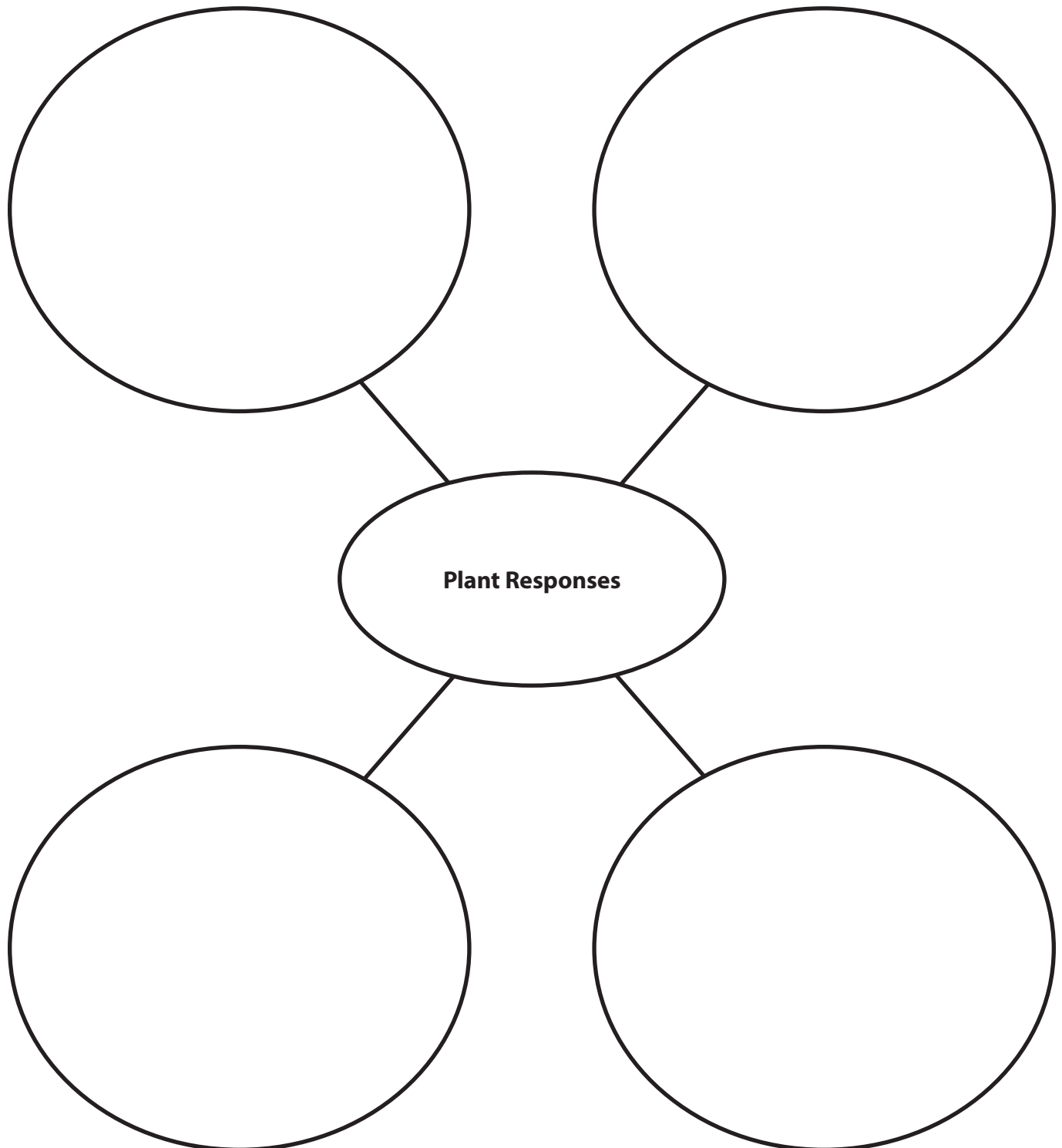
Date _____

Activity Page 13.1

Use with Lesson 13.

Plant Response Concept Map

As you read Chapter 7, complete the diagram below. Use the outer circles to write about the four ways plants respond to stimuli.



Name _____

Date _____

Activity Page 14.1

Use with Lesson 14.

Stimulus and Response Diagram

Answer the questions below based on your research.

1. Which animal did you choose to research? _____
2. What is that animal's strongest sense? _____
3. What are the types of sense receptors your animal uses to detect information in the environment?

4. What do those sense receptors do once they pick up on a stimulus? _____
5. What role does the brain play when it receives information? _____
6. What kind of stimuli does the animal encounter in its environment? _____
7. What are some ways the animal responds to the stimuli? _____
8. How does the animal use stimulus and response to survive? _____

Draw a diagram in the box below. Show how sensory input, the brain, and behavioral output are all parts of a system that allow your animal to survive in its environment. Be sure to do the following:

- **Label the inputs and outputs.**
- **Use boxes and arrows.**



Name _____

Date _____

Activity Page UR.1

Use with Unit Review.

Reading Braille

Study the braille alphabet guide.

									
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

Use the drawing box below to write a message for your partner to read. Glue the beads onto the paper to make letters.

Name _____

Date _____

Activity Page UR.2 (Page 1 of 2)

Use with Unit Review.

Vocabulary Crossword Puzzle

Review the cards in your Core Vocabulary deck before you begin.

Use the words in the word bank to complete the crossword puzzle. Not all words will be used.

adaptive	auditory	blindness	braille	brain	cell	deafness	function
muscle	nerve	organ	organ system*	response	sign language*		
skeletal	stimulus	structure	tissue	tropism	visual		

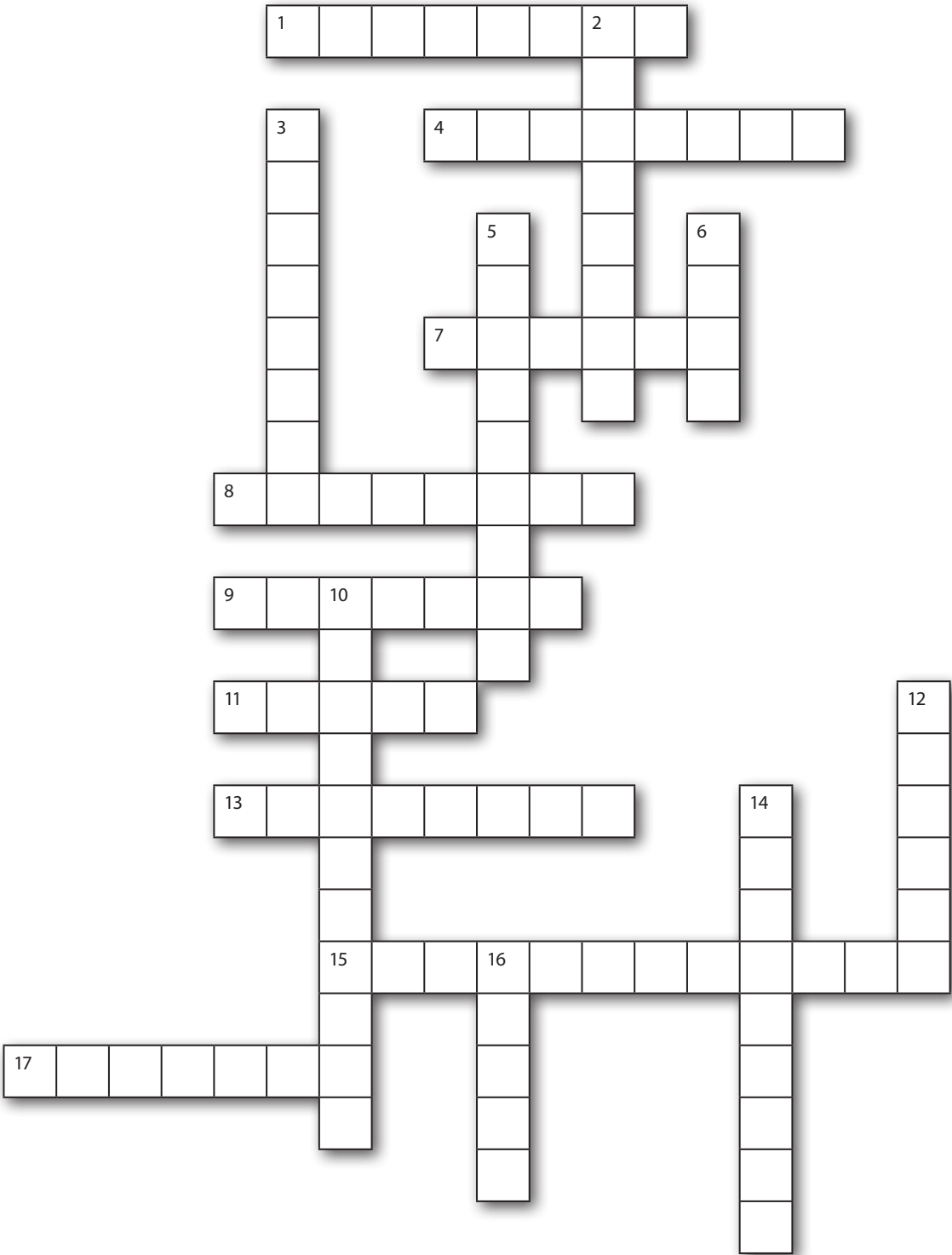
*No spaces between words are included in the puzzle.

Across

1. being unable to hear
4. the system of the body responsible for hearing
7. the system of the body responsible for sight
8. a type of reaction to a stimulus
9. the ability of a plant to move or grow based on a stimulus
11. a structure that carries out a specific function
13. an activity or purpose
15. a communication system for people who are deaf
17. a reading system for people who are blind

Down

2. something that causes a reaction
3. being able to change to improve functioning
5. being unable to see
6. the smallest unit of all living things
10. the nervous system is an example of this
12. a group of similar cells
14. an arrangement of parts
16. a type of fiber that transmits signals and messages to and from the brain



Name _____

Date _____

Activity Page UR.3

Use with Unit Review.

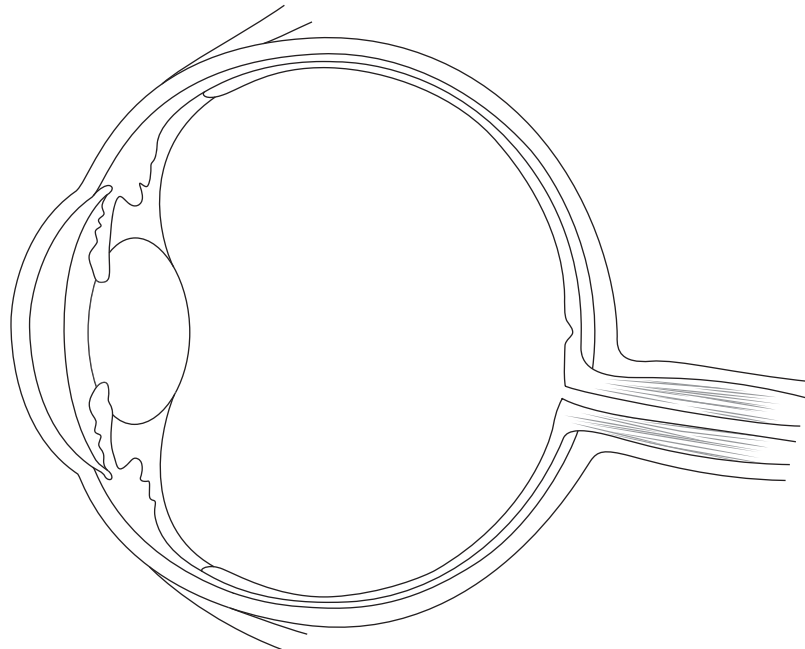
Vocabulary Review

Complete each sentence with the correct Core Vocabulary term or phrase. Not every word in the word bank will be used. **Review the cards in your Core Vocabulary deck before you begin.**

cells	organ	organs	tissue	nerves	stimuli	response
tropism	visual	auditory	structure	function	brain	muscular
braille	sign language	respond	deafness	adaptive	blindness	

1. Living things have bodies that are organized from smallest parts to largest, going from _____ to _____ systems.
2. A group of similar cells make up a _____.
3. The brain responds to a stimulus through _____.
4. Loud noises, flashing lights, and cold temperatures are examples of _____.
5. An example of _____ is when a plant responds to light by growing toward the sun.
6. The _____ system is responsible for sight, and the _____ system is responsible for hearing.
7. The way the parts of an organism are assembled is known as _____, and the way in which those parts work is known as _____.
8. Louis Braille invented a reading system known as _____.
9. The heart, the lungs, and the stomach are examples of _____.
10. Some animals _____ to stimuli by running away or hiding.
11. When someone is unable to hear, this is called _____.
12. Eyeglasses are an example of a(n) _____ device.
13. _____ is when someone is unable to see.

4. Choose one structure in a plant and one structure in an animal, and explain how it supports survival, growth, behavior, or reproduction.



5. On the image, label the following parts:

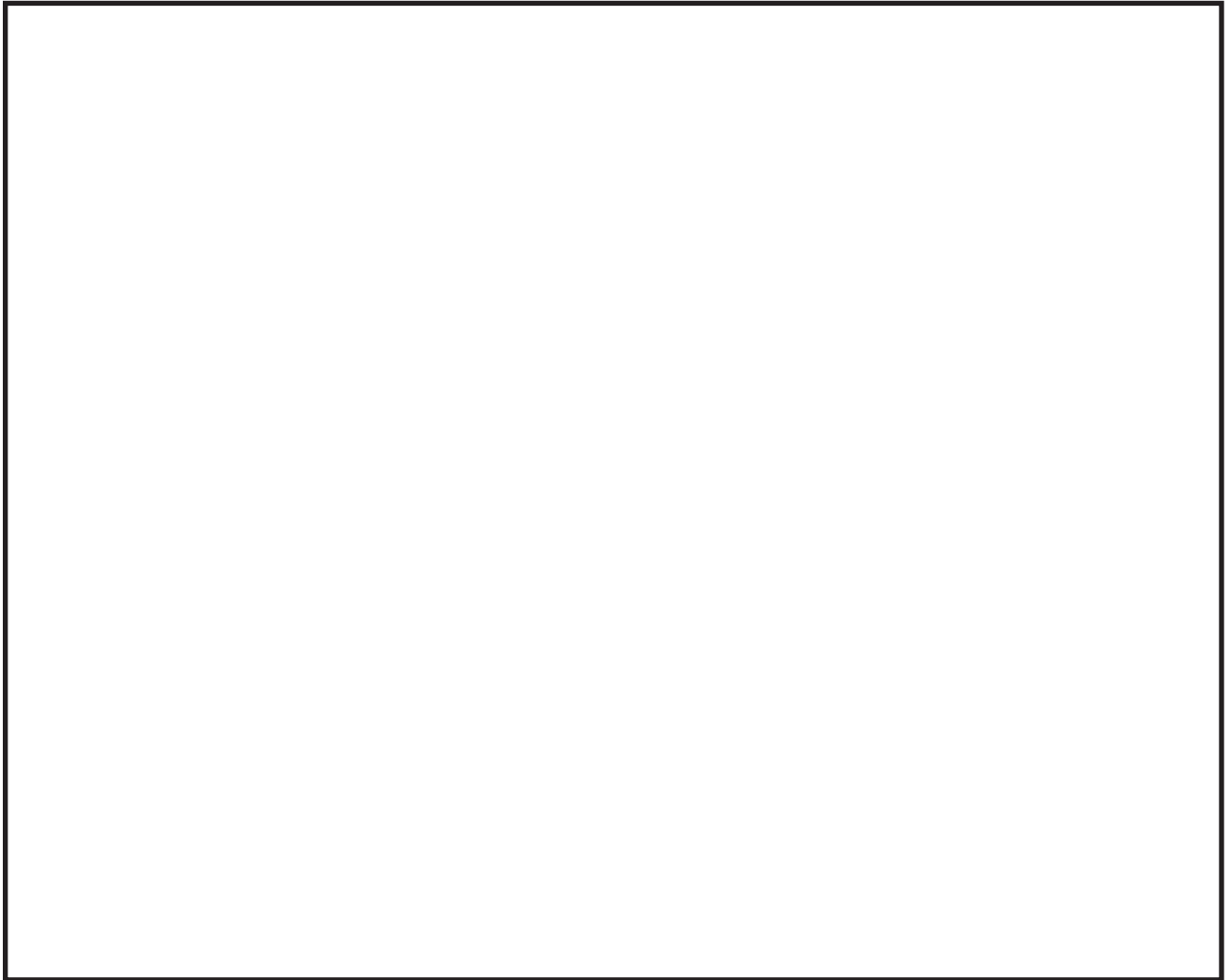
pupil

lens

optic nerve

How does this organ allow a human to see?

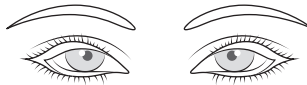
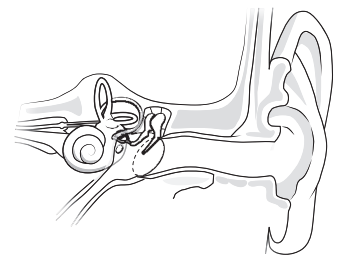
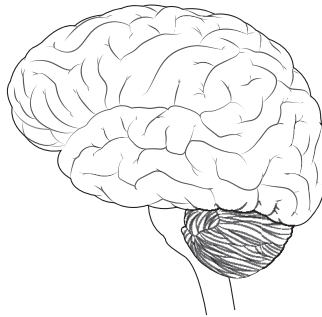
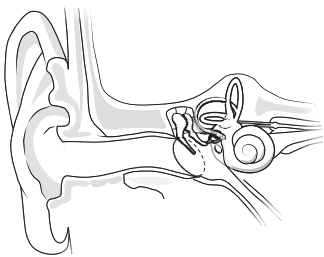
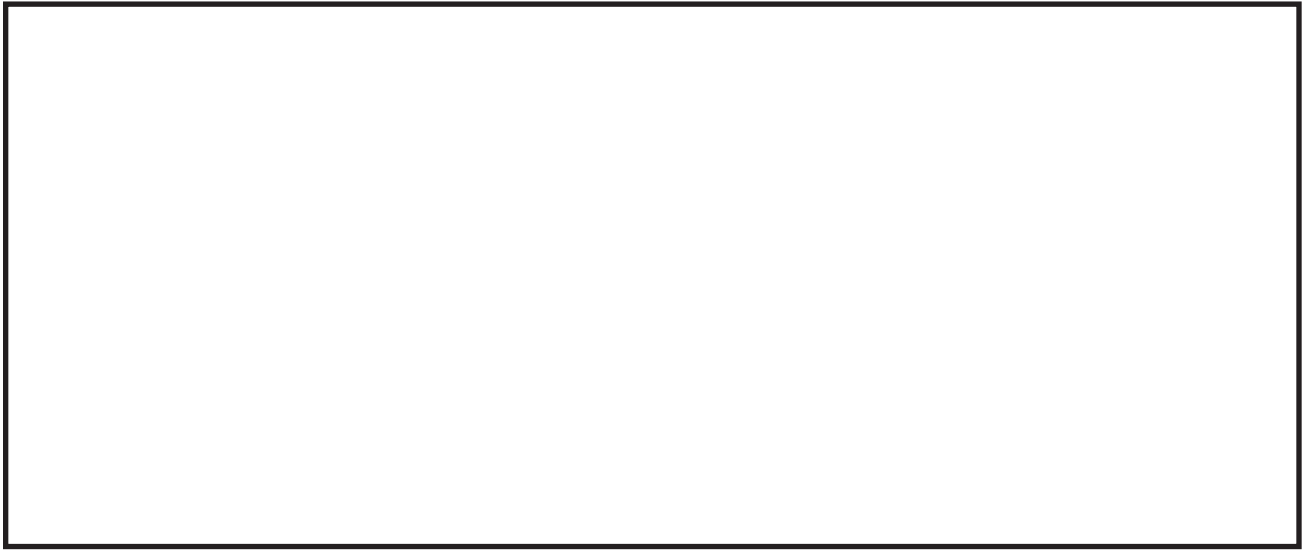
6. In the box below, draw a model of how the eyes see information. Be sure to include arrows that show how the information travels to the eyes.



7. Complete each sentence.

The outer ear _____ sound toward structures inside the ear. Structures inside the ear _____ sound waves. This system is known as the _____ system.

8. In the box below, draw a model of how the ear hears information. Be sure to include arrows that show how the information travels to the ears.



9. Explain how each part of the diagram works together as part of a system to support human hearing and seeing.

10. Write *stimulus* or *response* on each line to tell whether the action is a cause (stimulus) or an effect (response). Then answer the question that follows.

A hand feels the stove is very hot. _____

A knee swings forward after being tapped. _____

A bright light shines into a person's eyes. _____

A teacher asks students to put their pencils down. _____

A dog barks at a letter carrier walking by. _____

A child zips up her coat on a cold, windy day. _____

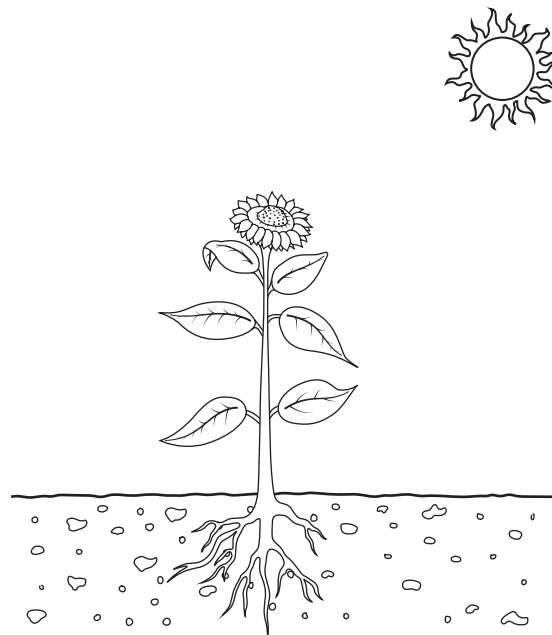
How are stimulus and response related?



11. Look at the picture of the cat. Then complete the steps listed below.

- Circle the organs it uses to see in its environment. Write the name of the sense next to the circles.
- Draw a square around the organ it uses to smell things in its environment. Write the name of the sense next to the square.
- Underline the area it uses to taste things in its environment. Write the name of the sense next to the area.
- Draw arrows next to each of the main parts of its body that it uses to feel its environment. Write the name of the sense next to the arrows.

12. Use the model of the cat to help answer the following question:
How might this animal use its senses to survive in its environment?



13. Think about a plant. Describe a way it might move in response to a stimulus in its environment.

Activity Pages Answer Key: Structures and Functions of Living Things

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 of the Activity Pages of this unit.

Structure of a Celery Stalk (AP 1.1) (page 117)

- Student drawings should show and have a labeled stem, leaves, roots, stalks, and petioles.
- Student drawings should show a cross section of the petiole including the structures that support the plant and structures that allow fluids and other materials to move through the celery.

Celery Investigation (AP 1.2) (pages 118–119)

Setup (Day 1)

STEP 4: Student observations should note that the colored water moved a short way up the celery stalk.

STEP 5: Student drawings should show an accurate version of their investigation setup.

Follow-Up (Day 2)

STEP 6: Student observations should note that the colored water moved much further up the celery stalk compared to the previous day.

- The investigation provides evidence that the function of structures in the celery stalks is to allow water to move through them.
- Over time, the colored water moves further through the celery stalks. Therefore, the water must be moving through hollow structures in the stalks. These structures enable the water to move through the stalks.
- If the leaves were removed, the water would move more slowly up the stalk. That observation would be evidence that water moving through the stalk is lost through the leaves.

Cells and Tissues Model (AP 2.1) (page 120)

- Student responses should note that many bricks are part of a building like many cells are part of a tissue.

(AP 2.1), continued

- Students should note that the structures were made from many similar plastic blocks joined together like tissues are made from many similar cells joined together.
- Students should note they could use different colors of plastic blocks or use different sizes of plastic blocks.
- Students should note that all organisms, or living things, are made up of at least one cell. Tissues are formed by similar cells that join together.

Lesson 2 Check (AP 2.2) (page 121)

- Students should note that bricks make up different parts of a building like many cells make up different parts of the body.
- Students should cite examples such as a concrete structure, a glass structure, a wooden structure.
- Students should cite examples such as cells joining together to form tissues that perform a specific function for the body.
- Student drawings should include structures that hold the celery up and structures that move water and other materials through the stalk.

Make a Lung Model (AP 3.1) (pages 122–123)

1. Students should note that when they pull on the balloon, the balloon inside expands, which is like inhaling. When they push the balloon in, the balloon inside shrinks, which is like exhaling. Since this is movement, there must be a muscle that causes the lung to inhale and exhale.
2. Students should note that the lungs take in air, which the body needs to survive.
3. Students should explain that the bottle surrounds a balloon like the skeleton surrounds the lungs, so the bottle represents the skeleton, your rib cage. Air passes through the straw into the balloon like air passes through the throat into lungs, so the straw represents the throat, your wind pipe.

(AP 3.1), continued

4. Students should explain that the balloon inside the bottle represents a lung. The balloon on the bottom of the bottle represents a muscle.
5. Students should explain that the lungs are part of the respiratory system. The muscle is part of the muscular system. When the balloon is pressed in or pulled, it is like a muscle, and the balloon shrinks or expands, like the lungs. The movement of the two balloons shows how the muscles and lungs work together.

6.

Nervous system: Sample answer: sends messages to and from the brain; brain

Circulatory system: Sample answer: moves blood throughout body; heart

Digestive system: Sample answer: processes food; stomach

Skeletal system: helps to support the body; bones

Muscular system: helps aid the body in movement; muscles

Lesson 3 Check (AP 3.2) (Pages 124–125)

1. Student answers may include skin, heart, lung, brain, liver, kidney, or other organs.
2. Students should explain that the lungs take in air, which the body needs to survive.
3. Student responses should come from the following organ systems: nervous, respiratory, circulatory, digestive, skeletal, and muscular.
4. Students should describe that the muscular system enables the body to move.
5. Student responses should include the respiratory and muscular systems. However, students may also note the nervous system is also involved.
6. Student responses should include the skeletal and muscular systems. However, students may also note the nervous system is also involved.

Organism Research and Concept Map (AP 4.1) (pages 126–127)

1. Students should note the plant or animal they researched.
2. Students should list examples of the needs such as air, water, space, and light.

(AP 4.1), continued

3. Students should note life functions such as growth, feeding, sheltering, and waste removal.
4. Students should describe an organ system and how it helps their organism survive.
5. Students should list the functions of growth, moving, breathing, getting energy, producing waste, and reproducing.
6. Students should match each basic function of all living things with the appropriate functions from their organism.

Concept map should show relationships between their organism's basic functions and the basic functions all living things need to survive.

Lesson 4 Check (AP 4.2) (page 128)

1. Students should name plant structures such as roots, leaves, or stems.
2. Student responses should pair to their answer in Question 1.
3. Students should match functions to their response in Question 2, such as "Leaves take in energy and help the plant breathe. This helps the plant live."
4. Students should name animal structures such as the heart.
5. Students should note the organ system their organ contributes to, such as "The heart helps the circulatory and respiratory systems."
6. Students should note the basic life functions their organ supports, such as breathing.

Functions in Animals (AP 5.1) (page 129)

Students should name their favorite animal and list the structures it has that contribute to its survival. If students are struggling to identify structures, list the basic functions of all living things for students and have them match structures their animal possesses that contribute to that life function.

Classifying Structures (AP 5.2) (page 130)

Part 1

1. Students should note the functions of survival, growth, behavior, and reproduction.

(AP 5.2), continued

2. Students should list two different animals.
3. Student charts should match the structure to the function. In some cases, their structure may have more than one function, such as the heart contributing to both circulation and respiration.

Part 2

Students should match their structure and function from Part 1.

Lesson 5 Check (AP 5.3) (page 131)

1. Accept any reasonable answer that cites evidence showing how the chosen structure supports an animal function.
2. Students should cite evidence such as the fact that being the same color as its surroundings helps the hare hide. Therefore, the color supports the hare's survival by helping it to hide from predators.
3. Students should note that since only the male birds are really colorful, the color of the feathers is to support the function of reproduction.
4. Student responses should include reasoning that the duckling is most likely to see its mother first. Therefore, the behavior supports the duckling's survival by ensuring it is close to its mother and protected from predators.

Functions of Plant Structures (AP 6.1) (page 132)

1. Students should list roots, stems, and leaves.
2. Students should connect the following: Roots: Absorb water, Absorb nutrients; Stems: Carry water to plant parts, Support plant above ground; Leaves: Absorb light, Make food, Exchange gases; Flowers: Reproduction, Attract insects
3. Students should note that roots, stems, leaves, and flowers are all made up of cells.
4. Students should explain that biological organization is the order of structures and systems in living organisms: cells, tissues, organs, organ systems.

Lesson 6 Check (AP 6.2) (page 133)

1. leaves
2. roots

(AP 6.2), continued

3. Students may include any two of the following: flowers, pollen, seeds, fruits.
4. Student responses may include answers such as the following: Roots grow downward in the plant's response to gravity. Since water may be available below ground, roots need to grow downward to access water in dry conditions.
5. Student responses may include answers such as the following: A plant will bend toward light so that it can make enough food. Roots will grow downward even after the plant is moved upside down or on its side.

Research and Writing Discussion (AP 7.1) (page 134)

1. Students should identify a plant or animal.
2. Students should note the purpose of their research is to learn more about a specific plant or animal structure and its function(s).
3. Students will explain how their information shows the relationship between the structure and the life functions it helps the organism meet.
4. Students should list their primary source of information.
5. Students should list the websites they will use in their research.
6. Students should note that websites with addresses ending in .gov, .edu, and .org are usually trustworthy.
7. Students should note the source of their printed materials.
8. Students should list the printed materials they will reference.

Research and Writing Outline (AP 7.2) (pages 135–136)

Day 1

1. Students should consider the strength of the match between the Big Question (How are structure and function related in any one plant or animal?) and how well their sources support the question in regard to the plant or animal they researched.
2. Students should identify the plant or animal they researched.

(AP 7.2), continued

3. Students should describe the specific structure and function they are researching.
4. Students should list their sources for research.
5. Students should relate the structure and function to how it helps the plant or animal meet basic life functions.
6. Students should cite evidence showing how the structure and function form part of a system.

Day 2

- Paragraph 1 introduces the plant or animal and a specific structure and function.
- Paragraphs 2–3 describe evidence of the structure and function and their interrelated role in supporting growth, survival, and/or reproduction.
- Paragraph 4 describes evidence of how the structure and its function are part of a system.
- Paragraph 5 is a conclusion to demonstrate the connection between the structure, its function as part of a system, and the system's role in growth, survival, and/or reproduction.

The Pupil (AP 8.1) (page 140)

1. Student drawings should include a labeled pupil.
2. lets light into the eye
3. to let more or less light in
4. you will not be able to see anything

Reflection (AP 8.2) (page 141)

1. when light bounces off an object
2. Student additions to the picture should show light moving toward the mirror, striking the surface, and then bouncing up and back toward the flashlight.
3. Sample answer: I drew the light from the flashlight hitting the mirror and then going back toward the flashlight again, because reflection is when light bounces off an object.

Sending Signals (AP 9.1) (page 142)

The boxes should be put in the following order:

1. Sound waves are produced and travel through the air.

(AP 9.1), continued

2. Sound waves enter the outer ear and travel down the ear canal to the eardrum.
3. The eardrum and small bones within the ear vibrate.
4. A fluid-filled structure turns the vibrations into electrical signals.
5. Electrical signals pass along the auditory nerve to the brain.

Ruler Drop Investigation (AP 10.1) (page 143)

- Student pairs should fill out the data table for all three trials of each set of conditions.
- The more senses you were able to use, the faster the response time was because the fastest time for each group was when the eyes were open and a sound was made.

Make a Model (AP 10.2) (page 144)

- the eyes, ears, hand, brain, muscles, bones
- Student models should be in the following sequence: ears + eyes > nerves > brain > nerves > hand muscle

Plant Stimulus and Response (AP 11.1) (page 145)

1. Accept appropriate student observations of stimuli in the video.
2. Student responses should match to the stimuli they observed and recorded in Question 1.

Student diagrams should show the cause and effect of the different responses to the stimuli seen in the video.

What Senses Do Animals Have? (AP 12.1) (page 146)

Sight:

- Students should identify the eyes as the structure that supports sight.
- Students should identify sight as important to help the animal find food and avoid predators.
- Sample response: A bird sees a dog running toward it (stimulus) and flies away (response).

Sound:

- Students should identify the ears as the structure that supports hearing sound. They may also note that they can sense vibrations, such as a train going by, in other parts of their body.

(AP 12.1), continued

- Students should identify hearing sound as important to help the animals find others of their species and to avoid danger.
- Sample response: A young deer sees its mother flash her tail (stimulus) and holds still to escape danger (response).

Smell:

- Students should identify the nose as the structure that supports the sense of smell.
- Students should identify the sense of smell as important to help the animals identify parts of their surroundings and find food.
- Sample response: A deer in the forest smells smoke (stimulus) and runs away (response).

Touch:

- Students should identify skin as the structure that supports the sense of touch.
- Students should identify the sense of touch as important to help the animal sense changes in its environment, such as change of temperature, or to sense predators or prey.
- Sample response: A polar bear feels a seal under the ice it is standing on (stimulus) and pounces to break the ice and catch the seal (response).

Taste:

- Students should identify the tongue as the structure that supports taste.
- Students should identify taste as important to help the animal identify food that is safe to eat.
- Sample response: A camel smells the water in a watering hole (stimulus) and the water smells clean so the camel drinks it (response).

Plant Response Concept Map (AP 13.1) (page 147)

Students should identify the four stimuli discussed in the Student Reader (light, gravity, temperature, and touch) and put information into the four outer circles on the concept map.

Stimulus and Response Diagram (AP 14.1) (page 148)

1. Students should identify the animal they researched.
2. Students should identify the animal's strongest sense.

(AP 14.1), continued

3. Students should identify the type of sense receptors.
4. Students should note the sense receptors send a signal through nerves.
5. Students should note the brain processes the signal from the stimuli and sends a response back through the nervous system.
6. Students should note one example of stimuli the animal encounters.
7. Students should note ways the animal responds to stimuli in its environment.
8. Students should cite an example of the animal using a stimulus response to survive.

Student drawings should show, in sequence, the sensory input the animal encounters, the signal being sent to the brain, the brain processing the signal, and the output (response) which follows. All elements should be labeled.

Reading Braille (AP UR.1) (page 149)

Monitor student messages for accuracy and neatness.

Vocabulary Crossword Puzzle (AP UR.2) (pages 150–151)

ACROSS:

1. deafness
4. auditory
7. visual
8. response
9. tropism
11. organ
13. function
15. sign language
17. braille

DOWN:

2. stimulus
3. adaptive
5. blindness
6. cell
10. organ system
12. tissue
14. structure
16. nerve

Vocabulary Review (AP UR.3) (page 152)

1. cells; organ
2. tissue
3. nerves
4. stimuli
5. tropism
6. visual; auditory
7. structure; function
8. braille
9. organs
10. respond
11. deafness
12. adaptive
13. blindness

Unit Assessment: Teacher Evaluation Guide

Teacher Directions: The Unit Assessment on pages 153–158 is designed as a fifty-point test. Through this assessment, students demonstrate their overall learning of the unit’s Learning Objectives. CKSci Unit Assessments typically range from ten to fifteen questions in the upper elementary grades, which can be answered in a longer, single classroom session or administered in two sittings.

Items with simpler answers that assess knowledge but not the deeper understandings of the content, such as multiple choice or short answers, are weighted differently and are worth fewer points. Assessment items that require more complex thinking and a deeper understanding of the content, such as writing explanations or identifying multiple relationships, are worth more points. Items that require synthesis of content and other student knowledge are weighted with more points as well. Some test items encourage students to use their Core Vocabulary decks as a reference source for terminology and concepts related to the test item.

Expected Answers and Model Responses

1. structure; cell; tissues; organs; systems; functions (3 points)
2. a, b, d (3 points)
3. Skin: protects the insides of an animal; Bones: protect the soft parts inside an animal; Muscle: helps an animal to move; Leaves: are the parts of the plant where food is made (4 points)
4. Students should note that skin in animals helps protect their insides by keeping harmful things out. It also helps animals to sense the temperature of their environment and to protect them from hot or cold objects. Roots in a plant draw water and nutrients into the plant, which helps the plant to make or store food. (4 points)
5. Students should label the pupil, lens, and optic nerve. Students should note that the eye helps organisms detect light waves reflecting off objects. It then sends that information to the organism’s brain, which identifies the objects. (4 points)
6. Student models should show light traveling from the sun, bouncing off an object, then entering an eyeball. (5 points)
7. Accept “funnels,” “moves,” or a similar word; accept “process” or any similar words; auditory. (3 points)
8. Student models should show sound waves moving from an object that is making a sound and into an ear. (4 points)
9. Sample response: The ears detect sound vibrations and send that information to the brain. The eyes detect light reflections and send that information to the brain. The brain processes the information. This helps the organism understand what it is seeing and hearing and how best to respond. (4 points)

- 10.** stimulus; response; stimulus; stimulus; response; response
A stimulus is something that causes something else to happen. A response is what happens as a result of a stimulus. (3 points)
- 11.** Students should circle the eyes, noting they are responsible for sight. Students should draw a square around the nose, noting it is responsible for the sense of smell. Students should underline the mouth, noting it is responsible for the sense of taste. Students should draw arrows pointing to each foot and the whiskers, noting they are responsible for the sense of touch. (4 points)
- 12.** Sample response: It uses its senses of sight and smell to search for food. It may also use them to escape from other animals that want to eat it. It uses its sense of touch to catch and hold its food. It uses its sense of taste to decide whether it should eat the food. (4 points)
- 13.** Sample response: During the day, some plants move. As the sun moves across the sky, the plants follow the sun. They do this to better soak up energy from the sun to help them grow and make food. (5 points)

Glossary

Blue words and phrases are Core Vocabulary terms for the unit, and Student Reader page numbers are listed in parentheses. **Bold-faced words and phrases** are additional vocabulary terms related to the unit that you should model for students during instruction and that are often used within the Student Reader, and these latter terms do not have specific page numbers listed. Vocabulary words are not intended for use in isolated drill or memorization.

A

adaptive, adj. able to adjust the way something works to improve its function

auditory system, n. the set of cells, tissues, and organs in the ears and brain that enable hearing (24)

B

bark, n. the outer covering of the trunk, branches, and roots of a woody plant

behavior, n. the ways in which an organism acts (13)

biological organization, n. the pattern of how an organism is structured

blindness, n. the complete loss of vision

braille, n. a tactile form of written language for people who are unable to see, developed by Louis Braille

C

cell, n. the smallest unit of life (1)

D

deafness, n. the complete loss of hearing

F

function, n. the way that something works to achieve a task or serve a purpose (5)

G

growth, n. the life process of becoming bigger and stronger (12)

I

input, n. any data, idea, or object that is put into any process or system

involuntary, adj. describing any action or movement done automatically, such as the pumping of a heart

L

leaf, n. the part of a plant that is at the end of a stem and is often flat and green

N

nerve, n. a bundle of cells that send and receive messages between the brain and other body parts (10)

O

organ, n. a body part made up of related tissues that perform a specific function (6)

organ system, n. a group of organs that work together to carry out certain functions (8)

organism, n. an individual plant, animal, or single-cell life form

output, n. the amount of something that is produced

oxygen, n. a gas that allows an animal to breathe

P

pupil, n. the dark middle part of the eye

R

reflect, v. to bounce light off of some objects, like a mirror, and cast back the light

reproduce, v. to make new, young individuals of the same type (14)

reproduction, n. the process of making new, young individuals of the same type

response, n. a reaction to some factor or condition (18)

root, n. the part of the plant that grows downward to seek water, usually underground

S

sense, v. to detect a stimulus (27)

senses, n. the faculties of sight, smell, hearing, taste, and touch

sensory, adj. relating to the senses

stalk, n. the main support, or stem, of a plant

stem, n. the main stalk of a plant or a shrub

stimulus, n. a factor or condition that causes a response
(plural *stimuli*) (27)

structure, n. the arrangement of parts that make up
something (5)

survival, n. the state of continuing to live (11)

survive, v. to stay alive (11)

T

tissue, n. a group of similar cells joined together (4)

tropism, n. a plant's growth or movement in response to a
stimulus (33)

V

vision, n. the ability to see

visual system, n. the set of cells, tissues, and organs in the
eyes and brain that make vision possible (22)

voluntary, adj. describing any behavior done by choice,
such as walking

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:

- 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, for students to read and agree to prior to the start of the first unit so students are aware of the expectations when engaged in science activities.

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 daughter or son 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 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 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

- 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 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

- 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

- 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.

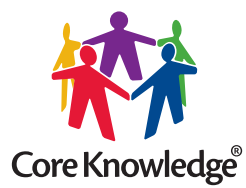
What to Do When Activities Don't Give Expected Results

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 plans to ensure the work is done in proper sequence and that it supports the lesson's Big 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 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 and figuring out *why* something happened will help them to develop a better sense of how to do science.



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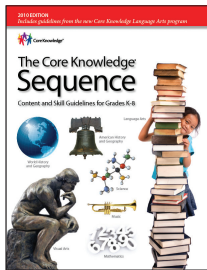
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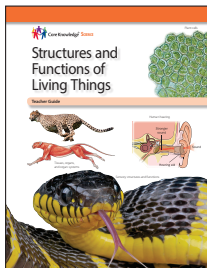
Structures and Functions of Living Things

Core Knowledge Science 4



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 the 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 readers from the middle to upper elementary grades. For teachers and schools following the *Core Knowledge Sequence*, this book is intended for Grade 4 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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ISBN: 978-1-68380-523-6