

Light and Sound

Tell It Again!™ Read-Aloud Anthology

Core Knowledge Language Arts® • Listening & Learning™ Strand



Core Knowledge®

GRADE 3





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Core Knowledge Language Arts®



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Alignment Chart for Light and Sound

The following chart contains core content objectives addressed in this domain. It also demonstrates alignment between the Common Core State Standards and corresponding Core Knowledge Language Arts (CKLA) goals.

Alignment Chart for Light and Sound	Lesson							
	1	2	3	4	5	6	7	8
Core Content Objectives								
Recall the senses and their corresponding sensory organs	✓				✓			✓
Identify the sun as Earth's main source of light and name other light sources	✓	✓						
Identify light as a form of energy that travels in waves	✓	✓	✓	✓				
Explain why light is so important	✓							
Describe how light waves travel in different mediums	✓	✓	✓	✓				
Explain how shadows are formed	✓	✓						
Explain how light is absorbed, reflected, or transmitted		✓	✓					
Describe the three types of mirrors: plane, concave, and convex		✓	✓					
Compare and contrast the terms <i>concave</i> and <i>convex</i>		✓	✓					
Compare and contrast transparent, translucent, and opaque objects			✓					
Describe how mirrors and lenses are used in a variety of instruments			✓					
Explain how light is refracted			✓					
Explain that color is determined by how light is absorbed and reflected				✓				
Explain what causes a rainbow to occur				✓				
Identify the spectrum of colors that makes up white light				✓				
Identify sound as a form of energy that travels in waves					✓	✓	✓	✓
Describe how sound waves travel in different mediums					✓	✓	✓	✓
Identify sources of sound					✓	✓	✓	✓

Alignment Chart for Light and Sound

Lesson

	1	2	3	4	5	6	7	8
Compare and contrast light and sound					✓	✓	✓	
Describe how the intensity and frequency of vibrations affects the qualities of a sound						✓	✓	✓
Identify the parts of the body that create the human voice							✓	✓
Explain how the human voice is produced and is able to make a wide range of sounds							✓	✓
Describe the life and contributions of Alexander Graham Bell								✓
Explain the significance of the invention of the telephone								✓

Reading Standards for Literature: Grade 3

Key Ideas and Details

STD RL.3.3	Describe characters in a story (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events.							
CKLA Goal(s)	Describe characters in a fiction read-aloud (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events	✓	✓		✓	✓		
	Identify and express mental states and emotions of self and others, including the narrator and/or characters of a fiction read-aloud		✓			✓	✓	
Integration of Knowledge and Ideas								
STD RL.3.9	Compare and contrast the themes, settings, and plots of stories written by the same author about the same or similar characters (e.g., in books from a series).							
CKLA Goal(s)	Compare and contrast the characters, themes, settings, and plots of chapters read aloud within a single novel					✓		✓

Alignment Chart for Light and Sound

Lesson

		1	2	3	4	5	6	7	8
Reading Standards for Informational Text: Grade 3									
Key Ideas and Details									
STD RI.3.1	Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.								
CKLA Goal(s)	Ask and answer questions (e.g., <i>who, what, where, when, why, how</i>), orally or in writing, requiring literal recall and understanding of the details and/or facts of a nonfiction/informational read-aloud				✓				
	Ask and answer questions, orally or in writing, that require making interpretations, judgments, or giving opinions about what is heard in a nonfiction/informational read-aloud, including asking and answering <i>why</i> questions that require recognizing or inferring cause/effect relationships					✓			
STD RI.3.3	Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.								
CKLA Goal(s)	Sequence four to six pictures or sentences illustrating/describing events from a nonfiction/informational read-aloud				✓	✓			
	Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a nonfiction/informational read-aloud, using language that pertains to time, sequence, and cause/effect				✓		✓	✓	✓
Craft and Structure									
STD RI.3.4	Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a Grade 3 topic or subject area.								
CKLA Goal(s)	Determine the literal and nonliteral meanings of and appropriately use common sayings and phrases	✓	✓			✓		✓	✓
	Determine the meaning of general academic and domain-specific words and phrases in a nonfiction/informational read-aloud relevant to a Grade 3 topic or subject area					✓			

Alignment Chart for Light and Sound

Lesson

		1	2	3	4	5	6	7	8
Integration of Knowledge and Ideas									
STD RI.3.7	Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).								
CKLA Goal(s)	Describe images, orally or in writing, and how they contribute to what is conveyed by the words in a nonfiction/informational read-aloud (e.g., where, when, why, and how key events occur)				✓	✓			
	Use images (e.g., maps, photographs) accompanying a nonfiction/informational read-aloud to check and support understanding	✓							
	Interpret information from diagrams, charts, graphs, and/or graphic organizers		✓	✓	✓		✓	✓	✓
STD RI.3.9	Compare and contrast the most important points and key details presented in two texts on the same topic.								
CKLA Goal(s)	Compare and contrast the most important points and key details presented in two nonfiction/informational read-alouds on the same topic					✓	✓	✓	✓
Writing Standards: Grade 3									
Text Types and Purposes: Informative/Explanatory									
STD W.3.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly.								
STD W.3.2a	Introduce a topic and group related information together; include illustrations when useful to aiding comprehension.								
CKLA Goal(s)	Identify and use parts of a paragraph, including a topic sentence, supporting details, and a concluding statement, in an informative/explanatory piece							✓	✓
	Introduce a topic and group related information together; include illustrations when useful to aiding comprehension						✓	✓	✓
STD W.3.2b	Develop the topic with facts, definitions, and details.								
CKLA Goal(s)	Develop an informative/explanatory topic with clearly presented ideas, facts, and details						✓	✓	✓
STD W.3.2c	Use linking words and phrases (e.g., <i>also</i> , <i>another</i> , <i>and</i> , <i>more</i> , <i>but</i>) to connect ideas within categories of information.								
CKLA Goal(s)	Use linking words and phrases (e.g., <i>also</i> , <i>another</i> , <i>and</i> , <i>more</i> , <i>but</i>) to connect ideas within categories of information							✓	✓
STD W.3.2d	Provide a concluding statement or section.								
CKLA Goal(s)	Provide a concluding statement or section for an informative/explanatory piece							✓	✓

Alignment Chart for Light and Sound

Lesson

		1	2	3	4	5	6	7	8
Production and Distribution of Writing									
STD W.3.4	With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose. (Grade-specific expectations for writing types are defined in Standards 1–3 above.)								
CKLA Goal(s)	With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose, i.e., ideas and paragraphs presented clearly and in a logical order								
STD W.3.5	With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing. (Editing for conventions should demonstrate command of Language Standards 1–3 up to and including Grade 3 on pages 28 and 29.)								
CKLA Goal(s)	With guidance and support from peers and adults, use the writing process of plan, draft, revise, edit, and publish to develop and strengthen writing								
STD W.3.6	With guidance and support from adults, use technology to produce and publish writing (using keyboarding skills) as well as to interact and collaborate with others.								
CKLA Goal(s)	Share writing with others								
CKLA Goal(s)	With guidance and support from adults, use technology to produce and publish writing (using keyboarding skills) as well as to interact and collaborate with others**								
Research to Build and Present Knowledge									
STD W.3.7	Conduct short research projects that build knowledge about a topic.								
CKLA Goal(s)	Conduct short research projects that build knowledge about a topic								
STD W.3.8	Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.								
CKLA Goal(s)	Make personal connections (orally or in writing) to events or experiences in a fiction or nonfiction/informational read-aloud, and/or make connections among several read-alouds								
CKLA Goal(s)	Gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories								
CKLA Goal(s)	Categorize and organize facts and information within a given domain								

Alignment Chart for Light and Sound

Lesson

		1	2	3	4	5	6	7	8
STD W.3.10	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.								
CKLA Goal(s)	Write responses to fiction and nonfiction/informational read-alouds that demonstrate understanding of the text and/or express/support opinion, using examples from a text and distinguishing own point of view from that of the author, narrator, or characters (short time frame)					✓			
	With guidance and support from peers and adults, use the writing process of plan, draft, revise, edit, and publish to develop and strengthen writing (extended time frame)						✓	✓	✓
	Write sentences to represent the main idea and details from a fiction or nonfiction/informational read-aloud (short time frame)					✓			

Speaking and Listening Standards: Grade 3

Comprehension and Collaboration

STD SL.3.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on Grade 3 topics and texts, building on others' ideas and expressing their own clearly.								
STD SL.3.1a	Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.								
CKLA Goal(s)	Carry on and participate in a conversation with an adult or peer for at least six turns, staying on topic, building on others' ideas, and expressing their own ideas clearly					✓			
	Demonstrate preparedness for a discussion, having read or studied required material, explicitly drawing on preparation and other information known about the topic to explore content under discussion					✓			
	Prior to listening to a read-aloud, identify (orally or in writing) what they know and have learned that may be related to the specific read-aloud or topic					✓			
	Make predictions (orally or in writing) prior to and during a read-aloud, based on the title, images, and/or text heard thus far, and then compare the actual outcomes to predictions	✓				✓			✓

Alignment Chart for Light and Sound

Lesson

		1	2	3	4	5	6	7	8
STD SL.3.1b	Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).								
CKLA Goal(s)	Use agreed-upon rules for group discussions, i.e., look at and listen to the speaker, raise hand to speak, take turns, say “excuse me” or “please,” etc.				✓				
STD SL.3.1c	Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others.								
CKLA Goal(s)	Interpret information presented, and then ask questions to clarify information or the topic in a fiction or nonfiction/informational read-aloud				✓				
STD SL.3.1d	Explain their own ideas and understanding in light of the discussion.								
CKLA Goal(s)	During a discussion, explain ideas and understanding in relation to the topic				✓				
STD SL.3.3	Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.								
CKLA Goal(s)	Ask and answer questions to clarify directions, exercises, and/or classroom routines and/or what a speaker says about a topic to gather additional information or deepen understanding of a topic or issue				✓				
Presentation of Knowledge and Ideas									
STD SL.3.4	Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.								
CKLA Goal(s)	Retell (orally or in writing) important facts and information from a fiction or nonfiction/informational read-aloud				✓				
STD SL.3.6	Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification. (See Grade 3 Language Standards 1 and 3 on pages 28 and 29 for specific expectations.)								
CKLA Goal(s)	Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification				✓				
Language Standards: Grade 3									
Knowledge of Language									
STD L.3.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.								
STD L.3.3a	Choose words and phrases for effect.*								
CKLA Goal(s)	Choose words and phrases for effect*	✓							✓

Alignment Chart for Light and Sound

Lesson

		1	2	3	4	5	6	7	8
Vocabulary Acquisition and Use									
STD L.3.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on Grade 3 reading and content, choosing flexibly from a range of strategies.								
STD L.3.4a	Use sentence-level context as a clue to the meaning of a word or phrase.								
CKLA Goal(s)	Use sentence-level context as a clue to the meaning of a word or phrase								
STD L.3.4b	Determine the meaning of the new word formed when a known affix is added to a known word (e.g., <i>agreeable/disagreeable</i> , <i>comfortable/uncomfortable</i> , <i>care/careless</i> , <i>heat/preheat</i>).								
CKLA Goal(s)	Determine the meaning of the new word formed when a known affix is added to a known word (e.g., <i>agreeable/disagreeable</i> , <i>comfortable/uncomfortable</i> , <i>care/careless</i> , <i>heat/preheat</i>)								
STD L.3.4c	Use a known root word as a clue to the meaning of an unknown word with the same root (e.g., <i>company</i> , <i>companion</i>).								
CKLA Goal(s)	Use a known root word as a clue to the meaning of an unknown word with the same root (e.g., <i>company</i> , <i>companion</i>)								
STD L.3.5	Demonstrate understanding of word relationships and nuances in word meanings.								
STD L.3.5a	Distinguish the literal and nonliteral meanings of words and phrases in context								
CKLA Goal(s)	Determine the literal and nonliteral meanings of and appropriately use common sayings and phrases								
	Distinguish literal language from figurative language as used in a fiction or nonfiction/informational read-aloud								
STD L.3.5b	Identify real-life connections between words and their use (e.g., describe people who are <i>friendly</i> or <i>helpful</i>).								
CKLA Goal(s)	Identify real-life connections between words and their use (e.g., describe people who are <i>friendly</i> or <i>helpful</i>)								
STD L.3.6	Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships (e.g., <i>After dinner that night we went looking for them</i>).								
CKLA Goal(s)	Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships								

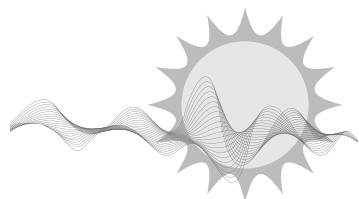
Alignment Chart for Light and Sound

		Lesson							
		1	2	3	4	5	6	7	8
Additional CKLA Goals									
CKLA Goal(s)	Listen to and understand a variety of texts, including fictional narratives and informational text					✓			
	Draw illustrations, diagrams, charts, and/or graphic organizers to represent the main idea and/or details from a fiction or informative/explanatory read-aloud, to depict a vocabulary word, or to enhance a piece of writing	✓	✓	✓	✓		✓		
	Distinguish the following forms of literature: fictional genres that are informational	✓							
	Demonstrate understanding (orally or in writing) of literary terms <i>character</i> , <i>narrator</i> , <i>setting</i> , <i>dialogue</i> , <i>third person</i> , and <i>point of view</i> by using this language in telling about the narratives	✓	✓	✓			✓		

✓ These goals are addressed in all lessons in this domain. Rather than repeat these goals as lesson objectives throughout the domain, they are designated here as frequently occurring goals.

* Skills marked with an asterisk (*) in Language Standards 1–3 are particularly likely to require continued attention in higher grades as they are applied to increasingly sophisticated writing and speaking.

** The editing and publishing steps of this informational writing piece have been placed at the beginning of Pausing Point 2. It is highly recommended that you regard this part of Pausing Point 2 as required in order to most accurately align with the writing requirements of the Common Core State Standards.



Introduction to Light and Sound

This introduction includes the necessary background information to be used in teaching the *Light and Sound* domain. The *Tell It Again! Read-Aloud Anthology for Light and Sound* contains eight daily lessons, each of which is composed of two distinct parts—the Read-Aloud and the Extension—so that the lessons may be divided into smaller chunks of time and presented at different intervals during the day. Each entire lesson will require a total of seventy minutes.

In addition to these lessons, there are two Pausing Points in this domain: one after Lesson 4, and another after Lesson 8. These Pausing Points are designed to allow five total days for reviewing, reinforcing, or extending the material taught up to that point. Two days are included for the Domain Assessment. The remaining day may be devoted to review, reassessment as needed, and extension of the writing process. **You should spend no more than fifteen days total on this domain.**

Domain Overview

Here is an overview of the domain schedule for *Light and Sound*. Please see the Unit 5 Teacher Guide for the corresponding Skills schedule.

Week One										
Min.	Day 1	#	Day 2	#	Day 3	#	Day 4	#	Day 5	#
50	Lesson 1: "What is Light?"		Lesson 2: "Reflection and Mirrors"		Lesson 3: "Refraction and Lenses"		Lesson 4: "What is Color?"		Pausing Point 1, Day 1	
20	Lesson 1B: Extensions		Lesson 2B: Extensions		Lesson 3B: Extensions		Lesson 4B: Extensions			

Week Two										
Min.	Day 6	#	Day 7	#	Day 8	#	Day 9	#	Day 10	#
50	Pausing Point 1, Day 2		Lesson 5: "What is Sound?"		Lesson 6: "Qualities of Sound"		Lesson 7: "Voice"		Lesson 8: "Alexander Graham Bell"	
20			Lesson 5B: Extensions		Lesson 6B: Extensions Informational Writing: Plan		Lesson 7B: Extensions Informational Writing: Plan/Draft		Lesson 8B: Informational Writing: Draft/Revise	

Week Three						
Min.	Day 11 # 10	Day 12 #	Day 13 #	Day 14 10	Day 15 10	
50	Pausing Point 2, Day 1	Pausing Point 2, Day 2	Pausing Point 2, Day 3	Domain Assessment	Domain Assessment; Remediate/Reassess as needed	
20	Informational Writing: Edit/Final Copy	Informational Writing: Final Copy/Publish	Informational Writing: Publish	Domain Assessment as needed; Informational Writing: Publish	Remediate/Reassess as needed; Informational Writing: Publish	
30	Informational Writing: Edit/Final Copy	Informational Writing: Publish	Informational Writing: Publish	Informational Writing: Publish	Informational Writing: Publish	

10 Lessons include Student Performance Task Assessments

Lessons require advance preparation and/or additional materials; please plan ahead

Domain Components

Along with this Anthology, you will need:

- *Tell It Again! Media Disk* or the *Tell It Again! Flip Book* for *Light and Sound*
- *Tell It Again! Image Cards* for *Light and Sound*

You may wish to have one notebook/binder readily available for each student to be used for *Light and Sound* Logs, note-taking, and/or other writing opportunities, including “domain dictionaries” and writing prompts in the comprehension questions.

You will find the Instructional Objectives and Core Vocabulary for this domain below. The lessons that include *Image Cards*, *Instructional Masters*, and *Assessments* are also listed in the information below.

Why Light and Sound Is Important

This domain will build upon what students have already learned about the five senses and the human body, focusing on the senses of seeing and hearing. Students will learn about the properties of light and sound, how light and sound travel in waves, and how light and sound can be manipulated by various instruments, such as magnifying glasses, microscopes, and telescopes. Students will also learn about devices that scientists have invented to improve vision and hearing, and about doctors who specialize in the fields of vision and hearing. Students will be introduced to this content through a narrative story about two old friends, Samuel and Jack, who are losing their senses of sight and hearing, and their adventures with Samuel’s grandchildren, Amy and Ethan.

Students will also learn about the life and inventions of the famous

inventor of the telephone, Alexander Graham Bell, including his experience with teaching the deaf.

The content students learn in this grade will serve as the basis in later grades for more in-depth study of the human body and the properties of light and sound.

Note: Light has both a wave and a particle nature. Under most circumstances, light acts like a series of waves. However, there are certain, less common situations where light acts like a stream of particles. Science today treats this dual nature of light by assuming that the light waves are bunched or bundled into packets. When light acts like a stream of particles, it is the packets (photons) that are the dominant actors whereas the waves dominate in all other situations.

At the Grade 3 level, we concentrate on the wave nature of light, briefly mentioning that “scientists are still studying and learning many new things about light, including that in special situations, light can act like a stream instead of a wave.” Students will learn more about the dual wave and particle nature of light in future grades.

What Students Have Already Learned in Core Knowledge Language Arts During Kindergarten, Grade 1, and Grade 2

The following domains, and the specific core content that was targeted in those domains, are particularly relevant to the read-alouds students will hear in *Light and Sound*. This background knowledge will greatly enhance your students’ understanding of the read-alouds they are about to enjoy:

The Five Senses (Kindergarten)

- Identify and demonstrate understanding of the five senses: sight, hearing, smell, taste, and touch
- Identify each of the body parts associated with the five senses
- Provide simple explanations about how the eyes, ears, nose, tongue, and skin work and their function
- Describe how the five senses help humans learn about their world
- Describe some ways the five senses help protect people from harm
- Describe the experiences and challenges of someone who is blind or deaf

The Human Body (Grade 1)

- Explain that the human body is a network of systems
- Identify each of the five body systems: skeletal, muscular, digestive, circulatory, and nervous

Astronomy (Grade 1)


- Recognize the sun in the sky
- Explain that the sun is a source of energy, light, and heat
- Identify the Earth's rotation or spin as the cause of day and night
- Explain sunrise and sunset
- Explain that Earth orbits the sun
- Explain that stars are large, although they appear small in the night sky
- Explain that astronomers study the moon and stars using telescopes

Cycles in Nature (Grade 2)

- Identify that the tilt of Earth's axis in relation to the sun causes the seasons
- Explain that most cells are too small to be seen without a microscope
- Identify the three states of matter in which water exists: solid, liquid, and gas

Core Vocabulary for Light and Sound

The following list contains all of the core vocabulary words in *Light and Sound* in the forms in which they appear in the text. The vocabulary words used in the Word Work activities are boldfaced. The multi-meaning vocabulary words that are used as activities in the Pausing Points are marked with a + sign. The inclusion of the words on this list *does not* mean that students are expected to immediately be able to use all of these words on their own. However, through repeated exposure throughout the lessons, they should acquire a good understanding of most of these words and begin to use some of them in conversation.

 **Note:** You may wish to display some of these vocabulary words in your classroom for students to reference throughout the domain. You may also wish to have students write these words in a “domain dictionary” notebook, along with definitions, sentences, and/or other writing exercises using these vocabulary words.

Lesson 1

energy*+
illuminates
light
light waves
particles
rays
shadow*
source*

Lesson 2

absorbed
angle*
concave*
convex*
mirror*
plane
reflected*
transmitted

Lesson 3

binoculars
instruments+
lens*
microscopes
opaque*
refraction*
telescopes
translucent
transparent*

Lesson 4

optometrist
prism*
rainbow
spectrum*
wavelength*
white light*
x-ray

Lesson 5

cacophony
medium*+
sound
sound waves*
vibration

Lesson 6

audiologist
composing
device
frequency
hearing aid
intensity*
pitch*

Lesson 7

diaphragm
larynx*
trachea*
variations
vocal cords*
voice box

Lesson 8

deaf
inventions*
inventive
mechanics
receiver
telegraph*
transmitter

The words or variations of the words marked with an asterisk () are included in the Skills Reader and Vocabulary Cards.

Comprehension Questions

In the *Tell It Again! Read-Aloud Anthology for Light and Sound*, there are three types of comprehension questions: literal questions to assess students' recall of the core content; inferential questions to guide students to infer information from the text and think critically; and evaluative questions to guide students to build upon what they have learned from the text to use their creative, analytical, and application skills. Many of these questions are also labeled as writing prompts and are discussed in more detail in the Writing Opportunities section in this introduction.



The last comprehension question in each lesson prompts students to ask, answer, and/or research any remaining questions they may have about the content; this question may also be expanded upon as an “Above and Beyond” research and/or writing activity. Many of these comprehension questions may also serve as meaningful take-home topics to discuss with family members.

It is highly recommended that students answer all comprehension questions in complete sentences—whether orally or in writing—using domain vocabulary whenever possible. You may wish to have students collect written responses in a notebook or folder.

Writing Opportunities

In the *Tell It Again! Read-Aloud Anthology for Light and Sound*, the content is reinforced through an informational writing piece, which students complete during Lessons 6–8, Pausing Point 2, and the Domain Genre Writing time using the steps of the formal writing process: plan, draft, revise, edit, and publish.

Everyday writing opportunities are included in the Comprehension Questions and Extensions in Lessons 1–8, as well as in both Pausing Points.

In the Comprehension Questions, shorter writing prompts that assess students' literal recall of the core content and provide practice for the short-answer writing section of the Student Performance Task Assessment are indicated by this icon: . Longer writing prompts that encourage students to think critically and expand creatively upon the content are indicated by this icon: . Some of these prompts may serve both purposes and may also be collected in a notebook or folder to provide source information for students to reference when writing their formal writing piece.

For these writing sessions, it is highly recommended that students take 5–10 minutes of Discussing the Read-Aloud time to write a half to a full page in response to one or more of the prompts, during which time you are encouraged to circulate and provide over-the-shoulder conferencing for a group of students each day. During these daily writing sessions, you may also choose to reinforce what students are learning in the Skills strand by having them practice these skills in their writing. The goal of these extended writing sessions is to provide students with daily, “low-stakes” writing practice and to have them receive immediate feedback on the content, featured skill(s), and clarity and depth of their written expression. You may also choose to publish select pieces of students’ writing—one or two sentences—to reinforce a particular concept or skill. It is highly recommended that students share their writing on a daily basis as time permits.

Student Choice and Domain-Related Trade Book Extensions

In the *Tell It Again! Read-Aloud Anthology for Light and Sound*, Student Choice and Domain-Related Trade Book activities are suggested in both Pausing Points. A list of recommended titles is included at the end of this introduction, or you may select another title of your choice.

Light and Sound Image Cards

There are thirty-eight Image Cards in the *Light and Sound* domain. These Image Cards include pictures of sources of light, as well as mirrors, lenses, and instruments used to manipulate and/or augment light and sound. These images will be used in a light and sound T-Chart. In the *Tell It Again! Read-Aloud Anthology for Light and Sound*, Image Cards are referenced in both Pausing Points and in Lessons 1–8.

Instructional Masters and Family Take-Home Letters

Blackline Instructional Masters and Family Take-Home Letters are included at the back of the *Tell It Again! Read-Aloud Anthology for Light and Sound*. Instructional Masters are referenced in the *Tell It Again! Read-Aloud Anthology for Light and Sound*, Instructional Masters are referenced in the Domain Assessment, in both Pausing Points, and in Lessons 1, 2, and 5–8. The Family Letters are referenced in Lessons 1B and 5B.

Above and Beyond Opportunities

In the *Tell It Again! Read-Aloud Anthology for Light and Sound*, there are numerous opportunities in the lessons and the Pausing Points to challenge students who are ready to attempt activities that are above grade-level. These activities are identified with this icon: ↗.

These opportunities may be found in the following: Comprehension Questions, Extensions, Pausing Point activities, research activities, and writing exercises.

You may also wish to assign some of these and other activities as homework for students who are ready for a challenge outside of the classroom. Many of the comprehension questions also serve as meaningful take-home questions to discuss with family members.

Additionally, you may choose to coordinate with your school's science, art, music, and/or social studies teacher(s) to further reinforce the content covered in this language arts block.

Student Performance Task Assessments

In the *Tell It Again! Read-Aloud Anthology for Light and Sound*, there are numerous opportunities to assess students' learning. These assessment opportunities range from informal observation opportunities to more formal written assessments and are indicated by this icon: ⑩. There is also a cumulative Domain Assessment. Instructional Masters DA-1, DA-2, and DA-3 are used for this purpose. The correct answers and corresponding statements have been provided on the back of the Answer Keys for Parts I and II of the Domain Assessment. You may wish to make a copy of the Answer Keys to send home to family members. Use the *Tens Conversion Chart* located in the Appendix to convert a raw score on each assessment into a Tens score. On the same page, you will also find the rubric for recording observational Tens scores.

Recommended Resources for Light and Sound

Trade Book List

It is highly recommended that students spend a minimum of twenty minutes each night reading independently or aloud to family members, or listening as family members read to them. You may suggest that they choose titles from this trade book list. These titles may also be put into the classroom book tub for various reading levels.

1. *Alexander Graham Bell*, by Victoria Sherrow (Millbrook Press Inc., 2001) ISBN 9781575055336
2. *Alexander Graham Bell: An Inventive Life*, by Elizabeth MacLeod (Scholastic Inc., 1999) ISBN 0439130468
3. *Alexander Graham Bell: Inventor of the Telephone*, by the editors of Time for Kids, with John Micklos, Jr. (HarperCollins Publishers Inc., 2006) ISBN 9780060576189
4. *Alexander Graham Bell: Setting the Tone for Communication*, by Mike Venezia (Children’s Press, 2009) ISBN 0531222071
5. *Dazzling Science Projects with Light & Color*, by Robert Gardner and Tom LaBaff (Enslow Elementary, 2006) ISBN 076602587X
6. *Did You Invent the Phone Alone, Alexander Graham Bell?*, by Melvin and Gilda Berger (Scholastic Inc., 2007) ISBN 0439833817
7. *Experiments with Light and Sound*, by Trevor Cook (The Rosen Publishing Group, Inc., 2009) 9781435828087
8. *Light & Sound*, by Clint Twist (Bearport Publishing Company, Inc., 2006) ISBN 1597160601
9. *Light (Science Alive)*, Darlene Lauw and Lim Cheng Puay (Crabtree Publishing Company, 2002) ISBN 0778706060
10. *Light and Color (Making Sense of Science)*, by Peter Riley (Smart Apple Media, 2005) ISBN 1583407154
11. *Light and Color (Straightforward Science)*, by Peter Riley (Franklin Watts, 1998) ISBN 0531153711
12. *Light and Dark (Science Alive)*, by Terry Jenkins (Smart Apple Media, 2009) ISBN 9781599202709
13. *Light and Sound*, by Dr. Mike Goldsmith (Kingfisher Publications, 2007) ISBN 9780753462812

14. *Light and Sound (Real World Science)*, by John Clark (Gareth Stevens Publishing, 2006) ISBN 0836863062
15. *Light and Sound (Science Fact Files)*, by Steve Parker (Raintree Steck-Vaughn Publishers, 2001) ISBN 0739810111
16. *Listen Up!: Alexander Graham Bell's Talking Machine*, by Monica Kulling (Random House Children's Books, 2007) ISBN 9780375831157
17. *A Picture Book of Thomas Alva Edison*, by David A. Adler (Holiday House, 1999) ISBN 0823414140
18. *Sound*, by Terri Jennings (Smart Apple Media, 2009) ISBN 9781599202754
19. *Sound and Hearing*, by Julie Murray (Abdo Consulting Group, Inc., 2007) 9781596798311
20. *Sound, Heat & Light: Energy At Work*, by Melvin Berger (Scholastic Inc., 2002) ISBN 0590461036
21. *Sounds and Vibrations (Making Sense of Science)*, by Peter Riley (Smart Apple Media, 2005) ISBN 1583407189
22. *The Thomas Edison Book of Easy and Incredible Experiments*, by The Thomas Alva Edison Foundation (John Wiley & Sons, Inc., 1988) ISBN 0471620904
23. *Thomas Edison: Young Inventor (Childhood of Famous Americans Series)*, by Sue Guthridge (Aladdin, 1986) ISBN 0020418507
24. *What Is Light?*, by Richard and Louise Spilsbury (Enslow Elementary, 2008) ISBN 0766030970
25. *What's Faster than a Speeding Cheetah?*, by Robert E. Wells (Albert Whitman and Company, 2007) ISBN 9780807522813
26. *Why Do We See Rainbows?*, by Melissa Stewart (Marshall Cavendish Corporation, 2009) ISBN 9780761429197

Websites

General

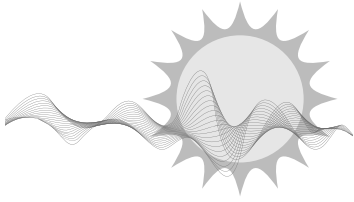
1. Science News for Kids
<http://www.sciencenewsforkids.org>
2. ZOOM Science Activities
<http://pbskids.org/zoom/activities/sci>

Light

3. Make Your Own Kaleidoscope (National Geographic Kids)
<http://kids.nationalgeographic.com/kids/activities/funscience/be-dazzled>
4. PBS Kids Light Experiments: Periscope Experiment
www.PBSkids.org
5. Science Games for Kids: Light and Dark
<http://www.sciencekids.co.nz/gamesactivities/lightdark.html>
6. Science Games for Kids: Sun, Light, and Shadows
<http://www.sciencekids.co.nz/gamesactivities/lightshadows.html>
7. Science Kids at Home: Sundial Experiment
www.sciencekidsathome.com

Sound

8. Bottled Music (National Geographic Kids)
<http://kids.nationalgeographic.com/kids/activities/funscience/sounds-great>
9. How Loud Is Too Loud?
<http://www.dangerousdecibels.org/virtualexhibit/3howloudistooloud.html>
10. Science Games for Kids: Changing Sounds
<http://www.sciencekids.co.nz/gamesactivities/changingsounds.html>
11. What Is Sound?
<http://www.dangerousdecibels.org/virtualexhibit/1whatsthatssound.html>



What Is Light?

1

☑ **Lesson Objectives**

Core Content Objectives

Students will:

- ✓ Recall the senses and their corresponding sensory organs
- ✓ Identify the sun as Earth's main source of light and name other light sources
- ✓ Identify light as a form of energy that travels in waves
- ✓ Explain why light is so important
- ✓ Describe how light waves travel in different mediums
- ✓ Explain how shadows are formed

Language Arts Objectives

The following language arts objectives are addressed in this lesson. Objectives aligning with the Common Core State Standards are noted with the corresponding standard in parentheses. Refer to the Alignment Chart for additional standards addressed in all lessons in this domain.

Students will:

- ✓ Describe how the characters in “What Is Light?” use their five senses and their sensory organs to experience their surroundings as described in the text and illustrated in the images (RL.3.3)
- ✓ Determine and distinguish between the literal and figurative meanings of “I will be your eyes if you will be my ears” (RI.3.4) (L.3.5a)
- ✓ Through hands-on exploration of materials, conduct research that builds knowledge about light concepts in “What Is Light?” (W.3.7)
- ✓ Make personal connections to concepts related to light presented in “What Is Light?” through hands-on activities and the Light and Sound Log (W.3.8)

- ✓ Categorize things that are sources of energy and ways in which we use energy (W.3.8)
- ✓ Make a prediction during “What Is Light?” about why Alfie is lying in the shade, based on the title, images, and text heard thus far, and compare to information provided later in the read-aloud (SL.3.1a)
- ✓ Generate a variety of interesting and informative words and phrases that describe light as heard and learned about it in “What Is Light?” (L.3.3a)
- ✓ Use the known root *lum* as a clue to the meaning of the newly learned word *illuminates* (L.3.4c)
- ✓ Draw an illustration in the Light and Sound Log to represent a main idea or key details from “What Is Light?” or to depict a vocabulary word
- ✓ Distinguish the read-alouds in the domain “Light and Sound” as fictional narratives that are informational
- ✓ Demonstrate understanding of the literary term *character* by using this word in discussing Samuel, Jack, and Alfie

Core Vocabulary

Note: You may wish to display some of these vocabulary words in your classroom for students to reference throughout the domain. You may also choose to have students write some of these words in a “domain dictionary” notebook, along with definitions, sentences, and/or other writing exercises using these vocabulary words.

energy, *n.* Force or physical power; what living things need to exist and be active

Example: The energy of the sun is one of the important things that plants need to make their own food through the process of photosynthesis.

Variation(s): energies

illuminates, *v.* Provides light; brightens; makes something clearer or easier to see or understand

Example: The lighthouse illuminates the rocky coastline along the harbor to help guide the ships to safety.

Variation(s): illuminate, illuminated, illuminating

light, *n.* A form of energy that most often acts like a wave and illuminates, or brightens, objects

Example: Rebecca’s lamp is her main source of light at night; without it, she could not read her bedtime stories.

Variation(s): none

light waves, n. The invisible rays that carry energy in straight paths
Example: Light waves travel most quickly through areas that have no matter, such as some areas of outer space.

Variation(s): light wave

particles, n. Tiny or very small bits of something

Example: Light beams become visible to us when the light is reflected by particles of dust in the air.

Variation(s): particle


rays, n. Lines of light that travel in a straight path from a bright object

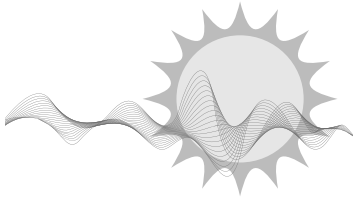
Example: My cat likes to bask in the warm rays of sunshine that come through my window in the morning.

Variation(s): ray

shadow, n. An area of darkness created when light is blocked by something
Example: On hot days, I like to sit in the shadow of my favorite tree and read.

Variation(s): shadows

<i>At a Glance</i>	Exercise	Materials	Minutes
Introducing the Read-Aloud	Domain Introduction		10
	What Do We Know?	chart paper, chalkboard, or whiteboard	
	Purpose for Listening		
Presenting the Read-Aloud	What Is Light?	Image Cards 1–5	20
Discussing the Read-Aloud	Comprehension Questions	Light and Sound Logs; chart paper, chalkboard, or whiteboard	15
	Word Work: Energy		5
 Complete Remainder of the Lesson Later in the Day			
Extensions	Hands On: Light and Shadow	flashlights; images with light and shadows; camera; drawing paper, drawing tools	20
	Light and Sound Log	Image Cards 1–5; Light and Sound Logs; Instructional Master 1B-1; chart paper; drawing paper, drawing tools [This activity requires advance preparation.]	
Take-Home Material	Family Letter	Instructional Masters 1B-2 and 1B-3	



What Is Light?

1
A

Introducing the Read-Aloud

10 minutes

Domain Introduction

Note: Students who have participated in the Core Knowledge Language Arts program have learned about many of the concepts in this lesson, including the following: the five senses and sensory organs and receptors of the human body in *The Five Senses* (Kindergarten), *The Human Body* (Grade 1), *The Human Body: Building Blocks and Nutrition* (Grade 2), and *The Human Body: Systems and Senses* (Grade 3); the sun as a source of light and heat and as the enabling component in the process of photosynthesis in *Plants* (Kindergarten); the tilt, orbit, and rotation of Earth in relation to the sun as the cause of day and night and the seasons in *Seasons and Weather* (Kindergarten), *Astronomy* (Grade 1), and *Cycles in Nature* (Grade 2); particles as related to the water cycle in *Cycles in Nature* (Grade 2); and the processes and related anatomy of vision and hearing in *The Human Body: Systems and Senses* (Grade 3).

Tell students that for the next several days they are going to hear about light and sound—two very important forms of energy—as well as how humans produce sound with their voices. Explain to students that they are going to hear a narrative with several characters who discuss the characteristics of light, sound, and voice. Remind students that a narrative is a fictional story, like *The Wind in the Willows* that they heard previously.

Note: You may choose to use different voices as you read to help students distinguish between the characters' voices and the Guided Listening Supports. You may wish to coordinate with the science teacher, art teacher, and/or music teacher in your school to plan some reinforcement activities throughout this domain about light and shadows, sound, vocals, and musical instruments.

What Do We Know?

Ask students, “How do we perceive, or sense, the world around us, specifically light and sound?” Guide students as necessary by reviewing the five senses of the human body and the sensory organs and receptors that allow us to perceive the world around us. You may choose to write the five senses and their corresponding sensory organs on chart paper, a chalkboard, or a whiteboard.

Ask students, “What do you know about light?” Allow students to share, recording their responses on chart paper, a chalkboard, or a whiteboard. If students provide incorrect information, write it down and tell them that you will revisit this information after the read-aloud to correct any errors. You may wish to guide the discussion with some of the following questions:

- What do you think of when you think of light? (Answers may vary.)
- What is Earth’s main source of light? (the sun)
- Do you know of any other sources of light, whether natural or man-made? (lasers; electricity, such as light bulbs and flashlights; fire, such as candles and lanterns; bioluminescent organisms, such as fireflies, glowworms, some deep-sea animals, and certain plants and bacteria; chemoluminescent or phosphorescent items such as glow-in-the-dark sticks, toys, stickers, etc.)
- Why is light so important to us? (allows us to see; gives us warmth; allows for photosynthesis and growth of living things; allows us to grow crops; etc.)
- Why do we experience sunlight for only part of the day? (Earth rotates on its tilted axis once a day, causing us to have day and night.)
- Why do some areas on Earth receive more sunlight and have warmer seasons at different times of the year? (Because Earth’s axis is tilted, as Earth orbits the sun some locations receive more sunlight for longer periods of time than others. Areas near the equator receive the most direct sunlight for the longest periods of time.)

Note: You may choose to create a KWL (**K**now-**W**onder-**L**earn) chart to record what students know, wonder, and learn about light, sound, and voice to reference and update throughout the domain.

Purpose for Listening

Read the title of the read-aloud to students: “What Is Light?” Tell students to listen carefully to hear the answer and to hear how light is described using various adjectives and other words. Tell students to also listen for how the five senses are used by the characters in the read-aloud to perceive the world around them.



What Is Light?

- ← **Show image 1A-1: Mr. Audire at garden gate; Mr. Van Lumen at his canvas**

“Good morning, my friend,” said a smiling Mr. Samuel Van Lumen [LOO-muhn]. “It is good to see you.”

“I see you are already working,” replied Mr. Jack Audire [aw-DEE-ray] as he pushed open the creaky garden gate. “What are you painting today?”

“Well, I am painting the roses that have just begun to bloom,” replied Samuel. “I am taking advantage of the early morning sunlight. As you know, my eyes are not what they used to be,” sighed Samuel. “Sadly, I can only paint for an hour each day.”

“You will have to speak up, Samuel. I am a little hard of hearing, you know,” said Jack with a laugh.¹

“How about we sit for a while under the oak tree?” replied Samuel. “I have just made some lemonade. I am hot standing in the sunlight, and my eyes are tired.”

- ← **Show image 1A-2: Samuel and Jack seated in garden chairs beneath shade of oak tree**

Samuel and Jack walked slowly toward the shade of the giant oak and settled themselves into two comfortable garden chairs. Samuel picked up a pitcher of ice-cold lemonade and poured it into two sparkling glasses. Both men were silent for a long while, until at last Samuel spoke.

“I have been pondering life,” said Samuel, speaking loudly so that Jack could hear him. “I have such wonderful memories, and you are in many of them.”

“I am glad to hear that,” said Jack. “Now that your eyes and my ears are failing, we should strike a deal: I will be your eyes if you will be my ears!” Jack exclaimed rather loudly.²

- 1 The characters Jack and Samuel are each experiencing the loss of one of their senses. Who can name some tools that help people to see or hear better? [Pause for students to share.] Eyeglasses are a tool to help Samuel see better, and later you will hear about a tool that helps Jack.



- 2 Do you think Jack is being literal or figurative when he says he will be Samuel’s eyes if Samuel will be his ears? (figurative) What does Jack mean when he says this?

The two men laughed. At that precise moment Samuel's dog, Alfie, came to join them. Alfie stretched and yawned and then curled up in the shade between the two friends.



← **Show image 1A-3: Samuel standing, motioning to sun high in the sky**

“Tell me,” said Jack. “What is the painter’s most valued tool?”

“**Light!**” shouted Samuel. “Let me tell you why light is so extraordinary!”

Samuel lifted himself out of his garden chair and stood beneath the giant oak. As he stood, he gazed out into his beautiful garden that was bursting with color and scent and began to speak.

“Our main **source** of light and heat is the sun, a hot star of “glowing gas.”³ Samuel smiled as he went on. “Light **illuminates** objects and makes them visible. Light spreads out in all directions. Because of light, our eyes and our brains are able to form pictures of the world we live in. I have spent my life painting those pictures. Light gives us every sunrise and every sunset. Without light, there is only darkness.”

Jack stared up into the sky. “I’ve always wondered how exactly light reaches us here on Earth. The sun is more than 92,000,000 miles away!”

Samuel nodded. “It is difficult to comprehend how it takes a mere eight minutes for light from the sun to reach us here on Earth.”⁴

“Light travels in the form of tiny waves called **light waves**,” explained Samuel. “These light waves travel in straight paths called **rays**.”⁵ Rays of light waves travel at the fastest speed possible in a vacuum, a place that has no tiny **particles** or bits of matter. Because most of outer space has very few particles, it is a vacuum, and light travels there at the remarkable speed of approximately 186,000 miles a second!”

Jack sat shaking his head and then took a sip of the refreshingly cool lemonade. “That is a lot to think about!” he admitted.

3 [Show Image Card 1 (Glowing Sun).]

4 It really *is* extraordinary that light can travel 92,000,000 miles in eight minutes! That would be like circling the Earth almost 4,000 times in eight minutes!

5 [Show Image Card 2 (Rays of Sunlight).] You can see the rays of light in this image because they are shining on bits of dust and moisture in the air.

“It sure is,” agreed Samuel, smiling. “Scientists are still studying and learning many new things about light, including that in special situations, light can act like a stream instead of a wave.”

Jack shook his head. “Figuring out how light works must be complicated, but it is indeed fascinating.”



← **Show image 1A-4: Alfie chasing a bee; light waves passing through pitcher of lemonade**

Samuel nodded. “Light from the sun reaches Earth because it can pass so quickly through outer space. There is almost nothing to block its path. Once light reaches Earth’s atmosphere, it slows down a little bit. The atmosphere is like a blanket of air full of gases and moisture that covers the Earth. This blanket of air slows the light down.”

“Then,” Samuel continued, “the speed of light slows down even more because objects start getting in the way of the light rays.”⁶ Samuel pointed to the lemonade. “For example, rays of light waves move more slowly when traveling through liquids, such as this lemonade.” Then Samuel pointed to the oak tree. “Light waves cannot pass through other objects, such as this beautiful oak tree. Because rays of light waves travel in a straight line, they cannot bend around the tree, either; instead, they leave a **shadow**, or shade, on the other side of it.”⁷

“Well, I, like Alfie, am enjoying sitting in the cool shade where there is clearly less light and heat,” pronounced Jack as he sipped his lemonade.

At that precise moment, as if he heard his name, Alfie leapt out from under Samuel’s chair and jumped high into the air in pursuit of a buzzing bumblebee. Both men stopped talking to watch the dog’s frantic attempt to capture the bee, but to no avail. The bee seemed to float away on the warm summer breeze, no doubt in search of a sweetly scented flower to pollinate.

6 [Point to the lemonade and oak tree in the image as you read the following sentences.]

7 [Point to the shadow in the image.]



← **Show image 1A-5: Jack, Samuel, and Alfie framed by garden**

“Another important thing to remember is light is fuel for our planet,” announced Samuel. “Light is **energy!**” Energy from the sun supports all forms of life on this planet. Without light and heat from the sun, the farmer would not have food to harvest. In fact, we could not exist on Earth!”⁸

“Hmm, speaking of food!” exclaimed Jack.

“Yes, indeed,” said Samuel. “I think I have exhausted both of us, and it is almost time for lunch. What do you say we go into the kitchen and get something to eat?”

“I say that’s the best thing I’ve heard all day!” laughed Jack. “And I smell something delicious coming from the house!”

8 [Point to the garden in the image.]
Would we have all of these plants without the energy of sunlight?



← **Show image 1A-6: Samuel and Jack inside having lunch**

The two men made their way into the coolness of the kitchen and prepared themselves a lunch of homemade zucchini bread and fresh fruits and vegetables gathered from Samuel’s garden. They sat at a table next to the kitchen window and talked about old times as they ate their meal. They recalled how they had first become friends in elementary school. They had been in the same third-grade class together, and they had both been keen baseball players. They had gone to high school together, and then on to the same college where Samuel had studied art, and Jack had studied music. They had even been soldiers together.

Eventually, Samuel and Jack had both married and had children. Their wives became good friends, and their children grew up playing with each other. Sadly, both of their wives had died. Their children were now adults with children of their own.⁹

9 Jack and Samuel are loyal friends. What other characters have you heard about this year who are loyal to each other? (Mole, Toad, Badger, and Rat in *The Wind in the Willows*).



← **Show image 1A-7: Samuel and Jack on porch at night**

Before they knew it, several hours had passed, and the bright sun had set.¹⁰ Samuel and Jack were now sitting on the porch in the shimmering twilight. Sounds of various night creatures were beginning to echo in the still of the evening.

10 [Show Image Card 4 (Sunset).]
Who knows why it looks like the sun is setting, or moving lower in the sky? (The earth is rotating.)

“It won’t be long before the stars are twinkling in the night sky and the moon is shining brightly,” said Jack. “It is almost time for me to go.”

Samuel gazed silently at the emerging night sky. They sat together enjoying the cooler evening air. Eventually Samuel spoke.



11 [Show Image Card 5 (Moon).]

← **Show image 1A-8: Jack and Samuel saying goodbye**

“Isn’t it amazing that stars make their own light, but the moon does not?”¹¹ Sunlight bounces off the moon to make it look like it’s shining brightly in the night sky,” mused Samuel. “Of course, I could sit here all night and talk about why light is so important, not only for myself as a painter, but for our very existence,” he said contemplatively.

“That’s a fact,” replied Jack, smiling at his friend.

Samuel smiled, too.

“Jack, how about we go fishing tomorrow morning?” asked Samuel.

“Sounds good to me,” said Jack as he stood up to go. “As you know, I am the better fisherman. It will be a miracle, Samuel Van Lumen, if you catch a single fish!”





“We’ll see about that!” exclaimed Samuel as he watched his best friend walk slowly down the garden path and through the creaky garden gate.

Comprehension Questions



15 minutes

If students have difficulty responding to questions, reread pertinent passages of the read-aloud and/or refer to specific images. If students give one-word answers and/or fail to use read-aloud or domain vocabulary in their responses, acknowledge correct responses by expanding the students' responses using richer and more complex language. Ask students to answer in complete sentences by having them restate the question in their responses. **It is highly recommended that students answer at least one question in writing and that some students share their writing as time allows.** For written responses in this domain, students will use their Light and Sound Logs to collect source material for longer writing pieces and as preparation for written responses in the Domain Assessment.

1. *Evaluative* *Lumen* means light in Latin. What word that you heard in “What Is Light?” contains the root word *lumen*? (*illuminates*) What does the word *illuminates* have to do with light? (If a flashlight or another light source illuminates an object, its light shines on it.)
2. *Literal* What characters did you hear about in this narrative? (Samuel Van Lumen, Jack Audire, and Alfie the dog) [Write these names on chart paper, a chalkboard or a whiteboard for students to see in preparation for the next questions.] Which character is a musician? (Jack Audire) Which character is a painter? (Samuel Van Lumen)
3. *Evaluative* Why do you think the author chose *Van Lumen* as Samuel’s last name? (His last name contains *lumen*, which means light. Samuel is very interested in and knowledgeable about light because he is a painter. He notices light when he paints, and tries to show the qualities of light in his paintings.)
4. *Evaluative* How do the characters in this narrative use their five senses and sensory organs to experience the world around them? (They see the roses, garden, sun, Alfie, etc., with their eyes; they taste the lemonade and their lunch with their taste buds; they smell the bread with their noses; they feel the sun and cool shade, glasses, etc., with their skin; they hear each other talking, Alfie barking, the buzzing bee, etc., with their ears.)

5.  *Literal* What is light? (Light is a form of energy that most often travels in waves and illuminates, or brightens, objects and makes them visible.)
 6.  *Evaluative* What is Earth's main source of light? (the sun) What are some other sources of light that you know about, both natural and man-made? (Answers may vary, but may include stars, electricity, fire, lasers, chemicals, bioluminescent creatures, etc.)
 7. *Inferential* You heard that light waves travel in rays. What does this mean? (Light waves travel in straight paths.) You also heard that rays of light waves travel fastest in a vacuum. What is a vacuum? (A vacuum is a place where there are no particles, such as areas in space between larger objects.) Through what substance do light waves travel, but more slowly than through air? (liquids)
 8. *Inferential* Can rays of light waves bend around objects, or do they travel in a straight path? (They travel in a straight path.) Because rays of light waves cannot bend around an object, what is formed on the opposite side of an object that is blocking light, such as a tree trunk? (A shadow, or shade, is formed where the light cannot reach.)
 9. *Inferential* What does Samuel mean when he says, "Light is fuel for our planet"? (Light from the sun helps us see, gives us warmth, gives all living things energy, allows us to grow crops, etc.) What is energy? (Energy is a force or physical power that living things need to exist and be active.)
 10.  *Evaluative* If you were asked to write a poem, what are some interesting and informative adjectives and phrases you might use to describe light? (Answers may vary, but may include: extraordinary, fast, straight, warm, glowing, sparkling, important, source of energy, travels in straight rays of light waves, necessary for life, etc.)
-  You may wish to allow time for individual students to use the list of words generated to write a poem.

I am going to ask a couple of questions. I will give you a minute to think about the questions, and then I will ask you to turn to your neighbor and discuss the questions. Finally, I will call on several of you to share what you discussed with your partner.

11.  *Evaluative* How are your senses of sight and hearing important to you? How might a person's life be different if they didn't have one of these senses? (Answers may vary.)
 12. After hearing today's read-aloud and comprehension questions and answers, do you have any remaining questions?
-  You may wish to allow time for individual, group, or class research of the text and/or other resources to answer any remaining questions.

Word Work: Energy

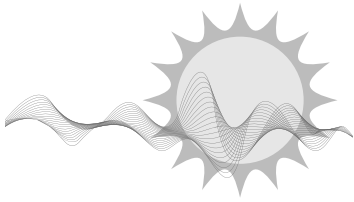
5 minutes

1. In the read-aloud you heard, "Light is *energy*!"
2. Say the word *energy* with me.
3. Energy is the force or physical power that living things need to exist and be active.
4. After Marcia ate a big breakfast, she had the energy she needed to rake all of the leaves in the yard.
5. When have you used energy to do something? What gave you the energy? What were you doing that needed energy? Be sure to use the word *energy* when you tell about it. [Ask two or three students. If necessary, guide and/or rephrase the students' responses to make complete sentences: "I used energy to . . ." or "_____ gave me the energy I needed to . . ."]
6. What's the word we've been talking about? What part of speech is the word *energy*?

Use a *Discussion* activity for follow-up. Have students discuss the sources from which they receive energy and ways that they use that energy. Have them discuss times when they feel they have a lot of energy and when they have only a little energy. As students share, make sure that they use the word *energy* in a complete sentence.



Complete Remainder of the Lesson Later in the Day



What Is Light?

1B

Extensions

20 minutes

Hands On: Light and Shadow

Note: To further reinforce the content covered in the language arts block, you may choose to coordinate with your school’s science teacher(s) to extend these kinds of hands-on activities. Additionally, you may choose to provide suggested materials at a classroom activity center.

Have students experiment with light and shadow using flashlights and various objects in the classroom. Have them work in groups to shine a flashlight on different objects and observe the shadows that are formed. Ask students to predict where the shadows will occur and how they will change when the proximity and/or location of the light source changes. Guide students to see that the closer an object is to a light source, the larger the shadow will be. Also, have them observe that the shadows that are created when a light source is above an object are shorter, and the shadows created when a light source is to the side of an object are longer.

You may choose to have students look at images that depict light sources and shadows, possibly following up by drawing an image of their own. Additionally, you may wish to provide students with a camera to take pictures at different times during the day to see the way the shadows change. You may also choose to demonstrate or allow students to demonstrate “shadow shapes” on the wall using their hands.

If possible, you may choose to take your students outside on a sunny day to observe the shadows made by various objects at various times of the day.

As students make predictions and conduct these experiments, model and encourage the use of domain-related vocabulary.




Light and Sound Log (Instructional Master 1B-1)

Copy Instructional Master 1B-1 onto chart paper. You will need to make the T-Chart large enough to fit several image cards in both columns. This may require several pieces of chart paper. Place Image Cards 1–5 under the “Light” heading.

Tell students that they are going to add to their Light and Sound Logs throughout this domain, adding information they learn after each read-aloud. Give each student a piece of paper. Have them reference the image cards on the T-Chart, write one or two sentences, and draw an illustration about something they learned in today’s read-aloud on light. Students may also write about their experiments with light and shadows, recording any predictions and outcomes.

Allow students to share their sentences and drawings with the class, encouraging them to use any domain-related vocabulary. Have students save written work in their Light and Sound Logs throughout the domain.

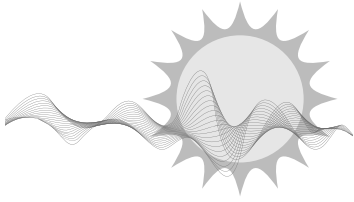
Note: If you began a KWL chart in the introduction, you may choose to update it now.

-  You may wish to have some students use Instructional Master 1B-1 to independently keep a record of phrases and images about light and sound.

Take-Home Material

Family Letter

Send home Instructional Masters 1B-2 and 1B-3.



Reflection and Mirrors

2

✓ **Lesson Objectives**

Core Content Objectives

Students will:

- ✓ Identify the sun as Earth's main source of light and name other light sources
- ✓ Identify light as a form of energy that travels in waves
- ✓ Describe how light waves travel in different mediums
- ✓ Explain how shadows are formed
- ✓ Explain how light is absorbed, reflected, or transmitted
- ✓ Describe the three types of mirrors: plane, concave, and convex
- ✓ Compare and contrast the terms *concave* and *convex*

Language Arts Objectives

The following language arts objectives are addressed in this lesson. Objectives aligning with the Common Core State Standards are noted with the corresponding standard in parentheses. Refer to the Alignment Chart for additional standards addressed in all lessons in this domain.

Students will:

- ✓ Describe Samuel's interest in the House of Mirrors and identify the reasons for his interest (RL.3.3)
- ✓ Describe what you learn about Jack's character when he says "this fish is the size of a whale" (RL.3.3)
- ✓ Determine and distinguish between the literal and figurative meanings of "this fish is the size of a whale" (RI.3.4) (L.3.5a)
- ✓ Interpret information about the way light is transmitted, reflected, and absorbed from the diagram Light Hitting Different Objects (RI.3.7)
- ✓ Through hands-on exploration of materials, conduct research that builds knowledge about light concepts in "Reflection and Mirrors" (W.3.7)

- ✓ Make personal connections to concepts related to light presented in “Reflection and Mirrors” through hands-on activities and the Light and Sound Log (W.3.8)
- ✓ Categorize objects as concave or convex (W.3.8)
- ✓ Use the known root *lum* and the newly learned word *illuminates* to determine the meaning of the unknown word *luminescent* (L.3.4c)
- ✓ Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships, to describe what happens when light hits various objects, such as *when*, *then*, *through*, *reflected*, *transmitted*, and *absorbed* (L.3.6)
- ✓ Use the graphic organizer to draw images observed in the concave and convex sides of a spoon
- ✓ Draw an illustration in the Light and Sound Log to represent a main idea or key details from “Reflection and Mirrors” or to depict a vocabulary word
- ✓ Demonstrate understanding of the literary terms *narrator*, *setting*, *dialogue*, *third person*, and *point of view* by using these words in discussing the story elements of “Reflection and Mirrors”

Core Vocabulary

Note: You may wish to display some of these vocabulary words in your classroom for students to reference throughout the domain. You may also choose to have students write some of these words in a “domain dictionary” notebook, along with definitions, sentences, and/or other writing exercises using these vocabulary words.

absorbed, v. Soaked up; added, placed, or taken into something

Example: The plant’s leaves absorbed the sunlight, which helped them grow.

Variation(s): absorb, absorbs, absorbing

angle, n. A slant; the space or shape formed when two lines or two surfaces meet in one place; the corner of something with straight sides

Example: When Toni looked into the mirror at a certain angle, she could see her brother behind her playing with his toys across the room.

Variation(s): angles

concave, adj. Curving inward; shaped like the inside of a bowl

Example: When I look into the concave side of a spoon, my image is smaller, upside-down, and strange.

Variation(s): none

convex, adj. Rounded or curving outward; shaped like the outside of a bowl

Example: The Pantheon in the city of Rome has a convex dome that bulges outward towards the sky.

Variation(s): none

mirror, n. A smooth, polished surface like glass, coated with aluminum or silver, that reflects an image of whatever is in front of it

Example: To see how he wanted to wear his new hat, Jamal looked at his image in the mirror.

Variation(s): mirrors

plane, adj. Flat or level

Example: Because they create the most accurate images, plane mirrors are used in many places such as dressing rooms.

Variation(s): none

reflected, v. Bounced back off a smooth surface


Example: The image of the clouds in the sky was reflected off the smooth, still water of the pond.

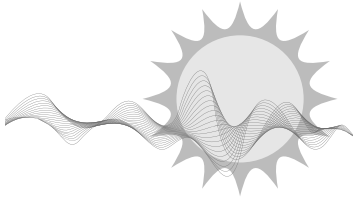
Variation(s): reflect, reflects, reflecting

transmitted, v. Sent, passed along, or spread through a material

Example: When Terran shone the flashlight through the blanket, some of the light was transmitted through the small holes in the fabric.

Variation(s): transmit, transmits, transmitting

<i>At a Glance</i>	Exercise	Materials	Minutes
<i>Introducing the Read-Aloud</i>	What Have We Already Learned?	T-Chart; Light and Sound Logs (optional)	10
	Story Elements		
	Purpose for Listening		
<i>Presenting the Read-Aloud</i>	Reflection and Mirrors	Image Cards 6–9; U.S. map; large, shiny serving spoon; makeup or shaving mirror	20
<i>Discussing the Read-Aloud</i>	Comprehension Questions	Light and Sound Logs; large, shiny serving spoon	15
	Word Work: Concave and Convex		5
 Complete Remainder of the Lesson Later in the Day			
<i>Extensions</i>	Hands On: Concave and Convex	Instructional Master 2B-1; drawing paper, drawing tools; large, shiny serving spoons; a variety of mirrors; makeup or shaving mirror; periscope; kaleidoscope (optional)	20
	Light and Sound Log	Image Cards 6–9; T-Chart; KWL Chart (optional); Light and Sound Logs	



Reflection and Mirrors

2_A

Introducing the Read-Aloud

10 minutes

What Have We Already Learned?

Ask students, “What have you been learning about?” Remind students that they have been learning about what light is and how it travels. Point to the Image Cards on the T-Chart. Ask students to share what they remember learning about light that is shown in each image.

Students may refer to the T-Chart, and you may wish to have students refer to their Light and Sound Logs as you ask the following riddles:

- I am an extraordinary kind of energy, and I travel as tiny waves. I am very fast, but you cannot see me moving. What am I? (light)
- I am a source of light. Light energy starts with me. Light waves move out from me and illuminate the area around me. Am I a shiny table, a silver watch, or the sun? (the sun) Am I the moon, a light bulb, or a mirror? (a light bulb)
- I am formed in places where all of the light doesn’t reach. Sometimes I am very dark, and sometimes only a little bit darker than what’s around me. Sometimes I take a shape similar to something nearby. What am I? (a shadow)
- I begin at a light source and travel through the air. Sometimes you can see me and sometimes you can’t. I show the way light travels in a straight line. What am I? (a ray)
- I am one of the characters in the story, and I am especially knowledgeable about light. I love to paint, and I always notice the qualities of the light and shadows. I am slowly losing my vision, or sense of sight. Who am I? (Samuel)

Story Elements

Read the following excerpt from the previous read-aloud:

“Jack, how about we go fishing tomorrow morning?” asked Samuel.

“Sounds good to me,” said Jack as he stood up to go. “As you know, I am the better fisherman. It will be a miracle, Samuel Van Lumen, if you catch a single fish!”

Ask students, “Who can tell me the difference between narration and dialogue?” Guide students to explain which parts of the excerpt are narration and which are dialogue.

Ask, “Who can tell me from what point of view this story is being told?” Tell students that this story is in the third person point of view, and remind them that they heard this point of view in the narrative *The Wind in the Willows*. Remind students that when a story is told in third person, the main pronouns used in the narration are *he, his, him, she, her, and hers*. Remind students that when a story is told in the first person, the main pronouns used in the narration are *I, my, mine, and me*. You may wish to read the first sentence of the excerpt in first person to illustrate this difference:

“Jack, how about we go fishing tomorrow morning?” I asked.

Purpose for Listening

Tell students to listen to find out more about what light does when it hits an object. Tell students to also listen to learn more about the characters and setting of this story.



Reflection and Mirrors

← Show image 2A-1: Jack walking towards Samuel and Alfie on the pier

The next morning both men were up bright and early, each one looking forward to a day of fishing. Fishing had become one of their most cherished pastimes, and they both enjoyed fishing for striped bass. They had a favorite fishing spot on the banks of the Hudson River, where Samuel arrived first.¹ There, an old, rickety, or wobbly, pier jutting out into the cool, lapping water. Nearby, a row of silver birch trees provided just the right amount of shade. There was also a picnic table. Alfie always accompanied them and frequently scared the fish away by jumping off the pier into the water.

“Hey, you beat me to it!” shouted Jack as he walked toward Samuel. Samuel was already on the pier, intently focused on attaching a large, juicy bloodworm to the hook on the end of his fishing line. Alfie was stretched out, enjoying the sun and the gentle breeze that was blowing across the Hudson River Valley.

“Just got here myself!” yelled back Samuel. “I hear the fish are jumping right onto the line!”

“Well, they’ll miss your line, for sure!” bellowed Jack. Then he laughed loudly to himself.

Samuel smiled at his friend and shook his head.

“If you continue to yell like a wild bear, you’ll scare away every living creature, including the fish,” said Samuel.

“Ahh, the fish can’t hear me!” retorted Jack.²

← Show image 2A-2: Samuel and Jack sitting on end of pier fishing

For several minutes the two men were silent. Samuel finished attaching the worm to the hook on the end of his line. Then he cast his line out into the smooth, glass-like surface of the Hudson River and plonked himself down on the edge of the pier.

1 [Point to the Hudson River on a U.S. map. Guide students to understand that the overall setting of this story is New York.]

2 Sometimes when people begin to lose their hearing, they speak more loudly because they can’t hear themselves as well.



3 [Point to the Adirondack Mountains and the Hudson River on a U.S. map.]

“You know, Jack,” said Samuel, “the Hudson River is 306 miles long and begins in the Adirondack Mountains in a lake called the “Tear-of-the-Clouds.”³

“I did know that,” replied Jack, as he, too, hooked the fish bait and cast his line out into the water. Then, sitting down beside Samuel, Jack said, “Tell me something I don’t know.”

For a long while Samuel gazed out at the glistening river. His old eyes were admiring the view of the sunlight dancing across the water.



← **Show Image 2A-3: Light hitting different objects**

“Going back to what we were talking about yesterday about light waves,” said Samuel, “did you know that when a light wave hits an object, three things can happen? The light can be **transmitted**, or passed through the object. The light can also be **reflected**, or bounced back off that object; or the light can be **absorbed**, or soaked up into it. This is determined by the type of object that the light wave hits. Sometimes the light does a combination of these things.”⁴

4 [Point to the objects in the image and have students discuss which are transmitting and reflecting light (eyeglasses, glass), and which are absorbing light. (tackle box)]

“Hmm,” Jack responded.

“Take reflection, for example,” continued Samuel eagerly. “Most of the light that reaches our eyes is reflected light. You see, apart from objects that produce their own light, such as the sun or a light bulb, all other objects are visible because light waves from a source bounce off them and into our eyes,” explained Samuel.

“If you recall, Samuel Van Lumen, I *did* go to school. For most of the time we were in the same class,” said Jack somewhat grumpily. “I remember learning about bioluminescent creatures such as lightning bugs. If I recall correctly, they produce their own light.”⁵

5 [Show Image Card 6 (Firefly).] This is a bioluminescent firefly. Say the word *bioluminescent* with me. What word part do you hear that is also in the word *illuminates* and in Samuel Van Lumen’s name? That’s right—*lumen*, which means light. The prefix *bio-* means life. *Bioluminescent* means a living thing that produces its own light.

“Yes!” exclaimed Samuel, laughing as he spoke. “It seems that as my eyes begin to fail me, I appreciate even more the things I am able to see. The science of light is really quite fascinating.”

“I’m sure it is,” shouted Jack. “However, I hope you’re not going to talk all day. That’s why you never catch any fish, you know!”



← **Show image 2A-4: Alfie staring at his reflection**

Samuel smiled at Jack and continued to talk anyway. “You see, when light hits a surface, some of the light bounces off the surface. It is the light that bounces off the surface that we call reflected light. Most objects reflect some light. In fact, you are reflecting some light right now, Jack; otherwise, I wouldn’t be able to see you,” explained Samuel. “Not that my eyes let me see a whole lot these days!” he added.

Jack glanced over at Alfie, who was staring at his reflection in the still water. Jack laughed and said, “Look at the way the smooth water is reflecting a perfect image of Alfie—just like a **mirror!**”⁶

At that moment Jack stood up to check on his line. “Hmm, I thought I sensed something nibbling, but there’s nothing there,” he said.

“When I was young,” Samuel mused, “I often wondered why we’re able to see our reflection in some things but not in others.”

Jack laughed. “We wondered a lot of things when we were young. I still wonder some of those things!”

← **Show image 2A-5: Jack and Samuel as kids in Mr. Benson’s class**

“Do you remember,” asked Samuel, “when our third grade teacher, Mr. Benson, brought a mirror and a piece of wood into class to explain how light is reflected off a surface? He showed us that when the surface of an object is perfectly smooth and shiny, like that of a mirror, light rays hit all parts of the surface of that object at the same **angle**. Therefore, light rays reflected by that object bounce back off it at the same angle and produce a clear and accurate reflection.”

Jack nodded, “I remember Mr. Benson well.”

“However,” Samuel continued, “when the surface of an object is not perfectly smooth and shiny, like that of a piece of wood, light rays hit different parts of it at different angles. Therefore, some light rays are absorbed by that object, and some are reflected by that object at different angles, so it does not produce a reflection.”

6 [Show Image Card 7 (Plane Mirror).]





← **Show image 2A-6: Alfie jumping off the pier; men laughing**

“Mr. Benson was one of my favorite teachers,” said Jack.

“Yep! He was one of my favorite teachers, too,” agreed Samuel. “I remember him explaining that because they are so smooth, mirrors reflect almost all the light that hits them.”

“Have you noticed that crazy dog of yours?” Jack asked. “He’s still staring at his reflection in the smooth, shiny surface of the water.”

“He does that,” explained Samuel.

Both men laughed loudly. The sound of their laughter seemed to act as a trigger for Alfie. He looked at them, wagged his tail, and then jumped headlong into the river.

“Don’t go too far out there, Alfie!” yelled Samuel, as if he was talking to a young child.

The two men stood up to check their lines and then returned to their chairs. Samuel continued to keep a watchful eye on Alfie, whose head was just visible above the water. He noticed that the water was now full of ripples, making the reflections in the water wavy and distorted.⁷

7 [Show Image Card 8 (Distorted Reflection in Moving Water).] Notice how the rippled water in this image produces a distorted, or unclear, image.



← **Show image 2A-7: Old mirror and new mirror**

“I remember that day John O’Connor brought a really old mirror into class,” recalled Jack. “It was his grandmother’s mirror, and we couldn’t see ourselves that well in it. Mr. Benson compared it to a modern mirror, the back of which was coated with a silvery material. The modern mirror could reflect almost all the light that hit it.”

“Yes,” said Samuel, “and Mr. Benson told us that most mirrors have flat surfaces and are called **plane** mirrors.”⁸

8 [Show Image Card 7 (Plane Mirror) again.]



← **Show image 2A-8: Samuel’s face in spoons**

“Mr. Benson also taught us about two other types of mirrors that have curved surfaces instead of flat surfaces: **concave** and **convex**,” recalled Samuel.

“Oh, I remember,” said Jack. “We had to draw two portraits of ourselves: one portrait was a concave image, and the other was a convex image. I remember that I borrowed my mother’s silver spoons and brought them to school.”

“That’s right!” exclaimed Samuel excitedly. “That experiment was a lot of fun!”

Jack went on, “Now let me see—concave and convex mirrors reflect light in such a way that they alter, or change, the view we see in them.⁹ A concave mirror curves inward, and produces a smaller upside-down image of an object, but only if it is a certain distance away from the viewer.”

“Yes,” added Samuel, “but if an object is very close to a concave mirror, its reflection will be upright and magnified! Do you remember how Mr. Benson showed us how you could put a pencil point right up into the “cave” of the spoon and see it upright and magnified?”¹⁰

Jack nodded and continued. “Convex mirrors curve outward, and always produce a smaller, upright image, as when you look into the convex side of the spoon.”¹¹

Samuel laughed out loud. “Did you actually learn something in school, Jack Audire? I seem to recall that you were always talking, especially when Mr. Benson was talking!”

“Oh, I learned a thing or two,” protested Jack, “and I’ll have you know—”

Suddenly Jack leapt out of his chair. “Jumping jelly beans! I think I’ve caught a fish!” he yelled.

9 [Show the two sides of a large serving spoon as you read the following sentences. Then point to the left (concave) spoon in the image.]

10 [Demonstrate for students how you can hold a pencil point inside the concave side of the spoon.] Later you will have a chance to try this activity on your own and you will be able to see the reflection up close.

11 [Point to the right spoon in the image and show Image Card 9 (Convex Mirror).] A convex mirror bulges outward and makes it easier to see the surrounding area. Why do you think it is helpful for school buses to have convex mirrors?



← **Show image 2A-9: Jack struggling with fishing line**

Almost at once Jack began to wrestle with his fishing pole.

“It’s a big one, Samuel!” screeched Jack as he struggled to hold onto his fishing pole and not fall headfirst into the river.

“If you stand still, you’ll stand a better chance of reeling it in,” advised Samuel.

“Stand still? Stand *still*?” shrieked Jack as he battled with the creature on the end of the line. “This fish is the size of a *whale*! How am I supposed to stand *still*?”¹²

For several minutes Jack appeared to do a dance on the end of the pier with a fishing pole. Finally, Samuel had the good sense to take a closer look at the creature that Jack was attempting to catch.

“Hold on a minute, Jack! Stop wrestling with that line. You’ve hooked Alfie by the collar! The poor dog is trying to free himself, and you keep trying to reel him in!” laughed Samuel.

“That darn dog should be banned from coming fishing with us! He’s more trouble than he’s worth!” roared Jack.

← **Show image 2A-10: Samuel taking pictures of Jack and his catch**

“Hold on, hold on. Let me get my camera!” shouted Samuel. I want to get a photograph of the day Jack Audire hooked himself a live springer spaniel!”

Moments later, having been unhooked by Jack, an extremely wet Alfie stood happily wagging his tail beside Jack, while Samuel busied himself taking photographs of the two of them.

“Get away from me, you darn dog,” muttered Jack as Alfie shook himself dry.

Samuel laughed aloud as he continued to capture photographic images of his two best friends.

“If you don’t put that camera away right now, you’ll be as wet as that silly dog!” announced Jack.

“Okay,” laughed Samuel. “Time for lunch, I think.”

12 Does Jack really think the fish on his line is as big as a whale? Why does he use this expression?





← **Show image 2A-11: Samuel and Jack having a picnic**

The two friends shared some chicken and coleslaw while Alfie lay in the sun to finish drying off.

“I’m glad I had my camera with me,” Samuel said between mouthfuls as he arranged the parts of his camera on the picnic blanket. “Did you know that some cameras contain plane mirrors that make it possible to see the image you are about to photograph?”¹³

“Yeah, well, you certainly didn’t need to record that image of me hooking Alfie,” grumbled Jack, offering a piece of chicken to Alfie.

Samuel laughed as he began to pack up the picnic basket. “Well, you’ve obviously forgiven him. Did I tell you that we are taking Amy to the fair tomorrow?”

“We?” exclaimed Jack.

“Yep! That was the deal,” explained Samuel. “I told her that if she made me some chocolate cake, I’d take her to the fair.”

“Me, too?” shouted Jack, a little less grumpily.

“You’re going to eat some cake, aren’t you?” Samuel yelled back.



“Well, okay then, but you’re not going to make me go on those bumper cars again, are you?” asked Jack.

“No,” said Samuel with a smile. “This time I thought we would try the House of Mirrors.”



Comprehension Questions

15 minutes

If students have difficulty responding to questions, reread pertinent passages of the read-aloud and/or refer to specific images. If students give one-word answers and/or fail to use read-aloud or domain vocabulary in their responses, acknowledge correct responses by expanding the students' responses using richer and more complex language. Ask students to answer in complete sentences by having them restate the question in their responses. **It is highly recommended that students answer at least one question in writing and that some students share their writing as time allows.** For written responses in this domain, students will use their Light and Sound Logs to collect source material for longer writing pieces and as preparation for written responses in the Domain Assessment.

1. *Inferential* What is the setting of this part of the story? (The setting is in the summer in the state of New York along the Hudson River.) From what point of view is this story being told? (It is told in third person by a narrator.) How do you know? (The pronouns in the narrative sections are the words *he*, *his*, and *him* instead of *I*, *mine*, *my*, and *me*.)
 2.  *Literal* You heard Samuel explain to Jack that when rays of light waves hit an object, they can be transmitted, reflected, or absorbed. What do these terms mean? (When light hits an object and passes through it, it is transmitted; when light hits an object and bounces back off it, it is reflected and creates a reflection; when light hits an object and is soaked up into it, it is absorbed and a shadow is created behind the object.)
 3.  *Inferential* What causes light to reflect off water, glass, and other smooth and shiny objects? (Rays of light waves hit all parts of smooth, shiny objects at the same angle and are then reflected off them at the same angle, creating a clear reflection.)
- ← **Show image 2A-3: Light hitting different objects**
4. *Evaluative* Why can't you see your reflection in a rough surface like a piece of wood? (Light rays hit different parts of the wood and many are absorbed. They do not reflect back at the same angle, so there is not a reflection.)



5.  *Inferential* What is a mirror? (A mirror is a smooth, polished surface like glass that reflects light and produces an image.) You heard Samuel tell Jack that there are three types of mirrors: plane, convex, and concave. [Show the two sides of a spoon as a guide for the terms *concave* and *convex*.] How would you describe each? (A plane mirror is flat and accurate, a concave mirror is curved inward like a cave, and a convex mirror is curved outward, towards you.)
6.  *Evaluative* Based on the information in the story so far, why do you think Samuel wants to visit the House of Mirrors? (Samuel is interested in the extraordinary science of light and the important part it plays in his art. He has already explained what causes light to reflect off smooth, shiny surfaces. By visiting the House of Mirrors, he will be able to demonstrate to Jack and the children the different ways that mirrors of various designs reflect light.)
7. *Evaluative* You heard Jack tell Samuel, “This fish is the size of a *whale!*” What does this descriptive statement make you think about Jack’s character? Does it make the story and/or character more dramatic or humorous? (Answers may vary, but may include some of the following: The words help the reader to visualize or “see” this scene. By Jack saying that the fish is as big as a whale, the reader knows that there is something very large or heavy on the end of Jack’s fishing line. Because it’s unlikely to be a whale, this makes Jack’s words kind of funny. The author is also making the point that Jack has a tendency to exaggerate.)

I am going to ask a question. I will give you a minute to think about the question, and then I will ask you to turn to your neighbor and discuss the question. Finally, I will call on several of you to share what you discussed with your partner.

8. *Evaluative Think Pair Share:* How many items can you find in the classroom that are reflective? Why are they reflective? (Answers may vary, but should include that reflective objects have smooth, shiny surfaces that produce reflections.)

Note: You may wish to have students keep a list of the reflective and nonreflective objects they discover in the classroom throughout the domain.

9. After hearing today's read-aloud and comprehension questions and answers, do you have any remaining questions?
- ✈ You may wish to allow time for individual, group, or class research of the text and/or other resources to answer any remaining questions.

Word Work: Concave and Convex

5 minutes

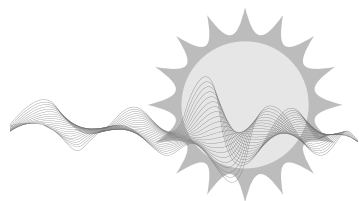
1. In the read-aloud, you heard Samuel say to Jack, "Mr. Benson also taught us about two other types of mirrors that have curved surfaces instead of flat surfaces: *concave* and *convex*."
2. Say the words *concave* and *convex* with me.
3. If you are looking at something concave, it is bent or curved inward; if you are looking at something convex, it is rounded and curved outward.
4. Every morning, I pour my cereal into a concave bowl. If I turn my bowl upside-down, the outside that is now facing me is convex.
5. Can you see some things in the classroom that are concave and convex? What other things have you seen that are concave or convex? Be sure to use the words *concave* and *convex* when you tell about them. [Ask two or three students. If necessary, guide and/or rephrase the students' responses to make complete sentences: "I saw a concave _____" or "_____ is convex . . ."]
6. What are the words we've been talking about? What part of speech are the words *concave* and *convex*?

Use a *Making Choices* activity for follow-up. Tell students that the words *concave* and *convex* are antonyms because they have opposite meanings. Directions: I am going to name several things. If what I name is concave, say, "That is concave." If what I name is convex, say, "That is convex."

1. a dent in a car (That is concave.)
2. a dome, looking at it from the outside (That is convex.)
3. a dome, looking at it from the inside (That is concave.)
4. the Roman Colosseum, looking down into it (That is concave.)
5. a bowl, looking into it (That is concave.)
6. a bowl, looking at it turned upside down (That is convex.)
7. the rounded top of a light bulb (That is convex.)



Complete Remainder of the Lesson Later in the Day



Reflection and Mirrors

2_B

Extensions

20 minutes

Hands On: Concave and Convex (Instructional Master 2B-1)

Note: To further reinforce the content covered in the language arts block, you may choose to coordinate with your school's science teacher(s) to extend these kinds of hands-on activities. Additionally, you may choose to provide suggested materials at a classroom activity center.

Have students form several groups. Give each group Instructional Master 2B-1, a large serving spoon, and drawing tools. Tell students that they are going to repeat the experiment that Samuel and Jack did together in Mr. Benson's third-grade class. First, have students observe their reflections in the convex side of the spoon and draw what they see in the first oval of the worksheet. Next, have students observe their reflections in the concave side of the spoon and draw what they see in the second oval. Discuss with students the differences between the upside-down concave image and the upright convex image. You may wish to have students record other observations on the back of their paper, including the reflection of the pencil point when it is placed close to the concave side of the spoon.

If possible, provide a variety of mirrors with which students can experiment. You may wish to have students experiment with holding other kinds of concave mirrors at various distances to see if the reflection changes from upside-down to upright. Discuss with students how a shaving mirror or a cosmetic mirror produces an upright image. Observe that this is similar to the pencil point reflection, and unlike the upside-down reflection of a face seen in the concave side of most spoons.

You may be able to find or purchase a periscope or kaleidoscope for students to examine. Discuss the purpose of these tools and toys. Help students understand the ways in which the mirrors work to reflect an image.

As students complete this exercise, model and encourage them to use domain-related vocabulary.



Light and Sound Log

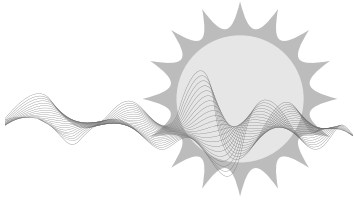
Place Image Cards 6–9 on the T-Chart. Give each student a piece of paper. Have them reference the image cards on the T-Chart and write one or two sentences and draw an illustration about something they learned in today’s read-aloud about light.

Students may also write about their experiment with concave and convex reflections, recording any predictions and outcomes.

Allow students to share their sentences and drawings with the class, encouraging them to use any domain-related vocabulary. Have students save written work in their Light and Sound Logs throughout the domain.

Note: If you began a KWL chart in the introduction, you may choose to update it now.

- You may wish to have some students complete Instructional Master 1B-1 independently.



Refraction and Lenses

3

✓ **Lesson Objectives**

Core Content Objectives

Students will:

- ✓ Identify light as a form of energy that travels in waves
- ✓ Describe how light waves travel in different mediums
- ✓ Explain how light is absorbed, reflected, or transmitted
- ✓ Describe the three types of mirrors: plane, concave, and convex
- ✓ Compare and contrast the terms *concave* and *convex*
- ✓ Compare and contrast transparent, translucent, and opaque objects
- ✓ Describe how mirrors and lenses are used in a variety of instruments
- ✓ Explain how light is refracted

Language Arts Objectives

The following language arts objectives are addressed in this lesson. Objectives aligning with the Common Core State Standards are noted with the corresponding standard in parentheses. Refer to the Alignment Chart for additional standards addressed in all lessons in this domain.

Students will:

- ✓ Interpret information about the way each lens bends light in the diagram *Convex and Concave Lenses* (RI.3.7)
- ✓ Through hands-on exploration of materials, conduct research that builds knowledge about light concepts in “Refraction and Lenses” (W.3.7)
- ✓ Make personal observations of the refraction of light when looking at a straw in a glass of water and connect this experience to the description and explanation in the text (W.3.8)
- ✓ Make personal connections to concepts related to light presented in “Refraction and Lenses” through hands-on activities and the Light and Sound Log (W.3.8)

- ✓ Categorize objects as transparent, translucent, or opaque (W.3.8)
- ✓ Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships, to describe what happens when light hits various objects, such as *then, through, reflected, transmitted, absorbed, bent, refracted, and scattered* (L.3.6)
- ✓ Draw an illustration in the Light and Sound Log to represent a main idea or key details from “Refraction and Lenses” or to depict a vocabulary word
- ✓ Demonstrate understanding of the literary terms *setting, character, and point of view* by using these words in discussing “Refraction and Lenses”

Core Vocabulary

Note: You may wish to display some of these vocabulary words in your classroom for students to reference throughout the domain. You may also choose to have students write some of these words in a “domain dictionary” notebook, along with definitions, sentences, and/or other writing exercises using these vocabulary words.

binoculars, n. A tool made of a pair of tubes with lenses, or curved pieces of glass, at both ends that allows someone to better see something that is far away

Example: Jay used his binoculars to see the bird on the other side of the lake more clearly.

Variation(s): none

instruments, n. mechanical or electronic tools designed and used for specific purposes

Example: In her science class, Gracie is learning how to use different instruments such as the microscope.

Variation(s): instrument

lens, n. A specially curved piece of glass or plastic used in tools and instruments such as glasses, cameras, binoculars, etc., that makes an object seem larger and closer by focusing rays of light together; or that makes an object seem smaller and farther away by spreading rays of light apart

Example: Benny forgot to uncover his camera lens before taking any pictures, so all of his pictures turned out black.

Variation(s): lenses

microscopes, n. Instruments that use lenses, or curved pieces of glass, to magnify objects so they appear larger and easier to see

Example: By using microscopes, scientists can see microscopic objects, such as germs, that they could not see with just their own eyes.

Variation(s): microscope

opaque, adj. Describes a material that absorbs light and prevents it from shining through; not transparent

Example: Because it was covered by a piece of plywood, the normally transparent or see-through window was opaque because no light could shine through it.

Variation(s): none

refraction, n. The act of light changing direction or bending as it travels through different objects or substances

Example: When Julia placed her pencil into a glass of water, she was amazed to see that the pencil appeared to bend due to refraction.

Variation(s): refractions

telescopes, n. Instruments constructed from long tubes with lenses, or curved pieces of glass, at each end that allow people to see distant objects such as stars and planets

Example: On a clear night, Aisha and her father looked through their telescopes to see Mars and the rings of Saturn.

Variation(s): telescope

translucent, adj. Describes an object that allows some light to pass through, so that you are able to see the form of an object but not a clear image


Example: Javier could see light and the shapes of trees through the frosted glass windows, but the images were blurry.

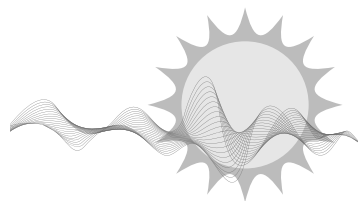
Variation(s): none

transparent, adj. Describes an object that is clear, allowing most light to pass through for a clear view of what is on the other side

Example: Maria could see the snow falling on the ground through the transparent window in her bedroom.

Variation(s): none

<i>At a Glance</i>	Exercise	Materials	Minutes
<i>Introducing the Read-Aloud</i>	Story Elements		10
	What Have We Already Learned?	T-Chart; Light and Sound Logs (optional)	
	Observation and Inquiry	Image Card 12; drinking glass, water, straw	
	Purpose for Listening		
<i>Presenting the Read-Aloud</i>	Refraction and Lenses	Image Cards 10–15	20
<i>Discussing the Read-Aloud</i>	Comprehension Questions	T-Chart; Light and Sound Logs	15
	Word Work: Opaque, Translucent, and Transparent		5
 Complete Remainder of the Lesson Later in the Day			
<i>Extensions</i>	Hands On: Reflection, Refraction, and Lenses	flashlight(s); variety of opaque, translucent, and transparent objects; variety of lenses; variety of instruments with lenses; straw(s); glass(es) of water	20
	Light and Sound Log	Image Cards 10–15; T-Chart; KWL Chart (optional); Light and Sound Logs	



Refraction and Lenses

3_A

Introducing the Read-Aloud

10 minutes

Story Elements

To review the narrative elements of this story, ask the following questions:

- Who are the characters so far in this story?
- What is the setting of this story?
- From which point of view is this story told?

What Have We Already Learned?

Point to the image cards on the T-Chart, and review the concepts learned about light in the previous lesson. You may also wish to have students refer to their Light and Sound Logs. You may wish to ask the following questions:

- What are light waves, and how do they travel?
- What does it mean for light to be transmitted, absorbed, or reflected?
- What are the three types of mirrors? Describe each.

Observation and Inquiry

Show students a plain, clear drinking glass filled with water. Place a colored plastic drinking straw into the water. Ask students to look closely at the straw from different angles. You may wish to show students Image Card 12 (Refraction). Allow students to describe what they observe. Observations may include that the straw appears bent, magnified, and separated at the water line. Ask students, “What do you think is happening to cause the straw to look the way it does?”

Share with students that certain substances have the ability to bend light and distort the image that we see. Ask students to think of other situations in which they have observed light bend. Guide students to think about the way images are sometimes distorted in swimming pools or aquariums. Tell students that sometimes inventors design and build special tools or instruments that use lenses and mirrors to bend light in useful ways. Ask students if they can think of any instruments that bend light.

Purpose for Listening

Tell students to listen carefully to learn more about light, how it bends, and how some familiar tools and instruments bend light in interesting and useful ways.



1 [Show Image Card 10 (Rays of Sunlight in Forest), and have a volunteer point to the rays of sunlight.]



Refraction and Lenses

← Show image 3A-1: Samuel walking in woods with Alfie

The next day Samuel was up bright and early. He had begun the day by painting in the garden, but as his eyes grew tired, he decided to put down his paintbrush and go for a walk in the woods with Alfie. Samuel loved to observe the perfectly straight shafts of light as they burst through the tree canopy into the woodland.¹

← Show image 3A-2: Children walking toward their grandfather

Later, when they had returned from their walk, Samuel passed several hours scrapbooking photographs of his grandchildren. Before he knew it, it was late in the afternoon.

“Grandad, Grandad, we’re here!” came the sound of two young voices.

“We!” replied Samuel joking. “How come there are two of you?”

Two smiling children walked toward Samuel as he sat in his favorite armchair. One of the children was a girl about eleven years of age. She was tall and skinny and had braided brown hair. Her face was awash with freckles. She was carrying a large chocolate cake. The other child was a boy about eight years old. He, too, had brown hair, and he wore a bright red T-shirt that said “Save Trees. Avoid Homework.” It was obvious that they were brother and sister. They were two of Samuel’s four grandchildren.

“Mom walked us to the garden gate. She says she’ll stop by later for dinner, after we’ve been to the fair. She’s going to bring us a meatloaf that she made,” said the girl, whose name was Amy.

Samuel grimaced.

“Mom says she knows you don’t like meatloaf, but you have to eat it anyway because it’s good for you!” said the boy who was clearly missing his two front teeth.

“Oh, she does, does she?” replied Samuel.

“Yep!” said the boy.

“How come you’re here?” said Samuel laughing. “Did you make that chocolate cake?”

The boy, whose name was Ethan, smiled boldly. “I didn’t make it, but I was the one who said it should be a double chocolate cake, and not just chocolate,” explained Ethan.

“Oh, well, I guess that’s a good enough reason for you to come to the fair with Amy and me,” said Samuel, teasing his grandson.

“Let’s go put the cake in the kitchen!”



← **Show image 3A-3: Samuel and children at kitchen table**

In the kitchen Samuel poured two glasses of ice cold water and placed a striped straw in each glass. “Have a cold drink before we go,” Samuel instructed.

Moments later they heard the sound of a very loud voice.

“Samuel!” yelled Jack. “You need to do something about that dog. He’s run off with my hat again!”

Samuel and the children burst out laughing.

At that moment Jack appeared in the kitchen looking a little flustered. “Why, if it isn’t my two favorite children!” Jack exclaimed.



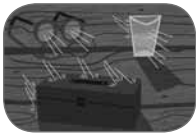
← **Show image 3A-4: Observing straw in glass**

Samuel poured two more glasses of water and joined his guests at the kitchen table. All four sat and chatted and sipped their drinks.

“Grandpa,” said Ethan, “Why does it look like the straw is separated where it meets the water? See, the part of the straw in the water is magnified and looks like it’s bent!”

“That’s a really good question, Ethan,” replied Samuel eagerly. “Well, where should I begin?”

“This could take a while,” warned Jack, smiling the tiniest bit.



← **Show image 3A-5: Transparent, translucent, and opaque objects**

“You may have learned by now that light can be transmitted, or passed through some objects, but not others,” began Samuel. “Objects that most light can pass through, such as eyeglasses or an empty glass, are called **transparent**, and objects that light cannot pass through, such as a tackle box or Jack’s hat, are called **opaque**.”

“My hat’s been called worse!” Jack shouted.

Amy and Ethan giggled.

“What about objects that some light can go through, like frosted glass and tracing paper?” asked Amy. “I think there’s a name for those, too.”

“Yes,” said Samuel, “Those objects are called **translucent**. They let a little bit of light pass through, and it scatters or spreads out, causing the objects you see through them to look fuzzy.”²

“Cool!” exclaimed Ethan. “We’re about to start learning all this stuff in third grade.”

“Yeah, it is cool,” joined in Amy. “And now you’ll be a little ahead, Ethan!”³

“You may have also learned,” continued Samuel, “that when light waves travel through different transparent substances, such as through the air and then through a drinking glass, or through a glass and then through the water, they change speed,” explained Samuel.

Amy nodded. “I remember learning that when a light wave suddenly changes speed, it quickly changes its direction and looks like it’s bending. That’s why when you look into a river and see fish, they seem closer to the surface than they actually are.”

“Does that apply to dogs, too?” yelled Jack, remembering catching Alfie.

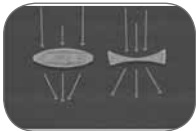
The children looked at Jack with puzzled expressions.

“Oh, it’s a long story,” said Samuel, laughing.

2 What substance shown in the image is translucent, letting some light pass through? (the lemonade) [Show Image Card 11 (Translucent Stained Glass).] Artists use the translucent qualities of stained glass to create beautiful windows.

3 [Show Image Card 12 (Refraction) as you read the next few paragraphs.]

4 A lens is a curved, transparent piece of glass. Concave and convex lenses are shaped like concave and convex mirrors, but they have a different function. You look *at* a mirror but *through* a lens.



5 [Show Image Card 13 (Instruments That Use Lenses), and have a volunteer point to the instruments.] Microscopes and magnifying glasses help us to see tiny objects by magnifying them, and telescopes and binoculars help us to see objects that are far away.

6 [Show Image Card 14 (Eyeglasses).] Concave lenses are also used in eyeglasses to help nearsighted people see faraway images more clearly.

“To return to your question, Ethan, that’s exactly why a straw standing in a glass of water appears to bend or even break apart as it enters the water. This sudden change of speed and direction of the light wave is called **refraction**.”

“Refraction?” repeated Ethan.

Samuel nodded and continued. “In fact, the refraction of light is how a concave or convex **lens** works in many **instruments**, or tools, that we use.”⁴

← **Show image 3A-6: Convex and concave lenses**

Samuel went on, “A convex lens curves outward so that it is thicker in the middle than at the edges. Rays of light passing through a convex lens are forced to change direction and move toward each other, making things look bigger if they are close enough to the lens. Convex lenses are used in instruments such as **microscopes**, magnifying glasses, **binoculars**, **telescopes**, and cameras.”⁵ The lenses in my eyeglasses are convex to help me see close images better when I’m painting.”

Samuel continued, “On the other hand, a concave lens curves inward like a cave and is thinner in the middle than at the edges. Light rays passing through a concave lens are forced to change direction and move away from each other, making things look smaller. Cameras use lenses to focus the light rays inside the camera to record an image. Lenses are also used in security cameras and peepholes that are in some doors to help the background view look wider and easier to see.”⁶

“I don’t want to interrupt your lecturing, Samuel, but I’ve heard it’s going to be busy at the fair tonight, so we should get going,” said Jack as he finished his drink.

“Good point, Jack. We’d better get ourselves out of here.”

“Yay!” yelled Ethan excitedly. “I want us all to go on the chair-o-planes!”

“We’ll have to see about that,” replied Jack. “I need to be able to walk home from the fair in one piece, not a million, zillion pieces!”



The two children laughed at Jack, and then Ethan ran off to rescue Jack's hat from Alfie.

← **Show image 3A-7: Everyone at fair eating cotton candy**

Fifteen minutes later, having arrived at the fair, they promptly bought a roll of tickets for various rides, as well as four helpings of cotton candy. They stood together for a short time, eating the sweet cotton candy and observing all the fun of the fair.

Finally, Amy asked, "What should we do first?"

"I have a special request," said Samuel. "I have been teaching Jack about the science of light. I have promised him a trip to the House of Mirrors."

"It was more like a threat," retorted Jack.

The two children laughed at Jack's grumpy reply.

"The House of Mirrors is so much fun!" exclaimed Amy.

"Let's go!" cried Ethan, as he grabbed his grandfather's hand. And with that, the four of them made their way toward the giant red, white, and blue sign that said "Welcome to The House of Mirrors."



← **Show image 3A-8: Everyone standing in front of distortion mirrors**

A man dressed like a clown stood at the entrance. He smiled and took their tickets. Upon entering the partly wooden, partly tented structure, they discovered an array, or selection, of distortion mirrors.⁷ As they stood in front of each mirror, they witnessed a variety of optical illusions.

"I have a head shaped like a giant melon," pronounced Jack.

"This is so cool," said Ethan eagerly, looking into the mirror that had convex and concave parts. "Look, I'm really tall and skinny."

"I'm short and really, really wide," exclaimed Amy, looking at her reflection in the mirror.

"How is this possible?" asked Ethan, as he observed his new shape.

"Well," began Samuel, "I'm glad you asked that question, Ethan."

7 [Show Image Card 15 (Distortion Mirror).] This mirror has both concave and convex parts.

“Oh no, I sense another speech,” said Jack. And with that, Jack walked toward the entrance to the mirrored maze.

“You’re going to miss my talk,” said Samuel as he watched Jack walk away.

“That’s fine with me,” Jack replied.

“Actually it’s a very simple concept,” explained Samuel, ignoring Jack’s comment. “Mirrors are made of reflective material. Each one of these mirrors has a different shape. Depending on the shape of the mirror, it can be used to bring light rays together, or spread them apart. Some of these mirrors have concave and convex parts, some are slightly twisted, and some are even folded.” Samuel continued, “Generally, convex mirrors make images look smaller, whereas concave mirrors can make images look larger. When you put them together, you get some really funny shapes!”⁸

“So, different mirrors do different things,” said Ethan, who had been listening intently to his grandfather.

“Yes! For example,” continued Samuel, “a convex mirror, like the ones on the sides of your school bus, curve outward so that rays of light striking them are forced to change direction and move away from each other, making distant things look smaller and the background wider.⁹ This allows the bus driver to see more area around the bus. Objects very close to these mirrors may look wider and distorted.”

“Cool,” exclaimed Ethan.

“It is cool,” Samuel agreed. “In comparison, a concave mirror—like the large makeup mirror your mother has or the shaving mirror your father has—curves inward so that light rays hitting it are forced to change direction and move toward each other, making things look larger,” explained Samuel.

“I get it! I get it!” exclaimed Amy happily. “When light strikes either a concave or a convex mirror, it is reflected in different ways at different angles.”

8 What type of mirror is flat and has as accurate a reflection as possible? (plane) Is the flat mirror on the bathroom wall a concave, convex, or plane mirror?

9 [Point to Image Card 9 (Convex Mirror) on the T-Chart.]



“Right on the button!” said Samuel. “Light reflects differently in each mirror in such a way that it alters the view. The waves of light provide a clear, but altered, image.”

← **Show image 3A-9: Everyone in the mirrored maze**

“Hey, you guys, I’m kind of lost in here!” called a very loud voice. It was Jack. “So any time you’re ready, I’d welcome being rescued.”

The children laughed out loud.

“Well, you did go wandering off!” yelled back Samuel. “Hold on! Hold on! We’re on our way.”

Samuel and his grandchildren made their way toward the entrance to the mirrored maze. The maze was a series of narrow, mirrored corridors. The trick was to find an opening into a new corridor, and if you followed the path correctly, you would eventually find your way out. However, because the walls were made entirely out of framed mirrors, it was difficult to find the openings, and people had been known to walk round and round for a very long time.

Eventually Samuel, Amy, and Ethan found Jack. They basically followed the sound of his very loud complaints. Once they were all together, they put Ethan in charge of finding the way out. It didn’t take him long to figure out the way to the exit.



← **Show image 3A-10: Everyone enjoying ice cream**

Once out of the maze, they spent the rest of the evening enjoying the fun of the fair. The children went on a variety of rides. They also ate ice cream and promised not to tell their mom that they had had dessert before dinner. Finally it was time to go. Samuel had promised his daughter Anna that the children would be home in time for dinner.

“Time to go, children,” said Samuel softly.

“Oh, granddad!” exclaimed Ethan. “We haven’t been on the chair-o-planes. Please can we go on them? Please!” pleaded Ethan.

“What do you say, Jack? Are you up for a little ride through the cool evening air?” said Samuel.

“Samuel, if I don’t make it back alive, are you prepared to feed my fish?” yelled Jack.

“No problem! I’ll take real good care of them,” replied Samuel calmly.

“Okay then, let’s do it!”



← **Show image 3A-11: Everyone swinging in chair-o-planes**

They reached the chair-o-plane ride just as it had stopped. They found four chairs all in a row and seated themselves. They fastened the chain across the front of the seat and waited for the ride to begin.

Several minutes later they began to move through the air in perfect circles. Slowly they rose higher and higher into the air as fairground music began to play. Samuel and Jack looked at the children’s eager faces and smiled with content.¹⁰

10 Samuel and Jack feel content at the end of their day at the fair. What are some synonyms of the word *content* that you can use to describe these characters? (*happy, peaceful*)


Discussing the Read-Aloud

20 minutes

Comprehension Questions

15 minutes

If students have difficulty responding to questions, reread pertinent passages of the read-aloud and/or refer to specific images. If students give one-word answers and/or fail to use read-aloud or domain vocabulary in their responses, acknowledge correct responses by expanding the students’ responses using richer and more complex language. Ask students to answer in complete sentences by having them restate the question in their responses. **It is highly recommended that students answer at least one question in writing and that some students share their writing as time allows.** For written responses in this domain, students will use their Light and Sound Logs to collect source material for longer writing pieces and as preparation for written responses in the Domain Assessment.

1. *Literal* Where do the characters go in today’s story? (the carnival, or fair)
2.  *Evaluative* What is the difference between a transparent object and an opaque object? (Transparent objects allow light to pass through, and opaque objects do not.) Can you name an example of a transparent object? (Answers may vary, but may include glass, a window, etc.) Can you name an example of an opaque object? (Answers may vary, but may include metal, books, a tree trunk, etc.)

3. *Evaluative* What happens to light when it encounters a translucent object? (Some light passes through, and some light is scattered.) Can you name an example of a translucent object? (Answers may vary, but may include stained glass windows, waxed paper, loosely woven cloth, frosted glass, etc.)
4. *Inferential* [Point to Image Card 12 (Refraction).] What happens in the read-aloud when the straw is placed in the glass of water? (The straw looks separated, magnified, and bent.) Is the straw actually bending in the water or separated? (no) What causes the straw to look the way it does? (Light moving from one material to another is refracted or bent.)
5. *Literal* What is a lens? (A lens is a curved piece of transparent glass or plastic that focuses together or spreads apart rays of light) What does a convex lens look like? (It curves outward toward the viewer so that it is thicker in the middle than at the edges.) What does a concave lens look like? (It curves inward away from the viewer so that it is thinner in the middle than at the edges.)
6. *Literal* What are some instruments that use lenses that you heard about in today's read-aloud? (magnifying glasses, binoculars, microscopes, telescopes, security cameras, cameras, peepholes, and eyeglasses)



← **Show image 3A-8: Everyone standing in front of distortion mirrors**

7. *Evaluative* You heard that the House of Mirrors in the story had distortion mirrors with different convex and concave parts. What does Ethan see when he looks at his reflection in one of the distortion mirrors? (He looks tall and skinny.) What does Amy see when she looks at her reflection in one of the distortion mirrors? (She looks short and wide.)
8. *Literal* What type of mirror is flat and has as accurate a reflection as possible? (plane)

I am going to ask a question. I will give you a minute to think about the question, and then I will ask you to turn to your neighbor and discuss the question. Finally, I will call on several of you to share what you discussed with your partner.

9. *Evaluative Think Pair Share:* Look around the classroom and out the windows. What are some concave and convex objects that you see? (Answers may vary, but may include some of the following: concave—various containers, inside of spoons and bowls, perhaps a satellite dish, etc.; convex—outside of domes, outside of spoons and bowls, school bus mirrors, magnifying lens, etc.) [You may choose to have students generate a list of concave and convex images observed.]
- [If students generated a list, ask them to invent a tool using one or more of the concave and convex objects observed. The purpose of this tool is to help Samuel see better. You may wish to have students write about the tool and draw a picture.] (Inventions will vary, but may include variations on eyeglasses, magnifying lenses, microscopes, etc.)
10. After hearing today’s read-aloud and comprehension questions and answers, do you have any remaining questions?
- You may wish to allow time for individual, group, or class research of the text and/or other resources to answer any remaining questions.

Word Work: Opaque, Translucent, and Transparent

5 minutes

1. In the read-aloud you heard, “Objects that most light can pass through, such as eyeglasses or a window, are called *transparent*; objects that let a little bit of light pass through, such as some liquids or stained glass, are called *translucent*; and objects that light cannot pass through, such as a tackle box or Jack’s hat, are called *opaque*.”
2. Say the words *opaque*, *translucent*, and *transparent* with me.
3. If something is opaque, it prevents light from shining through, which makes it impossible to see through it; if something is translucent, it lets some light pass through, which makes a blurry image; if something is transparent, it allows most light to shine through, making it possible to see a clear image through it.
4. Mark could not see anything through the opaque magazine, but he could see many things through the transparent window; he could also see blurry trees and light through the thin translucent curtains.

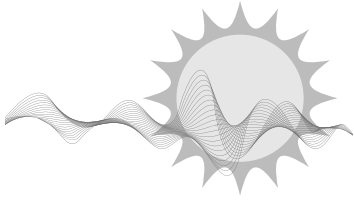
5. Have you ever seen something that was opaque, something that was translucent, or something that was transparent? What were they? Be sure to use the words *opaque*, *translucent*, and *transparent* when you tell about them. [Ask two or three students. If necessary, guide and/or rephrase the students' responses to make complete sentences: "I saw an opaque _____" or "The _____ was translucent" or "_____ was transparent because . . ."]
6. What are the words we've been talking about? What part of speech are the words *opaque*, *translucent*, and *transparent*?

Use a *Making Choices* activity for follow-up. Tell students that the words *opaque* and *transparent* are antonyms because they have opposite meanings. *Translucent* has a meaning in-between *opaque* and *transparent*. Directions: I am going to name several things. If the object that I name is opaque, say, "That is opaque." If the object that I name is translucent, say, "That is translucent." If the object that I name is transparent, say, "That is transparent."

1. a brick wall (That is opaque.)
2. a clear window (That is transparent.)
3. a piece of waxed paper (That is translucent.)
4. an eyeglass lens (That is transparent.)
5. a cardboard box (That is opaque.)
6. fog (That is translucent.)



Complete Remainder of the Lesson Later in the Day



Refraction and Lenses

3_B

Extensions

20 minutes

Hands On: Reflections, Refraction, and Lenses

Note: To further reinforce the content covered in the language arts block, you may choose to coordinate with your school's science teacher(s) to extend these kinds of hands-on activities. Additionally, you may choose to provide suggested materials at a classroom activity center.

Have students shine a flashlight on various objects in the classroom to see if they are transparent, translucent, or opaque. Let students know that sometimes it is hard to determine which type of object or material they are observing; sometimes there is a combination of things occurring.

Allow students to place a straw in a glass of water so they can more closely observe the example of refraction from the story. Ask them why the straw appears distorted, and remind them that light waves change their speed and path when moving from one substance to another.

If possible, provide glass or plastic lenses, and allow students to look at objects through them. Discuss whether the image of the object is smaller or larger.

If possible, provide a variety of instruments with lenses for students to observe and use, such as eyeglasses, magnifying glasses, microscopes, cameras, telescopes, and binoculars. Discuss the purpose of these instruments, and point out the concave and convex lenses.

Encourage students to use domain-related vocabulary as they complete these activities.




Light and Sound Log

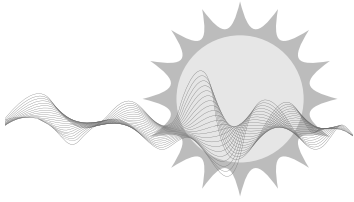
Place Image Cards 10–15 on the T-Chart. Give each student a piece of paper. Have them reference the image cards on the T-Chart as they write one or two sentences and draw an illustration about something they learned in today's read-aloud about light.

You may also choose to have students make a list of objects that are opaque, translucent, and transparent. Students may also write about the straw in the water and their experience with various instruments that contain lenses, recording any predictions and outcomes.

Allow students to share their sentences and drawings with the class, encouraging them to use any domain-related vocabulary. Have students save written work in their Light and Sound Logs throughout the domain.

Note: If you began a KWL chart in the introduction, you may choose to update it now.

 You may wish to have some students complete Instructional Master 1B-1 independently.



What Is Color?

4

☑ **Lesson Objectives**

Core Content Objectives

Students will:

- ✓ Identify light as a form of energy that travels in waves
- ✓ Describe how light waves travel in different mediums
- ✓ Explain that color is determined by how light is absorbed and reflected
- ✓ Explain what causes a rainbow to occur
- ✓ Identify the spectrum of colors that makes up white light

Language Arts Objectives

The following language arts objectives are addressed in this lesson. Objectives aligning with the Common Core State Standards are noted with the corresponding standard in parentheses. Refer to the Alignment Chart for additional standards addressed in all lessons in this domain.

Students will:

- ✓ Describe the characters Amy and Ethan and explain how their actions contribute to the events and discussions that occur in this domain (RL.3.3)
- ✓ Use the acronym *ROY G BIV* to sequence the colors of the rainbow (RI.3.3)
- ✓ Interpret the diagram Reflection and Color to describe the relationship between what happens when light hits an object and the effect it has on the color we see, using language that pertains to time, sequence, and cause/effect. (RI.3.3) (RI.3.7)
- ✓ Interpret information about different wavelengths of light from the diagram Light Energy from the Sun (RI.3.7)
- ✓ Through hands-on exploration of materials, conduct research that builds knowledge about light concepts in “What Is Color?” (W.3.7)

- ✓ Make personal connections to concepts related to light presented in “What Is Color?” through engagement in discussion about rainbows, hands-on activities, and the Light and Sound Log (W.3.8)
- ✓ Categorize statements as describing a spectrum or not describing a spectrum (W.3.8)
- ✓ Make a prediction prior to the read-aloud about what causes a rainbow, based on the images observed in the introduction, and compare to information provided during “What Is Color?” (SL.3.1a)
- ✓ Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships, to describe how a spectrum of colors is formed, such as *when, then, through, refracted, bent, and formed* (L.3.6)
- ✓ Draw an illustration in the Light and Sound Log to represent a main idea or key details from “What Is Color?” or to depict a vocabulary word

Core Vocabulary

Note: You may wish to display some of these vocabulary words in your classroom for students to reference throughout the domain. You may also choose to have students write some of these words in a “domain dictionary” notebook, along with definitions, sentences, and/or other writing exercises using these vocabulary words.

optometrist, n. A doctor who examines people’s eyes to check if their vision needs to be corrected in any way by wearing glasses or contact lenses, or by medical treatment

Example: Visiting the optometrist regularly is an important way to maintain the health of your eyes and have a “clean bill of health.”

Variation(s): optometrists

prism, n. A transparent, often triangular, object used to refract and divide white light into its different colors

Example: The prism was very useful in teaching the students how to create their own rainbows.

Variation(s): prisms

rainbow, n. A curved band of colors in the sky that sometimes occurs when sunlight passes through raindrops and the light is refracted into different colors

Example: After the thunderstorm passed, everyone was delighted to see a rainbow.

Variation(s): rainbows

spectrum, n. A series or range of objects, things, or ideas arranged in a particular order

Example: When Ms. Santiago shone the flashlight on a prism, she showed her class the spectrum of colors that was produced.

Variation(s): spectra, spectrums

wavelength, n. The distance between waves of energy

Example: Each color of the spectrum has its own unique wavelength; red has the longest wavelength, and violet has the shortest.

Variation(s): wavelengths

white light, n. Light that includes all of the colors of the spectrum; can be broken up into a spectrum of colors by a prism


Example: When the white light produced by the sun shone through a prism, a spectrum of colors was produced.

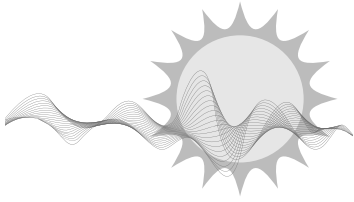
Variation(s): none

x-ray, n. A powerful invisible ray of energy that can pass through an object and make it possible to see inside of it; a picture that shows what makes up the inside of something, such as the many bones of the skeleton

Example: When Jacob fell off his bike and hurt his arm, he had to go to a doctor to get an x-ray to see if his arm was broken.

Variation(s): x-rays

<i>At a Glance</i>	Exercise	Materials	Minutes
<i>Introducing the Read-Aloud</i>	Story Elements		10
	What Have We Already Learned?	T-Chart; Light and Sound Logs (optional)	
	Observation and Inquiry	Image Cards 18 and 20	
	Purpose for Listening		
<i>Presenting the Read-Aloud</i>	What Is Color?	Image Cards 16–20	20
<i>Discussing the Read-Aloud</i>	Comprehension Questions	Light and Sound Logs	15
	Word Work: Spectrum		5
 Complete Remainder of the Lesson Later in the Day			
<i>Extensions</i>	Hands On: Prisms	prisms; bright flashlight; drawing paper; colored pencils for each color of the spectrum	20
	Light and Sound Log	Image Cards 16–20; T-Chart; KWL Chart (optional); Light and Sound Logs	



What Is Color?

4_A

Introducing the Read-Aloud

10 minutes

Story Elements

To review the narrative elements of this story, ask the following questions:

- What two new characters did you meet in the previous read-aloud? How are they related to Samuel?
- What adjectives would you use to describe Ethan and Amy?
- How do Ethan's and Amy's interests and actions contribute to the events and discussions that occur in this domain?

What Have We Already Learned?

Ask students, "What have you been learning about?" Remind students that they have been learning about what happens to light when it encounters different kinds of materials and surfaces. Point to the Image Cards on the T-Chart. You may wish to ask students to share what they remember learning about light that is shown in each image.

Tell students that they are going to complete a warm-up activity before listening to today's read-aloud. Explain that you will begin with the phrase, "Raise your hand if . . ." and that then you will add a second phrase about something related to light. Tell students to raise their hands if the statement is a true statement about light. Also tell students that they may refer to the T-Chart for information as needed.

Raise your hand if . . .

- light can travel through an opaque object like a book.
- light bends when it travels through a glass of water. (Raise hands.)
- eyeglass lenses are transparent. (Raise hands.)
- a flat, bathroom mirror on the wall is a convex mirror.
- a convex lens magnifies an object. (Raise hands.)
- light changes direction when it passes through a lens. (Raise hands.)

- you can always see a clear image when looking through a translucent object.
- a flat mirror on the wall is a plane mirror. (Raise hands.)

Observation and Inquiry

Show students Image Card 20 (Light Energy from the Sun). Explain that it shows all of the types of light energy that are produced by the sun and that make their way through space to the Earth. Tell students that some of the light energy is visible to us and some of the light waves are invisible to us. The visible light energy is what allows us to see the world as we do. Remind students that they may be familiar with some of the invisible types of light energy, such as x-rays, microwaves, and radio waves.

Show students Image Card 18 (Rainbow). Ask, “What do you see in this image? Have you ever seen a rainbow? Where did you see it?” Ask students to examine the two images and think about what they have in common. Ask students to predict what they think causes a rainbow.

Purpose for Listening

Tell students to listen to find out more about light and whether or not their predictions are correct.



What Is Color?

← Show image 4A-1: Samuel at the stove

It was a sunny Saturday morning, and Samuel had invited Amy, Ethan, and Jack to breakfast. It had been three days since Samuel had seen Jack and his grandchildren, because he had traveled to the city to a special hospital to have his eyes checked by an **optometrist**.

Samuel set up two extra easels in the garden next to his easel. He was trying to encourage his grandchildren to paint with him. He had long since given up trying to get Jack to take up painting as a hobby. When he was at the hospital, the optometrist had advised Samuel to rest his eyes, but he found it difficult to give up his daily trip to the garden to paint.

Amy and Ethan arrived first. They really enjoyed having breakfast with their grandfather. Samuel always served homemade pancakes, eggs, sausages, bacon, and hash browns. The breakfasts were always amazing.

“Hey, Granddad!” yelled Ethan, “I’m starving. Is breakfast ready?”

“I doubt you are actually starving,” replied Samuel, “but it’s almost ready. Just scrambling the eggs.”

Moments later Jack arrived, just in time to help Samuel serve the breakfast feast.



← Show image 4A-2: Everyone eating breakfast at kitchen table

Once the food had been served, Alfie arrived in the kitchen in the hope of getting a tasty morsel. Samuel pretended to be strict about feeding Alfie from the table, but in truth he liked to spoil him.

“You’ve outdone yourself,” said Jack appreciatively. He, too, enjoyed Samuel’s famous breakfasts. “What’s the plan for today?” asked Jack, hoping that there wouldn’t actually be one.

“Well, I’m going to make these two monkeys work a little,” said Samuel grinning. “They are going to have a painting lesson, and all three of you are going to have a lesson on the science of color.”

“That just means he’s going to talk a lot,” announced Jack.

The children laughed.

Samuel, Jack, and the children spent the next hour eating, talking, and enjoying each other’s company. Ethan secretly reached down under the table and fed Alfie small pieces of sausage, though Samuel was perfectly aware of what he was doing. Then, after loading the dishwasher and tidying up the kitchen, they made their way out into the garden.



← **Show image 4A-3: Everyone outside in shade of apple tree**

Samuel had set the easels up under the shade of the large apple tree. Once everyone was settled, including Alfie, he advised the children to pick a subject to paint—something they could clearly see and would enjoy painting.

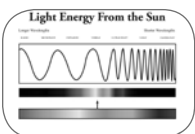
“I’d like to paint the bird feeder,” pronounced Ethan.

“I think I’ll paint that potted geranium,” said Amy, pointing to a plant with vivid red petals sitting snugly in a terra-cotta pot.

“I’ve chosen to sit here and close my eyes,” said Jack and then promptly did just that.

← **Show image 4A-4: “Light Energy From the Sun” graphic**

“The first thing I want you to understand, and I’ve already explained this to Jack, is that waves of light energy race through space from the sun to Earth,” Samuel began. “Each type of light energy has its own unique **wavelength.**”¹



1 [Point to the tops of two waves in the graphic.] A wavelength is the distance between the crests, or tops, of two waves. Some waves are longer than others. [Point to the microwave and x-ray parts of the graphic as you ask this question.] Who can tell me which type of invisible light has a longer wavelength, a microwave or an x-ray?
(microwave)

2 This graphic shows all of the wavelengths of light energy coming from the sun. [Point to the visible light.] This range of wavelengths—red, orange, yellow, green, blue, indigo, and violet—is visible to humans without using any special equipment. Do these colors remind you of something familiar? (a rainbow)

3 [Show Image Card 16 (X-Ray).] An x-ray is a powerful invisible ray of energy that can pass through an object, and special x-ray machines make it possible to see what is inside.



4 [Show Image Card 17 (Reflection and Color). Point to the grass and the arrows as you read the next paragraph.]

5 [Point to the child's red shirt on Image Card 17.] Look at the child's red shirt. What wavelength of light is reflected from the shirt? (red) What colors of light are absorbed by the shirt? (all but red)

“We cannot see all of the sun’s light energy, but the energy we can see is called visible light. **White light** is made up of a **spectrum** of all the colors we see in visible light.”²

“Some light is invisible, such as **x-rays**,” continued Samuel.³

“That’s complicated,” chimed in Ethan.

“Not really,” said Samuel.

“I agree with him,” said Jack, opening one eye and pointing at Ethan.

“Let me finish explaining, and it might make more sense,” continued Samuel. “We need light to be able to see. Light from the sun travels to Earth. Most of it is invisible to us unless we have equipment like x-ray machines. The visible light shines on objects in the world around us. Some of the light reflects off objects and into our eyes. Then, parts of our eyes receive that information and communicate with our brain. The brain figures out what colors we are seeing. However, and this is what is really interesting,” said Samuel eagerly, “the color of an object is determined by whether that object transmits, reflects, or absorbs light. Sometimes it is a combination.”

← **Show image 4A-5: Everyone in garden with paintings in progress**

“Oh, it’s so much easier to understand now,” joked Jack.⁴

“Think of it this way,” continued Samuel. “Look at the grass. It looks green because it reflects green light waves, but it absorbs the other wavelengths of visible light, meaning it absorbs all the other colors.”

“What does *absorb* mean?” asked Ethan with a puzzled look on his face. He had by now finished sketching the bird feeder and was dipping his paint brush into some carefully mixed brown paint.

“Absorbed light is the light that is soaked up by an object and is therefore no longer visible. The color you see when you look at an object is actually the reflected light. An object has no color if there is no reflected light,” explained Samuel.⁵

6 What happens if you wear black clothing on a sunny day?

“Oh, I get it,” said Amy, who by now was painting the terracotta pot. “That’s why my art teacher said that black materials absorb all colors of light and do not reflect any. So, in a way, black is not a true color, it is more a lack of light.”

“That’s exactly right, Amy,” said Samuel. “White is the opposite of that. An object that appears white to our eyes reflects all the colors of the spectrum and absorbs none of them.”

“Is that why people say you should wear white clothes in the summertime?” asked Ethan, who was concentrating hard on painting the roof of the bird feeder.

“Exactly!” exclaimed Samuel. “White material reflects most of the light that hits it and absorbs very little, so if you wear white clothing, you tend to stay a little cooler.”⁶

“Who would like some ice cream?” asked Jack loudly. He had grown restless and wanted to do something fun.

“Yay! Ice cream!” screeched Ethan.

“Yes, please,” said Amy.

“Here’s an interesting question,” said Samuel. “Which would melt faster—chocolate or vanilla ice cream?”

The children frowned thoughtfully.

“Chocolate!” called Ethan.

“And why is that?” asked Samuel.

“Because it’s a darker color and would absorb more light!” said Amy.

“Very good,” said Samuel.

“Do you have mint chocolate chip?” asked Ethan.

“That’s my favorite!” yelled Jack.

“Mine, too,” agreed Ethan.

“Do you have strawberry ice cream?” asked Amy.

“I sure do,” said Samuel. “How about we go inside and cool off with some ice cream?”



← **Show image 4A-6: Everyone in kitchen having ice cream**

Samuel didn't need a reply. Jack and the children were already walking towards the kitchen door. They hadn't realized it, but they had been out in the garden for quite some time, and in that time rain clouds had gathered in the distance.

Moments later, Samuel, Jack, Amy, and Ethan were sitting at the kitchen enjoying double scoops of ice cream. Amy and Ethan had drizzled chocolate sauce on top of theirs. There was even a very small scoop of strawberry ice cream for Alfie, even though Samuel knew he really shouldn't have any.

"What do you call a ghost's mother and father?" asked Ethan as he licked chocolate sauce from around his mouth.

"I don't know. What do you call a ghost's mother and father?" repeated Jack.

"Transparents!" announced Ethan

"Which one runs faster, hot or cold?" Ethan continued.

"Hot. Everyone can catch cold," answered Amy.

"Ahhh! You've heard it," said Ethan, sounding disappointed.

"Okay, how about this one?" said Amy. "Why is it so hot in a stadium after a football game?"

Samuel, Jack, and Ethan thought for a while but could not come up with a good enough answer.

"Okay, smarty pants, tell us the answer," said Jack.

"Because all the fans have left," said Amy, clearly delighted with herself.



← **Show image 4A-7: Clearing sky and rainbow visible through window**

“Look at that,” said Samuel pointing through the kitchen window.

“It’s a **rainbow!**” exclaimed Amy.

“Oh, no! He’s going to tell us how they are formed,” said Jack pointing his spoon at Samuel.

“Well, as a matter of fact,” replied Samuel, “A rainbow is a perfect spectrum of colors.”⁷ We see this spectrum when waves of white light encounter millions of falling raindrops. Just like the glass of water and the straw, Ethan, the light waves slow down and refract when they come into contact with the transparent rain drops.⁸ Essentially, beams of white light break apart into the colors of the rainbow. Each transparent raindrop acts as a **prism**, perfectly splitting white light into all of its colors,” explained Samuel.

“Oh, we used prisms in class!” shouted Ethan. “It was so cool. It was like making your own rainbow.”

← **Show image 4A-8: Amy and Ethan’s finished paintings**

Samuel, Jack, Amy, and Ethan continued to chat and joke and enjoy each others’ company. After a while, they returned to the garden where Samuel continued the painting lesson. He advised the children to pay attention to the angles and qualities of light and shade that hung in the air like soft, clear, transparent wings. He talked to them about texture and tone. All the while, Jack sat in his garden chair and napped. Morning turned to afternoon, and afternoon to early evening, and no one wanted to leave the comfort and shade of the beautiful garden—not even Alfie.



7 [Show Image Card 18 (Rainbow).] Lots of people use this acronym to remember the order of the colors of the rainbow: *ROY G BIV*. (red, orange, yellow, blue, indigo, violet). [Point out the spectrum of colors in the raindrops on Image Card 19 (Raindrop Prisms).] A prism is a transparent object such as water, glass, or plastic that refracts and divides white light into a spectrum of colors.





Comprehension Questions


15 minutes

If students have difficulty responding to questions, reread pertinent passages of the read-aloud and/or refer to specific images. If students give one-word answers and/or fail to use read-aloud or domain vocabulary in their responses, acknowledge correct responses by expanding the students' responses using richer and more complex language. Ask students to answer in complete sentences by having them restate the question in their responses. **It is highly recommended that students answer at least one question in writing and that some students share their writing as time allows.** For written responses in this domain, students will use their Light and Sound Logs to collect source material for longer writing pieces and as preparation for written responses in the Domain Assessment.

1. *Evaluative* Were your predictions correct about how rainbows are created? Why or why not? (Answers may vary.)
2.  *Inferential* What is visible light? (Visible light is light that we can see.) You heard that white light is related to visible light. What is white light made of? Hint: Remember *ROY G BIV*. (White light is all of the colors we can see in visible light: red, orange, yellow, green, blue, indigo, and violet.)
3. *Literal* [Show Image Card 16 (X-Ray).] What is the type of invisible light used to create this image? (x-ray)
4. *Literal* [Show Image Card 20 (Light Energy from the Sun).] How does light travel? (Light travels in waves.) How are light waves measured? (Light waves are measured in wavelengths, from the top of one wave to the top of the next.)
5.  *Literal* [Show Image Card 17 (Reflection and Color).] Why does the shirt appear red? (The red shirt absorbs all of the colors of white light except the red light. The shirt reflects the red light, and we see the shirt as red.)
6. *Inferential* What causes an object to look black? (Black is the absence of reflected light that occurs when all of the colors of the spectrum are absorbed.) What causes an object to look white? (White is what we see when all of the colors in the spectrum are reflected.)

7.  *Inferential* Describe the spectrum of colors and how it is formed. (The spectrum is all the colors of the rainbow—red, orange, yellow, green, blue, indigo, and violet. When the waves of white light are refracted in just the right way by a transparent material, such as a prism or raindrops, a band of colors appears.) What is an example of a spectrum that you heard about in the read-aloud? (a rainbow, all of the light energy from the sun)
8.  *Evaluative* What does an optometrist do? (An optometrist is a doctor who examines people’s eyes to check if their vision needs to be corrected by wearing glasses or contact lenses, or by medical treatment.) Can any of you share an experience of visiting an optometrist? (Answers may vary.)

I am going to ask a question. I will give you a minute to think about the question, and then I will ask you to turn to your neighbor and discuss the question. Finally, I will call on several of you to share what you discussed with your partner.

9. *Evaluative Think Pair Share:* In a completely dark room, is it possible to see colors? Why or why not? (No, because there is no color without light.)
 10. After hearing today’s read-aloud and comprehension questions and answers, do you have any remaining questions?
-  You may wish to allow time for individual, group, or class research of the text and/or other resources to answer any remaining questions.

Word Work: Spectrum

5 minutes

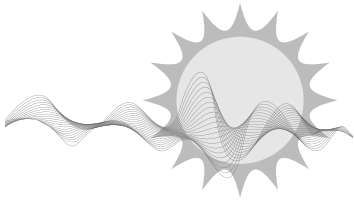
1. In the read-aloud, you heard, “A rainbow is a perfect *spectrum* of colors.”
2. Tell students that Image Card 18 (Rainbow) shows the spectrum of colors that are produced when white light passes through the raindrops in the atmosphere. Say the word *spectrum* with me.
3. A spectrum is a series or range of objects, things, or ideas arranged in a particular order.
4. Max could see the entire spectrum of colors after the light went through his prism, and he noticed that the colors were in the same arrangement as the rainbow he had seen in the sky after the thunderstorm.
5. Have you ever seen a spectrum of colors before? What was causing the spectrum? Be sure to use the word *spectrum* when you tell about it. [Ask two or three students. If necessary, guide and/or rephrase the students’ responses to make complete sentences: “I saw a spectrum of colors when . . .” or “_____ was a spectrum of colors.”]
6. What’s the word we’ve been talking about? What part of speech is the word *spectrum*?

Use a *Making Choices* activity for follow-up. Directions: I am going to name some things. If what I name is a spectrum, say, “That is a spectrum.” If what I name is not a spectrum, say, “That is not a spectrum.”

1. only the colors red and blue (That is not a spectrum.)
2. all of the colors of a rainbow (That is a spectrum.)
3. the colors that are created when white light is refracted by a prism (That is a spectrum.)
4. only the color green (That is not a spectrum.)
5. invisible x-ray light (That is not a spectrum.)



Complete Remainder of the Lesson Later in the Day



What Is Color?

4_B

Extensions

20 minutes

Hands On: Prisms

Note: To further reinforce the content covered in the language arts block, you may choose to coordinate with your school’s science teacher(s) to extend these kinds of hands-on activities. Additionally, you may choose to provide suggested materials at a classroom activity center.

Show students a prism, and have them predict what will happen when you hold it up to the sunlight. (A very strong flashlight may also work, if it contains enough red light waves.) Conduct the experiment, moving the prism until it is in the right position to refract the light. (It is best to hold the prism suspended on the edge of one of its ends.) Have students use colored pencils to draw the spectrum of colors, reviewing the acronym *ROY G BIV*. You may choose to have students write one to two sentences about what causes a spectrum to appear.

If possible, provide various prisms with which students can experiment. If your classroom has a sunny window for part of the day, you may choose to hang a prism or crystal in the window and observe the rainbows that are produced on the classroom walls.

As students make predictions and conduct experiments, model and encourage the use of domain-related vocabulary.



Light and Sound Log

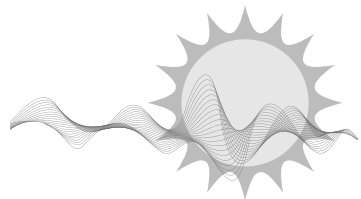
Place Image Cards 16–20 on the T-Chart. Give each student a piece of paper. Have them reference the image cards on the T-Chart as they write one or two sentences and draw an illustration about something they learned in today’s read-aloud about light.

Students may also write about their predictions regarding their experience with prisms, recording any predictions and outcomes.

Allow students to share their sentences and drawings with the class, encouraging them to use any domain-related vocabulary. Have students save written work in their Light and Sound Logs throughout the domain.

Note: If you began a KWL chart in the introduction, you may choose to update it now.

➤ You may wish to have some students complete Instructional Master 1B-1 independently.



Pausing Point 1

PP₁

Note to Teacher

This is the halfway point of the *Light and Sound* domain. Students have studied the properties of light, the way light travels, how light can be manipulated, the visible light spectrum, and instruments that use light. It is highly recommended that you pause here and spend two days reviewing, reinforcing, or extending the material taught thus far.

You may have students do any combination of the activities listed below. The activities may be done in any order. You may wish to do one activity on successive days. You may also choose to do an activity with the whole class or with a small group of students who would benefit from the particular activity.

Core Content Up to This Pausing Point

Students will:

- ✓ Recall the five senses and their corresponding sensory organs
- ✓ Identify the sun as Earth's main source of light and name other light sources
- ✓ Identify light as a form of energy that travels in waves
- ✓ Explain why light is so important
- ✓ Describe how light waves travel in different mediums
- ✓ Explain how shadows are formed
- ✓ Explain how light is absorbed, reflected, or transmitted
- ✓ Describe the three types of mirrors: plane, concave, and convex
- ✓ Compare and contrast the terms *concave* and *convex*
- ✓ Compare and contrast transparent, translucent, and opaque objects
- ✓ Describe how mirrors and lenses are used in a variety of instruments
- ✓ Explain how light is refracted
- ✓ Explain that color is determined by how light is absorbed and reflected

- ✓ Explain what causes a rainbow to occur
- ✓ Identify the spectrum of colors that makes up white light

Activities

Image Review

Show the images from any read-aloud again, and have students retell the read-aloud using the images.

Image Card Review

Materials: Image Cards 1–20

In your hand, hold Image Cards 1–20 fanned out like a deck of cards. Ask a student to choose a card but to not show it to anyone else in the class. The student must then give a clue about the picture s/he is holding. For example, for the microscope, a student may say, “I allow you to see things that are too small to be seen at all or well with your own eyes.” The rest of the class will guess what instrument or light concept is being described. Proceed to another card when the correct answer has been given.



Domain-Related Trade Book or Student Choice

Materials: Trade book

Read an additional trade book to review the properties of light; refer to the books listed in the domain introduction. You may also choose to have the students select a read-aloud to be heard again.

If students listen to a read-aloud a second time, you may wish to have them take notes about a particular topic. Be sure to guide students in this important method of gathering information. You may wish to model how to take notes, construct an outline, etc.

Key Vocabulary Brainstorming

Materials: Chart paper, chalkboard, or whiteboard

Give students a key domain concept or vocabulary word such as *energy*. Have them brainstorm everything that comes to mind when they hear the word, such as *physical power, needed by living things to exist and be active, not unlimited, can run out, must be used wisely*, etc. Record their responses on a piece of chart paper, a chalkboard, or a whiteboard for reference.

- ✈ You may also wish to have students do this brainstorming activity individually or with a partner.

10 Riddles for Core Content

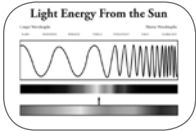
Ask students riddles such as the following to review core content:

- I am created when something or someone blocks a light source. What am I? (shadow)
- I am what you see in a mirror. What am I? (reflection)
- I work to help improve vision for people, and I prescribe things like glasses, contact lenses, or medical treatment. What am I? (an optometrist)
- I am the sequence of colors that becomes visible every time light goes through a prism. What am I? (a rainbow)
- I am a curved piece of transparent glass or plastic used in eyeglasses, cameras, and other instruments that makes an object seem larger, smaller, or closer by focusing rays of light together or spreading rays of light apart. What am I? (a lens)
- I am an instrument made of a pair of tubes with lenses at both ends that allows someone to see something that is far away. What am I? (binoculars)
- I am an instrument that uses light to create pictures that are captured through a lens. What am I? (camera)
- I am an empty space that has no particles of solids, liquids, or gases. What am I? (vacuum)
- I am a word that describes an object, such as a mirror or a lens, that curves inward like a cave. What word am I? (concave)
- I am a word that describes an object, such as a mirror or a lens, that curves outward. What word am I? (convex)
- I am an object used to refract and divide white light into a spectrum of colors. What am I? (a prism)
- I am the distance between waves of energy. What am I? (wavelength)
- I am the powerful invisible rays of energy that can pass through an object, making it possible to see inside of it. What am I? (x-ray)

✈ Multiple Meaning Word Activity: Energy

Materials: Image Card 16 (X-Ray)

Tell students that you are going to talk about many different meanings of the word *energy*. Explain to them that you will show a picture and state the meaning for the word *energy* in that example. For each example, have students take turns creating sentences to describe the energy in the picture. Tell students to be sure to use the word *energy* in a complete sentence when they describe the image.



← Show image 4A-4: The spectrum of light graphic

1. In the first read-aloud you heard, “Light is energy!” In this context, energy is all the light energy that comes from the sun in the form of waves. Which parts of the image match this description of energy? [Have a student point to the correct parts of the image.] (the waves of different wavelengths showing the different kinds of energy) Who can create a sentence describing energy as it is illustrated in this image?
2. The energy we can see from the sun is called visible light or white light, and it contains all the colors of the rainbow. Which part of the image matches this description? [Have a different student point to the correct part of the image.] (the color spectrum, the wavelengths marked visible light) [Now have a volunteer create a sentence describing visible light or white light energy.]
3. [Show Image Card 16 (X-Ray).] Another kind of light energy is invisible, such as the kind of energy in x-rays. What is the main difference between visible light and x-rays? (X-rays are invisible; x-rays have shorter wavelengths than visible light.) [Have a different student point to the correct part of image 4A-4. Then have a student create a sentence describing the meaning of the word *energy* when it comes in the form of an x-ray.]



← Show image 1A-4: Alfie chasing a bee; light waves passing through pitcher of lemonade

4. In addition to using the word *energy* to talk about light, *energy* is also a word we use when we talk about the physical force or power living things use to do things. [Ask a volunteer to use the word *energy* in a complete sentence to describe this kind of energy as illustrated in the image.]



← **Show image 4A-2: Everyone eating breakfast at kitchen table**

5. The word *energy* can also refer to energy that is saved up in our bodies. You may have learned about the high activity level of birds in the domain *Classification of Animals*. Humans, animals, and other living things need energy to grow and be active. Living things get this energy from the food they eat. It is like fuel that is either used or stored up in the body. [Ask a different volunteer to create a sentence describing energy in the image.]



← **Show image 3A-7: Everyone at fair eating cotton candy**

6. The final meaning for the word *energy* that we will discuss today is the kind of energy found in fuels and used to power lights, vehicles, tools, and other machinery. Tell students that people capture energy from resources like gasoline, coal, oil, solar power, wind turbines, and nuclear power. The energy created provides electricity for our homes and powers engines in our cars. [Ask a different student to create a sentence that describes something about the energy in this image.]



← **Show image 4A-1: Samuel at the stove**

With your neighbor, talk about the different kinds of energy you see in this image. Remember to be as descriptive as possible and use complete sentences. I will call on a few of you to share your sentences.

Note: You may wish to revisit this activity in Pausing Point 2 in order to include the energy of sound.

 **Class Book: Light and Sound**

Materials: Drawing paper, drawing tools

Tell the class or a group of students that they are going to make a class book to help them remember what they have learned thus far in this domain. Have students brainstorm important information about the properties of light. Have each student choose one idea to draw a picture of, and ask him or her to write a caption for the picture. You may choose to add pages about the properties of sound upon completion of the entire domain before binding the book.



Venn Diagram

Materials: Instructional Master PP1-1; chart paper, chalkboard, or whiteboard

Tell students that together you are going to compare and contrast two things students have learned about related to light by asking how they are similar and how they are different. Use Instructional Master PP1–1 to list two items at the top of the diagram and then to capture information provided by students. Choose from the following list or create a pair of your own:

- convex and concave mirrors
- a lens and a prism
- all light energy and white light
- concave and convex mirrors
- opaque and transparent objects
- reflection and refraction

You may wish to create several copies of the Venn diagram to compare and contrast several things. You may also wish to have students use these diagrams as brainstorming information for further writing.

-  You may wish to have some students use Instructional Master PP1–1 to complete this activity independently.
-  You may wish to have some students create a three-way Venn diagram to compare and contrast three things, e.g., opaque, translucent, and transparent objects; a telescope, a microscope, and a magnifying lens; etc.

Creating a Light Spectrum

Materials: Large bowl filled with water, mirror, white cardboard, drawing paper, drawing tools

Have students fill a bowl with water. After placing the mirror in the water, adjust it to reflect sunlight on the white cardboard. Have students examine the way the light is reflected onto the cardboard as a spectrum. After the experiment, have students write an explanation for what caused this spectrum to become visible. You may also wish to have students draw and color a light spectrum of their own.

Creating a Sundial

Materials: Sturdy, straight stick; rocks or chalk; watch or clock

Have students find a grassy place outside that gets the most direct sunlight throughout the school day. Once the place is found, put the stick into the ground so that it is vertical. Each hour of the school day, on the hour, place a stone showing where the stick's shadow falls across an imaginary arc circling the stick. Once the sundial has been created, students may return to examine the sundial on another day. Ask students to observe how the shadow moves throughout the day. Discuss how the sundial works and how this instrument was used in the past to tell time. Have students discuss how the sundial and clock are different and similar. Refer to www.sciencekidsathome.com for further information.

Making and Using a Periscope

Materials: Two, quart-size milk or juice cartons; two small mirrors; scissors; tape

Open the tops of two empty cartons. Then, either with tape or glue, connect the cartons together. With scissors, cut out an opening on the back of the box on top and an opening on the front of the box on the bottom. Cut out two diagonal slots on one side of the box. Both slots should be parallel, with one close to the top opening and the other close to the bottom opening. Next, place a mirror into each of the slots. The mirrors should be able to reflect what is seen through the top portion of the periscope and vice versa. Have students examine the top and bottom of the periscope, and then have them discuss what makes this instrument useful.

Refer to www.PBSkids.org for further information.

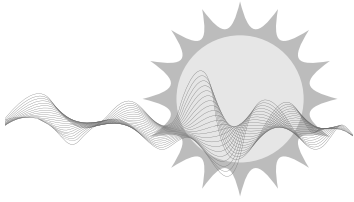
Research Activity: Enlightening Inventors and Inventions

Give students the opportunity to research inventors and inventions that are related to light, e.g., Thomas Edison and the light bulb or Isaac Newton and the science of optics. Refer to the list of trade books and websites in the introduction as well as to the Skills Reader. Encourage students to write about an inventor's life and contributions. Have students present their findings to a group or with the class.

Writing Prompts

Students may be given an additional writing prompt such as the following:

- The most interesting thing I've learned thus far is _____ because . . .
 - My favorite instrument that we have discussed so far is _____ because . . .
 - A rainbow is formed by . . .
 - Light can be manipulated by . . .
 - My favorite translucent material is _____ because . . .
 - The direction of a ray of light can change its path because . . .
- ✍ Compare and contrast transparent, translucent, and opaque materials



What Is Sound?

5

✔ **Lesson Objectives**

Core Content Objectives

Students will:

- ✓ Recall the sense of hearing and the corresponding sensory organ
- ✓ Identify sound as a form of energy that travels in waves
- ✓ Describe how sound waves travel in different mediums
- ✓ Identify sources of sound
- ✓ Compare and contrast light and sound

Language Arts Objectives

The following language arts objectives are addressed in this lesson. Objectives aligning with the Common Core State Standards are noted with the corresponding standard in parentheses. Refer to the Alignment Chart for additional standards addressed in all lessons in this domain.

Students will:

- ✓ Describe how Jack’s dedication to music contributes to the discussions the friends share while they are on the train and visiting New York City (RL.3.3)
- ✓ Identify and describe how Jack, Samuel, Amy, and Ethan may have felt about the noises they experienced on the streets of New York City (RL.3.3)
- ✓ Compare and contrast the setting of Samuel’s home along the Hudson River as described and illustrated in “Reflection and Mirrors” with the setting of the streets of New York City as described and illustrated in “What Is Sound?” (RL.3.9)
- ✓ Sequence the steps between the movement of an object and the reception of a vibration by the ear as illustrated in the image Sound Waves Entering Ear, using language that pertains to time, sequence, and cause/effect (RI.3.3)

- ✓ Determine and distinguish between the literal and figurative meanings of “his bark is worse than his bite” (RI.3.4) (L.3.5a)
- ✓ Describe sources of sound found in the images that contribute to the cacophony of sounds on the streets of New York City described in “What Is Sound?” (RI.3.7)
- ✓ Compare and contrast the most important points and key details presented about light and sound using the image cards on the T-Chart and information from all read-alouds (RI.3.9)
- ✓ Make personal connections to concepts related to sound presented in “What Is Sound?” through engagement with teacher demonstrations and hands-on opportunities (W.3.8)
- ✓ Use the known root *aud-* as a clue to the meaning of unknown words, such as *auditorium*, *auditory*, and *audience* (L.3.4c)
- ✓ Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships to describe the steps of the creation and transfer of sound vibrations such as *first*, *next*, *then*, *through*, and *finally* (L.3.6)
- ✓ Demonstrate understanding of the literary term *setting* by using this word when comparing and contrasting Samuel’s home along the Hudson River and the streets of New York City

Core Vocabulary

Note: You may wish to display some of these vocabulary words in your classroom for students to reference throughout the domain. You may also choose to have students write some of these words in a “domain dictionary” notebook, along with definitions, sentences, and/or other writing exercises using these vocabulary words.

cacophony, n. Harsh, jarring noise

Example: Marcie woke up surprised by the cacophony of loud car horns honking in the city streets.

Variation(s): cacophonies

medium, n. A type of substance through which energy travels

Example: A tin can phone works best when the string is pulled tight, making a more solid medium through which the vibrations can travel.

Variation(s): mediums, media

sound, n. Vibrations that are produced that travel through particles and are heard by our ears

Example: Tommy loved to hear the sound of the birds singing outside his window every morning.

Variation(s): sounds

sound waves, n. The form that sounds take when they travel through a surrounding medium, such as air, liquid, or a solid


Example: The sound waves from the dog’s bark traveled through the air and into my ear.

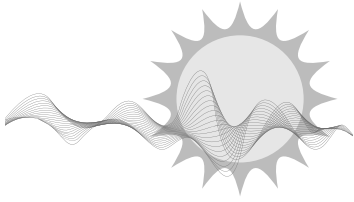
Variation(s): sound wave

vibration, n. Rapid movement back and forth

Example: The vibration of the guitar string produces a musical note.

Variation(s): vibrations

<i>At a Glance</i>	Exercise	Materials	Minutes
Introducing the Read-Aloud	What Do We Know?	Image Card 21; KWL Chart (optional); chart paper, chalkboard, or whiteboard; tuning fork	10
	Essential Background information or Terms	chart paper, chalkboard, or whiteboard	
	Purpose for Listening		
Presenting the Read-Aloud	What Is Sound?	Image Cards 21–26; U.S. map	20
Discussing the Read-Aloud	Comprehension Questions	KWL Chart (optional); Light and Sound Logs	15
	Word Work: Vibration	rubber band; cup; tuning fork; variety of musical instruments	5
 Complete Remainder of the Lesson Later in the Day			
Extensions	Sayings and Phrases: His Bark Is Worse than His Bite		5
	Sequencing the Creation and Transfer of Sound Waves	Image Card 25; sentence strips [This activity requires advance preparation.]	15
	Multiple Meaning Word Activity: Medium	Image Card 26; KWL Chart (optional); index cards; images depicting the various meanings of <i>medium</i> (optional)	
Take-Home Material	Family Letter	Instructional Master 5B-1	



What Is Sound?

5A

Introducing the Read-Aloud

10 minutes

What Do We Know?

Tell students that the name of this read-aloud is “What is Sound?” Ask students, “What do you know about sound?” Allow students to share, recording their responses on chart paper, a chalkboard, or a whiteboard. If students provide incorrect information, write it down and tell them that you will revisit this information after the read-aloud to correct any errors. You may wish to guide the discussion with some of the following questions:

- What do you think sound is?
- How do we perceive sound? What sensory organ is used?
- How do you think light and sound are similar? How do you think they are different?
- Can you name different sources of sound? (Answers may vary, but may include some of the following: people, animals, televisions, computers, iPods, radios, cell phones, telephones, cars, planes, motorbikes, machinery, musical instruments, household appliances, thunder, rain, hail, ocean, waterfalls, etc.)
- If an instrument is a type of tool used for a specific purpose, what is the purpose of a musical instrument?

Show students Image Card 21 (Tuning Fork) and if possible, a real tuning fork as well. Ask if any students have seen or used a tuning fork. Ask students how they think the tuning fork might be used to create vibrations. If possible, demonstrate the tuning fork. Share with students that a tuning fork is a useful tool to singers and musicians because it can be used to obtain a specific musical note.

Note: If you have chosen to create a KWL chart to record what students know, wonder, and learn about light, sound, and voice, you may wish to update it now.

Essential Background Information or Terms

Ask students which character in the story has hearing loss. Write *Jack Audire* on chart paper, a chalkboard, or a whiteboard. Write the word *auditory*, which means having to do with hearing or listening. Ask students which parts of *auditory* and *Audire* are the same. Underline the prefix *aud-* in both words. Ask students, “What other words have this prefix?” (auditorium, audio equipment, auditory nerve, audition, audience, applaud) Discuss with students how each word is related to hearing or listening.

Ask students, “If a person cannot hear well, what are some ways to help their communication with others?” Allow students time to share; some may have friends or family members who have hearing loss. Explain that there are devices, or tools, called hearing aids that improve, or increase, the sound that can be heard. People with hearing loss also use other cues to communicate effectively—they can read lips and nonverbal gestures. Remind students that if they are speaking to someone with hearing loss, it is helpful to speak clearly and look at them so they can read your lips and see your facial cues.

Purpose for Listening

Tell students to listen carefully to find out the answer posed in the name of the read-aloud “What is Sound?” and to listen for the kinds of sounds that Samuel, Jack, Ethan, and Amy experience on their trip to New York City. Have students also listen for ways that sound and light are similar and different.



1 [Point to the image.] What sources of light and sound can you see in this image?

What Is Sound?

← Show image 5A-1: Jack and Samuel in Samuel's car¹

"Come on, Samuel, we haven't got all day!" called Jack. "You're going to have to drive a little faster than you did on the way here!"

"Why all the rush?" asked Samuel. "We've got plenty of time."

"I don't want to miss the train!" urged Jack, reaching over to honk the horn to signal the children to come outside.

Samuel and Jack were taking Amy and Ethan to New York City for the day.² They were going to park at the train station and take the train into the city. The day would be filled with a boat tour around Manhattan followed by a concert and dinner.

"They're here!" called Ethan from the doorway. The children ran excitedly toward the car, waving goodbye to Alfie and their mom and dad. Alfie barked excitedly in response.

"Alfie, behave yourself and don't bark all day at squirrels!" called Samuel.

"Ha!" laughed Jack, "His bark is worse than his bite."

"You mean like yours?" quipped Samuel.

"Ha, ha," said Jack dryly.

← Show image 5A-2: Train passing through the beautiful countryside

They arrived and made their way to the platform, where the train was already waiting. The four travelers boarded the train and went in search of four seats together. Moments later, their train pulled out of the station.

"You see?" exclaimed Jack. "We just made it in time!"

Images of the leafy countryside and the sparkling Hudson River flashed past. The children talked excitedly about the sights they would see and the food they would eat in New York City. After a while they sat back in their seats and admired the view. Samuel



had brought his new cane with him. And while his new glasses had improved his vision to some extent, walking with a cane helped him to feel even more secure.

- 3 [Show Image Card 22 (Sound Waves). Point to Image Card 20 (Light Energy From the Sun) on the T-Chart.] Light and sound are similar because they both travel as waves.



“Granddad,” said Ethan, “do you like the **sound** of the train? I really, really like it. It makes me feel as if we are going on a real adventure.”

“We *are* going on a real adventure,” Samuel replied. “Did you know that sound travels in **sound waves** just as light travels in light waves?” Samuel asked.³

← **Show image 5A-3: Jack lecturing on the train**

“Now hold on a minute,” yelled Jack. “You are a wonderful painter, Samuel, and you have taught us all you know about light. You have explained to us how it helps you create beautiful images. But I do declare, Samuel, you are *not* going to lecture us about sound. If anyone is going to do that, it should be me—Jack Audire!”⁴

- 4 [Point to *Jack Audire* where it was written on chart paper, a chalkboard, or a whiteboard in the introduction.] Who can point to the part of Jack’s name that has to do with hearing?

“I don’t think I’ve taught you *everything* I know about light,” retorted Samuel, “but if you want to tell us some interesting facts about sound, then please do. I would love to hear what you have to say. After all, you are a talented musician and have spent your life dedicated to music.”

“Flattery will get you nowhere, Samuel Van Lumen!” yelled Jack, continuing the conversation. “Did you know that our ears, the receptors of sound, are usually self-cleaning?” said an animated Jack.

“Oh, that’s just plain gross!” exclaimed Amy.

“Okay, well, how about this?” Jack continued. “Your ears don’t stop working, even when you are asleep. Your brain shuts out noises. Well, as much as it possibly can.”

“Jack, is that really true?” asked Ethan quizzically.

“Sure it is,” Jack replied confidently. “That’s why alarm clocks work—if they’re loud enough!”

“Oh, look at the horses!” exclaimed Amy excitedly. “They’re galloping!”

“All right, kiddos. I think we should all sit back and relax. When we are in the city, I will share my knowledge and wisdom with you, whether you like it or not! In the meantime, enjoy the view.” With that, Jack sat back and stared contentedly out of the train window.



← **Show image 5A-4: The four travelers in busy, loud NYC**

It was well over two hours before they reached their destination. As the four disembarked the train and made their way out of the train station, a **cacophony** of city sounds rose up into the morning air. People were shouting, horns were honking, and traffic was moving in all directions.

“It’s so noisy!” screeched Ethan.

“Ethan, hold Jack’s hand please,” instructed Samuel. “Amy, give me your arm.”

Together the four made their way toward a row of bright yellow taxicabs parked in front of the train station. Moments later they were sitting inside one of the cabs on their way to the city harbor. There they would take a boat ride around the island of Manhattan.



← **Show image 5A-5: Everyone inside taxi looking out at the sights**

The children stared out of the taxi windows at the hustle and bustle of the city. Sunlight glimmered and shined on the windows that adorned or decorated the high-rise buildings. As the cab moved through the congested city streets, they were engulfed by what felt like a wave of sound and movement.

“As you can tell,” said Jack enthusiastically, looking at the children’s amazed expressions, “even if you couldn’t see the city, you sure can hear it. But do you know what sound is and how it travels?” he asked.

“Not really,” Amy replied. Ethan simply shook his head. At that moment their cab came to a stop again. It was in a long line of cars trying to turn left, but nothing was moving. Jack took this opportunity to talk to the children.

5 [Show Image Cards 23 (Guitar) and 24 (Recorder).] If a stringed instrument like this guitar produces sound by the plucking of a string, how do you think a wind instrument like this recorder makes sound? (Vibrations are caused by the flow of air around and through the instrument, which disturbs the particles in the air and allows the vibrations to travel.)



6 [Show Image Card 25 (Sound Waves Entering Ear).] The sound waves created by the violinist in the distance move through the air to the person's ears.

7 Have you ever felt vibrations through a solid object? [Pause for students to share.]

“Well, just like light, sound is a form of energy,” Jack continued. “There are many, many different kinds of sounds. All sound is made by the movement of objects. That movement is called **vibration**. When you pluck a guitar string, the string vibrates, or moves back and forth. The vibrations make the air shake. The air shakes because tiny particles in the air have been disturbed by the vibration. Those vibrations are called sound waves,” said Jack authoritatively.⁵

← **Show image 5A-6: Objects producing different sounds**

“That’s cool,” said Ethan who was listening intently. “So, just as light enters our eyes in light waves, the sounds of the horns, people, and cars rushing by enter our ears in sound waves,” he offered.⁶

“Exactly,” said Jack cheerfully. “Sound waves move outward from a vibrating object, kind of like ripples of water. Just like light, sound waves can travel through solids, liquids, and gases. Sometimes we can *feel* very strong vibrations through solid objects like the ground or the hard floor of a building.”⁷

“Interestingly, though,” Jack continued enthusiastically, “sound waves cannot travel through space.”

“Why not?” asked Amy.

“Well, unlike light, sound cannot travel through space because it is quite nearly a vacuum. There are almost no particles to disturb in the vacuum of space. For example, think about a rocket that can be seen shooting through space. You might be able to see it, but it simply cannot be heard,” Jack explained.

“Wow,” pondered Ethan. “It’s strange that something that is so loud on Earth would be silent in space!”

Jack added, “Light waves travel better when there are fewer particles, and sound waves travel better when there are more particles. The very fact that space is a vacuum is what allows light waves to travel so quickly through it. On the other hand, the vacuum of space doesn’t allow sound to travel through it at all!”

Suddenly Samuel announced, “We’re here!”



← **Show image 5A-7: Four travelers on a boat leaning over handrail**

Samuel paid the taxicab driver, and the four travelers made their way towards the big sign that said “Harbor Tours.” Before long they were onboard a tour boat and were busily munching on hot dogs, pizza, and pretzels. As they gazed out into the harbor filled with a variety of boats, the warm breeze ruffled Ethan’s hair.

“This is so cool, Granddad!” exclaimed Ethan excitedly. “I can’t wait for the boat to start moving.”

“I hope you’ve brought your sea legs,” said Jack as he devoured a salted pretzel.⁸

“Oh, and before I forget, you should also know,” Jack continued, “that sound waves travel much more slowly than light waves do. Sound waves travel at different speeds depending on the **medium** through which the vibrations are traveling— whether it’s a solid, a liquid, or a gas. Sound waves travel fastest through solids.”⁹

“Oh,” said Amy. “That is the opposite of light waves, which travel fastest through a vacuum!”

Samuel smiled at her keen observation.

The captain of the boat tooted the horn and announced that they were about to set off on a tour around Manhattan.

“And another thing,” said Jack. “On a warm day like today, the sound of the horn travels faster than it would on a cold day. Do you know why?”

Amy and Ethan shrugged.

“When it is warm, the particles in the air vibrate faster, which causes the sound waves to travel faster.”

“Awesome!” said Ethan as he stared up at the large horn.

As the boat moved away from its mooring, the captain tooted the horn again. Ethan listened to the sound of the horn as it seemed to be carried away by the wind, and thought long and hard about the things Jack had just explained to him about sound.¹⁰

8 If you have “sea legs” you have the ability to keep your balance on a moving boat.


9 [Show Image Card 26 (Sound Traveling Through String).] Sound can travel well through the medium of the solid string between the two metal cans if it is held tight.

10 You might be interested to know that even though light and sound can both travel easily through air, light travels through air 850 times faster than sound!

Comprehension Questions

15 minutes

If students have difficulty responding to questions, reread pertinent passages of the read-aloud and/or refer to specific images. If students give one-word answers and/or fail to use read-aloud or domain vocabulary in their responses, acknowledge correct responses by expanding the students' responses using richer and more complex language. Ask students to answer in complete sentences by having them restate the question in their responses. **It is highly recommended that students answer at least one question in writing and that some students share their writing as time allows.** For written responses in this domain, students will use their Light and Sound Logs to collect source material for longer writing pieces and as preparation for written responses in the Domain Assessment.

1. *Literal* Which character is teaching about sound in this part of the story? (Jack Audire) What part of this character's name means *hearing*? (*aud-*) Who remembers what the second part of Samuel's last name, Van Lumen, means? (*light*)
2.  *Literal* What is sound? (Sound is a form of energy that is caused by the vibration of particles and that travels in waves.)
3. *Inferential* How do we sense the vibrations of sound waves? (Our ears receive the sound waves and help us to hear, and we can feel vibrations through solid objects.)






← Show image 5A-6: Objects producing different sounds

4. *Evaluative* You heard the word *cacophony* in the story. What does it mean? (harsh, jarring noise) In which setting you heard described in today's read-aloud was there a cacophony of sounds? (They were greeted by a cacophony of sounds on the streets of New York City when they left the train station.) Describe sources of sound found in the image that contribute to the cacophony of sounds heard. (They might hear people talking, cars and taxis, streetlights humming, etc.) Based on what you know about the characters Samuel, Jack, Ethan, and Amy, how do you think they may have responded to these sounds? (Answers may vary.)



← **Show image 1A-2: Samuel and Jack seated in garden chairs beneath shade of oak tree**

5.  *Evaluative* Compare and contrast the setting of Samuel's home along the Hudson River with the setting of the streets of New York City. Be sure to use the word *setting* when you tell about it. (Answers may vary.)
6.  *Evaluative* Compare and contrast light and sound. How are they similar? (Both are forms of energy; both travel in waves; both are perceived by our senses; etc.) How are they different? (They travel at different speeds through various mediums. Light waves travel fastest through a vacuum, and sound waves travel fastest through solids; light can travel without particles, but sound cannot travel through a vacuum, because it needs particles to vibrate; etc.)
7. *Evaluative* What is the loudest place you have ever been? Was there a cacophony of sound, or were they pleasant sounds? Use descriptive adjectives when you tell about it. (Answers may vary.)
8. *Inferential* Why can't you hear a rocket in space? (Sound waves cannot travel in a vacuum, because there are no particles to vibrate.)
9.  *Evaluative* Describe how Jack's dedication to music contributes to the discussions the friends and the children share while they are on the train and visiting New York City. (Answers may vary, but may include: Jack knows a lot about sound, so they talk about the sounds they hear, what makes sound, and how it travels.)

I am going to ask a question. I will give you a minute to think about the question, and then I will ask you to turn to your neighbor and discuss the question. Finally, I will call on several of you to share what you discussed with your partner.

10. *Evaluative Think Pair Share:* When you experience a thunderstorm, do you see the lightning first, or hear the thunder first? Why do you think this is? (Because light travels faster than sound, you see the lightning before you hear the thunder.)
11. After hearing today's read-aloud and comprehension questions and answers, do you have any remaining questions?

✈ You may wish to allow time for individual, group, or class research of the text and/or other resources to answer any remaining questions.

Note: Place Image Cards 21–26 on the T-Chart and briefly review what was learned in the read-aloud about sound. Have students save written work in their Light and Sound Logs throughout the domain.

Note: If you began a KWL chart in the introduction, you may choose to update it now.

Word Work: Vibration

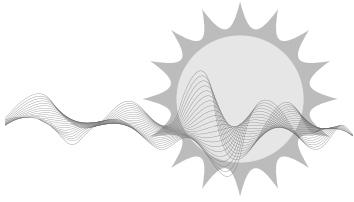
5 minutes

1. In the read-aloud you heard, “All sound is made by the movement of objects. That movement is called *vibration*.”
2. Say the word *vibration* with me.
3. A vibration is a rapid movement back and forth.
4. The vibration of the guitar strings made a beautiful sound.
5. Have you ever heard a vibration? What was causing the vibration? If it was a musical instrument, then what was that instrument? Be sure to use the word *vibration* when you tell about it. [Ask two or three students. If necessary, guide and/or rephrase the students’ responses to make complete sentences: “I heard a vibration from . . .” or “_____ was causing the vibration.”]
6. What’s the word we’ve been talking about? What part of speech is the word *vibration*?

Use a *Discussion and Hands-On* activity for follow-up. Have students observe and discuss different types of vibrations. Have students put their hands to their throats and hum or speak to feel the vibration of their voice. Demonstrate the tuning fork again. Discuss different musical instruments that produce vibrations (e.g., violin, harp, recorder, guitar). Stretch a rubber band across a cup and show students the vibration. As students share, make sure that they use the word *vibration* in a complete sentence.



Complete Remainder of the Lesson Later in the Day



What Is Sound?

5_B

Extensions

20 minutes

Sayings and Phrases: His Bark Is Worse than His Bite

5 minutes

Proverbs are short, traditional sayings that have been passed along orally from generation to generation. These sayings usually express general truths based on experiences and observations of everyday life. Although some proverbs do have literal meanings—that is, they mean exactly what they say—many proverbs have a richer meaning beyond the literal level. It is important to help your students understand the difference between the literal meanings of the words and their implied or figurative meanings.

Reread the following excerpt from the read-aloud:

“Alfie, behave yourself and don’t bark all day at squirrels!” called Samuel.

“Ha!” laughed Jack. “His bark is worse than his bite.”

Ask students if they have ever heard anyone else say “his bark is worse than his bite.” Have the students repeat the saying. Ask students if they have an idea about what this saying may mean, and discuss their ideas. Explain that the literal meaning of this saying is that a dog is more apt to bark loudly and viciously than it is likely to bite; often times when this saying is used, it is referring to a person who may talk in a harsh tone, but is actually harmless. Instead of Jack saying “His bark is worse than his bite,” he could have said, “Don’t worry; Alfie is harmless.”

Ask the following questions:

- Do you think Alfie barking means that he would bite? Why or why not? (No, Alfie just barks because he is excited.)
- What do you think Samuel meant when he says to Jack, “You mean like yours?” (Samuel was joking that “Jack’s bark is worse than his bite,” meaning that his grumpy talk is harmless and that Jack wouldn’t hurt anyone.)
- Can you think of a time when someone may have complained or been grumpy when speaking to you, but they did not do anything that was harmful? (Answers may vary.)

Tell students to listen for times when this phrase is appropriate as they continue listening to the story. Try to find other opportunities to use this saying in the classroom.



Sequencing the Creation and Transfer of Sound Waves

Show Image Card 25 (Sound Waves Entering Ear).

Have students sequence the following sentence strips that have already been prepared. Make sure that the sentence strips are not numbered and are presented in a random order. As students discuss the strips, encourage them to use domain vocabulary as well as temporal and spatial language such as *first*, *then*, *next*, *into*, *through*, and *away from*.

1. The violinist moves her bow across the strings of the violin.
2. The violin strings vibrate.
3. The vibrating violin strings cause the air particles to vibrate.
4. The sound waves travel through the medium of the air.
5. Sound waves are received by the listener's ears.

As you read through the final listing of the strips, ask a student volunteer to point to the parts of the image that apply to each step.



Multiple Meaning Word Activity: Medium

Materials: Image Card 26; index cards; images depicting the various meanings of medium (optional)

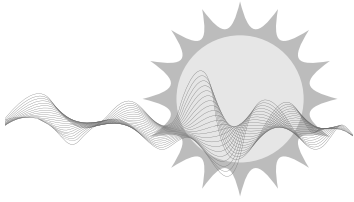
1. In the read-aloud, you heard the word *medium* as in, “Sound waves travel at different speeds depending on the medium . . .” Who can tell me what *medium* means in this example? (a type of substance or material through which something can travel—in this, case sound energy) What are the three types of mediums mentioned in the read-aloud? (solids, liquids, and gases)
2. [Show Image Card 26 (Sound Traveling Through String).] What is the medium in this image? (the string) What type of medium is it? (a solid) What form of energy is moving through this solid medium? (sound) What is an example of a liquid medium for sound? (sound traveling through water) What is an example of a gas medium for sound? (sound traveling through the atmosphere) Can a vacuum be a medium for sound? (no) Why not? (There are no particles to vibrate and cause sound.)

3. What other form of energy have you learned about that travels through different mediums? (light) Light and sound travel through different mediums in different ways and at different speeds. For example, light cannot travel through an opaque solid, such as a wall, but sound can; sound cannot travel through a vacuum, but light can.
4. The word *medium* has several other meanings. With your neighbor, brainstorm as many meanings for *medium* as you can and discuss ways you can use the word *medium*. [Have partners jot down the different meanings and/or sentences they discover together on index cards. Tell students they will revisit these cards at the end of the activity.]
5. You may hear the word *medium* in art class, because paint, crayons, chalk, and clay are all different mediums for art expression. The paint, crayons, chalk, or clay become the channel through which an artist's expression is conveyed to others. [Ask for a volunteer to share a sentence using the word *medium* with this meaning.]
6. *Medium* can also refer to something that is in a middle position or size. For instance, if you were selecting a medium-sized drink, and it was not the largest or the smallest, it would be in the middle. [Ask for a volunteer to share a sentence using the word *medium* with this meaning.]
7. The word *medium* can also be used to describe a surrounding environment. For instance, you might plant flower seeds in a medium like a special potting soil that would provide excellent nourishment for those seeds to grow. [Ask for a volunteer to share a sentence using the word *medium* with this meaning.]
8. Check your index cards to see if you predicted any meanings correctly, or if you have any other meanings to share. Now quiz your neighbor on the different meanings of *medium*. For example, you could say, "I think the medium-sized hat fits me best. Which meaning of *medium* am I using?" And your neighbor should say, "That meaning of the word *medium* is a middle position or size."

Take-Home Material

Family Letter

Send home Instructional Master 5B-1.



Qualities of Sound

6

☑ **Lesson Objectives**

Core Content Objectives

Students will:

- ✓ Identify sound as a form of energy that travels in waves
- ✓ Describe how sound waves travel in different mediums
- ✓ Identify sources of sound
- ✓ Compare and contrast light and sound
- ✓ Describe how the intensity and frequency of vibrations affects the qualities of a sound

Language Arts Objectives

The following language arts objectives are addressed in this lesson. Objectives aligning with the Common Core State Standards are noted with the corresponding standard in parentheses. Refer to the Alignment Chart for additional standards addressed in all lessons in this domain.

Students will:

- ✓ Identify the reason that Jack would put his hearing aid in before the orchestra begins to play (RL.3.3)
- ✓ Describe the relationship between the frequency of vibrations and the pitch of the resulting sound, using language that pertains to time, sequence, and cause/effect (RI.3.3)
- ✓ Describe the relationship between the intensity of vibrations and the loudness of the resulting sound, using language that pertains to time, sequence, and cause/effect (RI.3.3)
- ✓ Interpret information about the intensity and pitch of sounds produced by drums by referring to diagrams in “Qualities of Sound” (RI.3.7)
- ✓ Compare and contrast a photograph of the Lincoln Center and the artists’ illustration of the Lincoln Center (RI.3.9)

- ✓ Use a Venn diagram to group related information together to aid in planning an informative writing piece comparing light and sound (W.3.2a)
- ✓ Begin development of an informative writing piece comparing light and sound by clearly stating ideas, facts, and details in the Venn diagram (W.3.2b)
- ✓ With guidance and support from peers and adults, use the steps of the writing process such as plan, draft, revise, edit, and publish to create an informative writing piece that will be developed and strengthened over an extended time frame (W.3.5) (W.3.10)
- ✓ Make personal observations of musical instruments as they are played and connect this experience to the descriptions and explanations of the qualities of sound in the text (W.3.8)
- ✓ Gather information from Light and Sound Logs, the T-Chart, and other print and digital sources and sort the information using the Venn diagram planning tool (W.3.8)
- ✓ Categorize low-frequency and high-frequency sounds (W.3.8)
- ✓ Determine the meaning of the new words formed when a known affix is added to a known word, such as *compose/composition* (L.3.4b)
- ✓ Draw an illustration in the Light and Sound Log to represent a main idea or key details from “Qualities of Sound” or to depict a vocabulary word

Core Vocabulary

Note: You may wish to display some of these vocabulary words in your classroom for students to reference throughout the domain. You may also choose to have students write some of these words in a “domain dictionary” notebook, along with definitions, sentences, and/or other writing exercises using these vocabulary words.

audiologist, n. A doctor who studies hearing and how to help people with hearing loss

Example: Tom’s dad, the local audiologist, tests his patients’ hearing to check for and treat any hearing loss.

Variation(s): audiologists

composing, v. Creating or writing; arranging

Example: Renée has been composing music on her piano since she was four years old.

Variation(s): compose, composes, composed

device, n. A piece of equipment designed for a specific purpose

Example: A television remote control is a device that allows a person to change channels and volume from a distance.

Variations(s): devices

frequency, n. The rate at which sound waves are produced; the number of times something happens within a particular period of time

Example: The thick strings of the bass guitar produced a sound with very low frequency and pitch.

Variation(s): frequencies

hearing aid, n. A device that is worn in the ear of a person who has difficulty hearing; used to make sounds louder

Example: Gunther had trouble hearing, so an audiologist recommended that he wear a hearing aid to help him hear everyday sounds better.

Variation(s): hearing aids

intensity, n. The measured strength of light and sound; the amount of energy or power something has


Example: The violin solo sounded lovely in the performance, and as the rest of the orchestra started playing, the song grew in intensity.

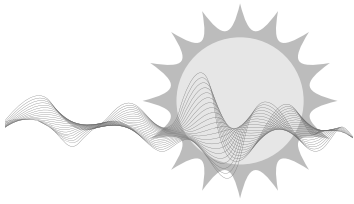
Variation(s): intensities

pitch, n. The quality of a sound as high or low

Example: The baby in the restaurant screamed with a high pitch that hurt everyone's ears.

Variation(s): pitches

<i>At a Glance</i>	Exercise	Materials	Minutes
<i>Introducing the Read-Aloud</i>	What Have We Already Learned?	T-Chart; Light and Sound Logs (optional)	10
	Essential Background Information or Terms	Image Card 27; a piece of sheet music	
	Observation and Inquiry	one or two easily available simple musical instruments	
	Purpose for Listening		
<i>Presenting the Read-Aloud</i>	Qualities of Sound	Image Cards 28–31; T-Chart	20
<i>Discussing the Read-Aloud</i>	Comprehension Questions	Light and Sound Logs	15
	Word Work: Frequency		5
 Complete Remainder of the Lesson Later in the Day			
<i>Extensions</i>	Light and Sound Log	Image Cards 27–31; T-Chart; KWL Chart (optional); Light and Sound Logs	20
	Writing Informational Paragraphs: Plan	T-Chart; KWL Chart (optional); Light and Sound Logs; Instructional Master 6B-1	



Qualities of Sound

6A

Introducing the Read-Aloud

10 minutes

What Have We Already Learned?

Point to the image cards on the T-Chart to review content from the previous read-aloud. You may also wish to have students refer to their Light and Sound Logs. You may choose to ask the following questions:

- Which character is teaching about sound?
- What is sound? How does it travel?
- What are some sources of sound?
- How are light and sound similar? How are they different?

Essential Background Information or Terms

Ask students if they have ever heard of an orchestra. Show Image Card 27 (Orchestra), and explain that an orchestra is made up of a group of musicians who play a variety of instruments—including stringed, woodwind, brass, and percussion—that produce a variety of sounds. Show students a piece of sheet music. Tell them that musicians perform musical pieces that are written down in musical notes on sheet music. Explain that musical notes are symbols that indicate at what pitch—how high or how low—each note should be played. Tell students that these musical notes are written, or composed, by composers, people who write music. Point to the conductor on the image card, and explain that the conductor leads the orchestra to keep everyone playing together.

Note: You may wish to coordinate with the music teacher in your school to allow students to observe instruments being played from each group and describe the sound variations of each instrument. This may be done in the Extension and/or Pausing Point.

Observation and Inquiry

You may use one or two easily available instruments; a harmonica, a recorder, a child's drum, or a bell will work fine for this discussion. Ask the students to look at the instrument and think about how vibrations are created. Ask the students to predict how the particular instrument makes changes in its sounds. You may choose, or ask a volunteer, to demonstrate the way the instrument makes sounds, and the ways it allows the musician to change the sound.

Ask the students to describe the qualities of the sound the instrument makes. Ask, "Do you find the sounds pleasing or displeasing?" Explain that in this read-aloud, students will hear about an orchestra concert and the sounds instruments make.

Purpose for Listening

Tell students to listen to find out more about sound and the different qualities that cause variations of sound.



Qualities of Sound

← Show image 6A-1: Travelers eating ice cream cones

- 1 Who can tell me why Ellis Island and the Statue of Liberty are significant? (Students may recall from the Grade 2 *Immigration* domain that Ellis Island was the first place of entry for many immigrants into the United States, and the Statue of Liberty is a symbol of the United States and of freedom for people immigrating to this country.)

The children had a great time on the boat tour of Manhattan. They had admired the Statue of Liberty, Ellis Island, and the Brooklyn Bridge, and had especially enjoyed waving to passengers on other boats that passed them by.¹

Once they were back on land, Samuel insisted that they all have ice cream. No one protested. They stood on the edge of the curb as Samuel waved his cane in the air in the hope of attracting a taxi.

“It looks like you are planning to attack someone with a large stick!” Jack exclaimed.

Both Amy and Ethan burst out laughing.

“I’m trying to hail a taxi,” Samuel explained.

“Well, I don’t know if I would stop!” yelled Jack. “I think I would fear for my life.”

Nevertheless, after a few minutes of cane waving, a taxi slowed to a halt. The driver poked his head out of the window and asked, “Where to?”

“The Lincoln Center,” Jack replied.

← Show image 6A-2: Cab pulling up to Lincoln Center²



- 2 [Show Image Card 28 (Lincoln Center).] This is a photograph of Lincoln Center. [Point to image 6A-2.] How would you describe the way the artist chose to portray the Lincoln Center in this image? What is similar? What is different? [Pause after each question for students to share.]

Jack had arranged for them to attend an afternoon concert at the Lincoln Center. They were going to listen to an orchestra made up of young musicians from all over the United States. After the concert, they were going to have dinner before catching the train home.

The traffic seemed to be moving a little faster than it had been earlier in the day, and before they knew it they had arrived at their destination. Once again, they paid the taxi driver and piled out of the cab. Immediately, Jack took charge and led them toward an impressive building known as Avery Fisher Hall.



Inside the main door, Jack collected four tickets from the box office, and after showing the tickets to a member of the staff, they were handed programs and directed to their seats.

← **Show image 6A-3: Inside the concert hall**

Jack had bought tickets in the first balcony to the left of the stage. They sat down together in the comfortable plush seats and took in the beautiful sights and sounds of the famous concert hall.

“What sort of music will we hear?” asked Ethan.

“The musicians are going to play music from well-known movies. I think you’ll enjoy it, Ethan.” explained Jack.

“Which movies?” asked Amy.

“Take a look in the program,” advised Samuel. “There you will find the titles of all the pieces being played today.”

Amy and Ethan immediately began to scour the pages of the program.



← **Show image 6A-4: Jack telling about playing his violin**

Turning to the children, Jack said, “As you know, I am a musician who has been **composing** and playing combinations of carefully arranged musical notes most of my life. Each musical note has a particular sound. When you combine these sounds successfully, the end result is a perfectly harmonious musical composition.”³

“So, music is like the gift of sound,” Ethan mused.

“That’s a nice way to think about it,” Amy replied.

Jack reached into his pocket and pulled out a small **hearing aid** and placed it inside his left ear.⁴

“Jack, I didn’t know you used a hearing aid,” Amy said.

“Yes, the **audiologist** I went to see gave this **device** to me. I should use it more than I do,” replied Jack. “Today I want to make sure that I can hear these wonderful musicians.”

3 What is the word Jack used to describe the written piece of music? (*composition*) What root word is in *composition*?

4 [Show Image Card 29 (Hearing Aid).] A hearing aid is a small device, or piece of special equipment, that is worn in the ear to make sounds louder so a person can hear better.

“He doesn’t wear it when I am talking to him,” announced Samuel.

“What would be the point of that?” joked Jack. He was no longer yelling. It was clear that the hearing aid was helping him to hear.



← **Show image 6A-5: Orchestra playing**

Before long it was time for the concert to begin. The lights began to dim, the musicians appeared, the conductor took his place, and the sound of music burst forth into the air.⁵

The orchestra played a number of well-known pieces. Amy and Ethan recognized some of them from their favorite movies. They watched and listened intently as the musicians played.

After about forty-five minutes, the lights in the concert hall brightened for the intermission, and people began to stretch their legs and wander out into the atrium, or entrance hall.

5 [Point to the conductor in the image.] What does the conductor do?



← **Show image 6A-6: String and bass instruments**

Jack pointed to the violinist, who was adjusting the tightness of the strings on his instrument.⁶

“Have I ever explained to you how my favorite instrument, the violin, works?” asked Jack. “The strings of the violin determine how high or low its sound is. The thickness, tightness, and length of the strings all make a difference in the kind of sound it makes.”

“I love when you play the violin,” said Amy, smiling.

“What’s that instrument called, Jack?” Ethan asked curiously, pointing to a large brass instrument toward the back of the orchestra.

“Oh, the tuba! Another one of my favorites!” exclaimed Jack with pleasure.⁷ “The musician blows on the mouthpiece to produce the vibrations inside the instrument. His fingers press the valves, or buttons, on the tuba. This changes the length of the tube through which the air flows.”

“Let me guess!” cried Amy. “The length of the air tube makes the sound lower or higher!”

“You would make a fine musician!” beamed Jack.

“Or maybe a scientist,” Amy responded proudly.

6 The violin is classified as a member of the string family of instruments. Is anyone familiar with another stringed instrument? (guitar, harp, banjo, etc.)

7 The tuba is classified as a brass instrument. Is anyone familiar with another brass instrument? (French horn, trumpet, trombone, etc.)



← **Show image 6A-7: Comparison of drums' intensity showing loud and soft sounds**

“This might sound like a silly question,” said Amy, “but what makes sound loud or soft?”

“That’s not a silly question at all,” replied Jack. “You see, the loudness or softness of a sound is caused by the amount of energy being carried in the vibration. The greater the **intensity**, or power, of a sound wave, the louder the sound. Think about the difference between a drum that is tapped lightly and one that is struck very hard. When the drummer taps lightly, there is less energy applied to the drum—less energy means lower intensity and a softer sound. When the same drum is struck with greater energy, the sound has higher intensity and it’s—*loud!*”



← **Show image 6A-8: Comparison of two different drums' pitches**

“I see,” said Ethan. “I have another question. What is **pitch**? I heard that word in music class, but I didn’t know what it meant,” Ethan continued.

“Another excellent question,” said Jack. “In order to explain that, let me go back a step or two. When an object vibrates, such as the top of a drum, it does not produce just one sound wave, but many sound waves per second. The faster something vibrates, the shorter the wavelengths it produces. For example, the top of a larger drum vibrates more slowly than the top of a smaller drum. The tightness and thickness of the top of the drum make a difference, too.”

Jack took a breath and Samuel jumped in, “If the sound waves have a short wavelength, there are many waves per second. If the waves have a longer wavelength, there are fewer waves per second.”

Amy and Ethan giggled as Jack glared at Samuel.

“The rate at which sound waves are produced is known as the **frequency** of sound,” resumed Jack.⁸

Amy nodded. “I see. So, a sound with a long wavelength and fewer waves per second, like the sound produced by the larger

8 [Point to Image Cards 20 (Light Energy From the Sun) and 25 (Sound Waves Entering Ear) on the T-Chart.] Both light waves and sound waves are measured in wavelengths and can have high and low frequencies.

drum, has a low frequency, whereas one with a short wavelength and more waves per second, like the sound produced by the smaller drum, has a high frequency?”

“Exactly,” said Jack. “And to answer your first question, **pitch** describes how high or low a sound wave sounds.”

“Oh, I understand now,” said Amy cheerily. “High frequency sound waves have high pitches, and low frequency sound waves have low pitches. That must be why the violin—which is small and has short strings—has a higher pitch than a stand-up bass, which is huge with much longer strings.”⁹

9 [Show Image Card 30 (Violin and Bass).] Which instrument would produce higher frequency vibrations? (violin) Would it have a higher or a lower pitch than the bass? (higher)

“So, the sound of a bird chirping is a high-pitched sound, but the sound of a cow mooing is a low-pitched sound,” burst in Ethan who was now mooing loudly like a cow.

“You’ve got it,” said Jack. “Variations in sound waves cause sounds with different qualities.”



← **Show image 6A-9: Show resuming**

Before long, the musicians and the conductor returned to the stage. Samuel, Jack, Amy, and Ethan sat back and enjoyed the rest of the concert. Each musical composition created an atmosphere of its own. The audience listened attentively and applauded enthusiastically, especially when the better known pieces were played. Music from well-known superhero movies, fantasy movies, and Disney movies were particularly well received. The music recreated magical images and brought back memories for each member of the audience.



← **Show image 6A-10: Everyone having dinner**

When the concert was over, Samuel and Jack took the children to their favorite Italian restaurant. The restaurant was less than a block from the concert hall, and the four laughed and joked as they walked to the restaurant and talked about their favorite parts of the concert.

“I wish we could have brought Alfie to the city!” said Ethan eagerly.

Jack shook his head. “Alfie would have gone crazy! You know all of those loud sounds we heard today? He would have heard even more sounds.”

“What do you mean?” asked Amy.

“Well, have you ever seen someone using a dog whistle? A dog whistle produces a very high sound; the frequency is so high that we cannot hear it, but dogs can. Alfie is able to hear a greater range of sounds—higher pitch sounds and lower pitch sounds—than we can hear. As with light, some wavelengths or frequencies can not be sensed by humans.”

“Oh, wow,” said Ethan. “Maybe that’s why Alfie can always hear a thunderstorm coming before we do! The storm must produce vibrations that are too low for us to hear.”

“Yup,” said Jack.

Over dinner, Samuel and Jack recalled how they, too, had been taken on a trip to the city when they were young.

“When we were in the fourth grade, your grandfather’s father took us to a concert at Carnegie Hall. That was the day I decided that I wanted to be a professional musician,” recalled Jack.

Samuel smiled. “I remember that day as if it were yesterday,” he said.

Jack smiled, too. “My life was never the same after that experience.”¹⁰

10 [Show Image Card 31 (Carnegie Hall).] Carnegie Hall is also a real place in New York City. Even though this is a fictional story, the author has included some nonfiction locations as part of the setting of this story. What is the setting of the read-aloud you have heard today?



Comprehension Questions




15 minutes


← Show image 6A-2: Cab pulling up to Lincoln Center

1. *Evaluative* What is the setting throughout most of this read-aloud? (Avery Fisher Hall at Lincoln Center in New York City) What are some adjectives and other words you could use to describe this setting? (large space, beautiful, crowded, exciting, dim lights, elegant, etc.)



← Show image 6A-3: Inside the concert hall

2. *Evaluative* What are some sources of sound Jack, Samuel, Ethan, and Amy heard inside the concert hall at the Lincoln Center? (Answers may vary, but may include applause, instruments being tuned up, the orchestra playing, music, voices, etc.) How would you describe these sounds? (Answers may vary.)
3.  *Inferential* How does the frequency of sound waves affect the pitch of a sound? (High frequency sound waves have a higher pitch, or higher sound. Low frequency sound waves have a lower pitch, or lower sound.)
4. *Evaluative* What are some examples of high-pitched sounds? (Answers may vary, but may include birds tweeting, babies crying, a whistle, a violin playing, etc.)
5. *Evaluative* What are some examples of low-pitched sounds? (Answers may vary, but may include growls, cow mooing, low bass or tuba being blown, etc.)
6.  *Evaluative* What is intensity? (energy or power) What is an example of a high-intensity sound? (a jackhammer, loud music) What is an example of a low-intensity sound? (a whisper, the rustling of leaves)
7.  *Inferential* Describe how pitch, frequency, and intensity affect the qualities and variations of sounds that we hear. (Answers may vary, but should include domain vocabulary.)


8.  *Literal* [Show Image Card 27 (Orchestra).] What is an orchestra? (Answers may vary, but may include that an orchestra has musicians who play various instruments and follow sheet music written by composers; led by a conductor; etc.) What is someone doing if he or she is composing music? (A composer writes or creates music.) What is a composition? (A composition is the written piece of music that is created.)
9. *Evaluative* Why do you think Jack puts in his hearing aid before the orchestra begins to play? (He wants to hear the full sound of the music; he loves music.) What kind of doctor recommended that Jack use a hearing aid? (Jack’s ear doctor is called an audiologist.)



← **Show image 6A-2: Cab pulling up to Lincoln Center**

10. *Evaluative* [Show Image Card 28 (Lincoln Center).] During the read-aloud, we looked at the way the artist chose to portray the Lincoln Center. If you were going to paint or draw the Lincoln Center yourself, how would you choose to portray it? What would you include? What would you leave out? What would you include but change in some way? (Answers may vary.)

I am going to ask a question. I will give you a minute to think about the question, and then I will ask you to turn to your neighbor and discuss the question. Finally, I will call on several of you to share what you discussed with your partner.

11.  *Evaluative Think Pair Share:* If you could only perceive light or sound, which would you choose and why? (Answers may vary.)
 12. After hearing today’s read-aloud and comprehension questions and answers, do you have any remaining questions?
- You may wish to allow time for individual, group, or class research of the text and/or other resources to answer any remaining questions.

Word Work: Frequency

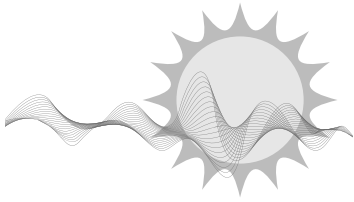
5 minutes

1. In the read-aloud, you heard, “The rate at which sound waves are produced is known as the *frequency* of sound.”
2. Say the word *frequency* with me.
3. The frequency of sound is how often sound waves are produced; sound waves can have a high frequency or a low frequency. *Frequency* also means the number of times something happens within a particular period of time.
4. Tobias knew that the sound of the jet engine had a high frequency because it was producing many sound waves in a short period of time.
5. Have you ever heard something that had a high or low frequency? Be sure to use the word *frequency* when you tell about it. [Ask two or three students. If necessary, guide and/or rephrase the students’ responses to make complete sentences: “I heard a high/low frequency . . .” or “_____ had a high/low frequency.”]
6. What’s the word we’ve been talking about? What part of speech is the word *frequency*?

Use a *Brainstorm and Discussion* activity for follow-up. Have students discuss different types of sounds they have heard, making a list of high-frequency and low-frequency sounds. You may choose to provide a theme, such as animal sounds or instrument sounds. You may also choose to discuss the correlation of frequency to pitch. Finally, you may choose to review the meaning of *frequency* as it relates to anything that is repeated. As students add to and review the list, make sure that they use the word *frequency* in a complete sentence.



Complete Remainder of the Lesson Later in the Day



Qualities of Sound

6_B

Extensions

20 minutes



Light and Sound Log

Place Image Cards 27–31 on the T-Chart. Give each student a piece of paper. Have them reference the image cards on the T-Chart as they write one or two sentences and draw an illustration about something they learned in today’s read-aloud about sound.

Allow students to share their sentences and drawings with the class, encouraging them to use any domain-related vocabulary. Have students save written work in their Light and Sound Logs throughout the domain.

Note: If you began a KWL chart in the introduction, you may choose to update it now.

- You may wish to have some students complete Instructional Master 1B-1 independently.

Writing Informational Paragraphs: Plan (Instructional Master 6B-1)

Ask students what two forms of energy they have been learning about. Tell students that they are going to write an informational piece together to compare and contrast light and sound. Ask, “Who can tell me what *compare* and *contrast* mean?” Remind students that to *compare* means to tell how items are similar, and to *contrast* means to tell how items are different.

Ask, “Who can tell me what informational writing is?” Write the word *informational* on the board, and ask what word students see inside that word. You may wish to underline or put a box around the words *information* or *inform*. Remind students that informational writing shares *information*, or facts, about a certain topic. Remind students that they wrote an informational paragraph in the *Classification of Animals* domain to explain how a particular animal is classified. Explain that this informational piece about light and sound will be longer than the piece they wrote about animals, because they are writing about two topics and are comparing and contrasting them.

Remind students of the steps of the writing process—plan, draft, revise, edit, and publish—and tell them that today they will complete the first step of the informational piece together: planning.

Copy Instructional Master 6B-1 onto chart paper, a chalkboard, or a whiteboard. Write the words *Light* and *Sound* in the two headings of the Venn diagram. Have students reference the T-Chart and their Light and Sound Log to help you fill in the sections of the diagram, telling how light and sound are similar and how they are different.

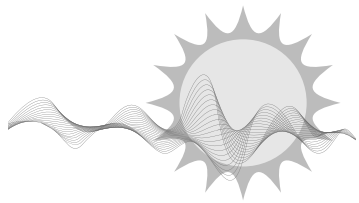
Remind students that sometimes when writing an informational piece, a writer may already know information, or facts, about the chosen topic. Explain that many times, however, writers will need to research several sources for information, including books, magazines, websites, etc.

Tell students that they will use what they already know and what they have learned to compare/contrast light and sound. You may also wish to allow students to research further, using trade books in the classroom book tub and other sources. If you include in these paragraphs information that is found in these sources, be sure to explain that you are writing this information in your own words in order to avoid plagiarism. Explain that plagiarism is the act of taking other people's work exactly as it is written and using it as your own.

Tell students that together they will write at least three ways that light and sound are similar, and three ways that light and sound are different, using examples from the texts they have heard and read. For example, light and sound are alike because they are both forms of energy that move in waves; light and sound are different because light can travel in a vacuum, but sound cannot.

Tell students that they will begin the drafting step together the next time they meet to work on writing. Tell them to be thinking of a title for their informational piece.

Note: You may wish to have some students use Instructional Master 6B-1 to complete this step of the writing process with partners, in groups, or on their own. You may need to take more than one day to complete this step of the writing process, as this informational piece is longer than some of the other genres previously taught.



☑ **Lesson Objectives**

Core Content Objectives

Students will:

- ✓ Identify sound as a form of energy that travels in waves
- ✓ Describe how sound waves travel in different mediums
- ✓ Identify sources of sound
- ✓ Compare and contrast light and sound
- ✓ Describe how the intensity and frequency of vibrations affects the qualities of sound
- ✓ Identify the parts of the body that create the human voice
- ✓ Explain how the human voice is produced and is able to make a wide range of sounds

Language Arts Objectives

The following language arts objectives are addressed in this lesson. Objectives aligning with the Common Core State Standards are noted with the corresponding standard in parentheses. Refer to the Alignment Chart for additional standards addressed in all lessons in this domain.

Students will:

- ✓ Compare and contrast the seasonal setting of autumn in this read-aloud to summer in prior read-alouds, as well as anticipate a winter setting in the next read-aloud (RL.3.9)
- ✓ Describe the relationship between the characteristics of the voice box and the quality of sound produced, using language that pertains to time, sequence, and cause/effect (RI.3.3)
- ✓ Determine and distinguish between the literal and figurative meanings of “actions speak louder than words” (RI.3.4) (L.3.5a)

- ✓ Interpret information from the diagrams about the various organs that produce sound in the human body (RI.3.7)
- ✓ Compare and contrast the diagrams showing the organs that produce sound in the human body (RI.3.9)
- ✓ Identify and use parts of a paragraph, including a topic sentence, supporting details, and a concluding sentence in each paragraph of an informative writing piece (W.3.2a)
- ✓ Use the information categorized in the Venn diagram to group related information as they draft each paragraph for an informative writing piece comparing and contrasting light and sound (W.3.2a)
- ✓ Begin drafting an informative writing piece comparing and contrasting light and sound and clearly stating ideas, facts, and details (W.3.2b)
- ✓ Use linking words and phrases such as *also*, *another*, *because*, *finally*, and *in addition* to connect ideas within paragraphs (W.3.2c)
- ✓ Provide a concluding paragraph for the informative writing piece comparing and contrasting light and sound (W.3.2d)
- ✓ With guidance and support from peers and adults, use the steps of the writing process such as plan, draft, revise, edit, and publish to create an informative writing piece that will be developed and strengthened over an extended time frame (W.3.5) (W.3.10)
- ✓ Make personal connections to the concepts presented in “Voice” (W.3.8)
- ✓ Gather information from Light and Sound Logs, the T-Chart, and other print and digital sources and sort the information using the Venn diagram planning tool (W.3.8)
- ✓ Make a prediction prior to the read-aloud about what causes our bodies to produce our voices, based on the discussion and activities in the introduction, and compare to information provided during “Voice” (SL.3.1a)
- ✓ Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships, to describe the organs of the human body shown in the image and how each contributes to producing the human voice (L.3.6)

Core Vocabulary

Note: You may wish to display some of these vocabulary words in your classroom for students to reference throughout the domain. You may also choose to have students write some of these words in a “domain dictionary” notebook, along with definitions, sentences, and/or other writing exercises using these vocabulary words.

diaphragm, n. The sheet of muscle that separates the lungs from the lower part of the torso and that allows air to be breathed into the lungs

Example: Paul was an excellent trumpet player because he used his diaphragm to take very deep breaths so he could hold notes for a long time.

Variation(s): diaphragms

larynx, n. A hollow organ in the throat between the nose and the lungs that contains the vocal cords; voice box

Example: When Jennifer lost her voice, her doctor told her that it was because her larynx was swollen.

Variation(s): larynxes

trachea, n. A long tube through which air travels to and from the lungs when breathing; windpipe

Example: The trachea is an important breathing passage through which oxygen enters the lungs and through which carbon dioxide exits.

Variation(s): tracheae, tracheas

variations, n. Changes in amount, form, or level of something

Example: The transition between winter and spring often brings temperature variations that are hard to predict.

Variation(s): variation

vocal cords, n. Thin, folded tissues located in the larynx that vibrate when air is exhaled (breathed out from the lungs), allowing people and animals to make sounds


Example: A professional singer must take care of his or her vocal cords by doing warm-up exercises.

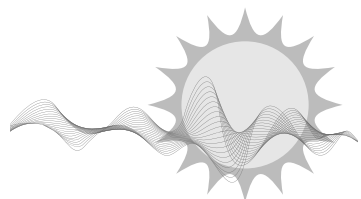
Variation(s): vocal cord

voice box, n. The larynx

Example: The opera singer was so loud that the audience thought her voice box must be very strong.

Variation(s): voice boxes

<i>At a Glance</i>	Exercise	Materials	Minutes
<i>Introducing the Read-Aloud</i>	What Have We Already Learned?	T-Chart; Light and Sound Logs (optional)	10
	Essential Background Information or Terms		
	Purpose for Listening		
<i>Presenting the Read-Aloud</i>	Voice	Image Cards 32 and 33; world map or globe	20
<i>Discussing the Read-Aloud</i>	Comprehension Questions	Image Card 32; Light and Sound Logs	15
	Word Work: Variations		5
 Complete Remainder of the Lesson Later in the Day			
<i>Extensions</i>	Sayings and Phrases: Actions Speak Louder than Words		5
	Writing Informational Paragraphs: Draft	Image Cards 32 and 33; T-Chart; KWL Chart (optional); Light and Sound Logs; Instructional Masters 6B-1 and 7B-1	15



Introducing the Read-Aloud

10 minutes

What Have We Already Learned?

You may wish to allow students to refer to the T-Chart or their Light and Sound Logs during this introduction.

Have students touch their throats while they hum or talk so they can feel the vibrations.

Ask students the following:

- What do the vibrations feel like?
- Can you feel the vibrations on the inside, the outside, or both?
- What other objects makes vibrations that we can hear?

Have students touch their throats while they make a soft sound and a loud sound.

Ask students the following:

- How does your throat feel different when you make these two different kinds of sounds?
- What is intensity?
- Which kind of sound, soft or loud, has the most intensity?

Have students touch their throats while they make a high-pitched sound and a low-pitched sound.

Ask students the following:

- How does your throat feel different when you make these two different kinds of sounds?
- What is frequency?
- How does it affect the pitch of the sound that is made?

Ask students to predict how they think their bodies produce their voices.

Essential Background Information or Terms

Ask students, “If you could not speak, how else would you communicate?” Explain that people who cannot use their voice boxes to speak are mute. Tell students that people who are mute have the ability to communicate with others using sign language and the written word. Explain that there is also technology that helps people who cannot speak communicate effectively.

Purpose for Listening

Tell students to listen carefully to learn more about voice and to see whether or not their predictions about how our voices are produced are correct.



Voice

← Show image 7A-1: Jack and Samuel playing chess in the kitchen

Many weeks passed before Samuel, Jack, Amy, and Ethan were able to spend some time together again. After a long, hot summer, school had reopened, and the children were also involved in after-school sports. During that time Samuel had undergone eye surgery to remove cataracts from his eyes, and Jack now had to wear his hearing aid all the time.¹

1 A cataract is a clouding of the lens of the eye which makes it so that a person cannot see clearly.

The outside world had changed, too. Fall had arrived. Green leaves had been replaced by a montage of copper, red, yellow, and brown leaves. Gone was the warm morning air, and in its place was a chilly morning breeze. There were many mornings when frost lay on the ground. Everyone was looking forward to Thanksgiving as a joyful holiday to spend with family and friends.²

2 So, what seasonal setting is it now in the story? What season will follow next?

It was a Saturday morning, and Jack was sitting in Samuel's kitchen. The two men were playing their weekly game of chess. They had first played chess together when they were third-grade classmates.



← Show image 7A-2: Amy and Ethan entering kitchen waving tickets

They had not been playing for long when Amy and Ethan arrived and scampered eagerly into the kitchen, closely pursued by Alfie. They had come to visit their grandfather, and Amy had some exciting news to share with him.

“Slow down, slow down,” advised Samuel. “You’ll go crashing into the wall if you aren’t careful!” he warned. As Samuel spoke, Alfie wagged his tail and promptly sat down on Ethan’s feet.

“Hello, Granddad,” said Amy cheerfully. “How are you?”

“I’m very well,” replied Samuel cheerily. “What have you troublemakers been up to?”

“It’s almost Thanksgiving,” said Ethan excitedly. “We’re going to sing in a concert at school.”

“You are, are you?” said Jack. “Well, I hope we’re invited to hear you sing.”

“Oh, yes, you are,” chimed in Amy. “We brought you tickets—see?” Amy held up two tickets.

“It’s next Wednesday, and you have front row seats. The third, fourth, and fifth grade classes are going to sing traditional songs from around the world. My class is singing ‘An Irish Lullaby,’” Amy explained.

“My class is going to sing a French song called ‘Frère Jacques,’” said Ethan.³

3 These two songs are traditional songs from the countries of Ireland and France. [Ask a volunteer to point to Ireland and France on a world map or globe.]



← **Show image 7A-3: X-ray view of all four characters talking**

“Sounds very entertaining,” said Jack as he contemplated his next move on the chess board. “You know, each human voice is quite unique. Each voice has its own tone. That’s the reason why you can recognize a person by his or her voice,” explained Jack.

“Our voices are as unique as we are,” Samuel agreed. “Only I have my voice.”

“Precisely,” agreed Jack. “However, although human voices differ from one another, they are all produced in the same way.”

“They are?” said Ethan.

“Indeed they are,” Jack continued, having finally decided to move one of his bishops.⁴ “If you could see inside your body, you would discover that inside your throat, at the top of your windpipe, or **trachea**, is your **voice box**. The voice box is also known as the **larynx**. Within your larynx are two bands of muscle called **vocal cords**. These vocal cords enable humans to make a wide range of sounds.”⁵

“Neat,” said Ethan. “But how is the sound made?”

“It’s not as complicated as you might think,” explained Jack. “When you breathe in, your vocal cords relax so that air can reach your lungs. When you breathe out, a muscle called the **diaphragm** moves upward to force air out of your body. When you speak, air

4 [Point to each body part on Image Card 32 (Anatomy of Voice) as you read the next section.]

5 [Refer back to image 7A-3.] Can someone point to a trachea in this image? You just learned about the voice box, which can be found at the top of the trachea or windpipe. If the voice box were added to this image, who can point to where the artist would place it? What is another name for the voice box?

6 [Refer back to image 7A-3.] Who can point to the lungs in this image? What important muscle for breathing is not shown in this illustration? (diaphragm) If the artist were to add the diaphragm to this image, who can point to where it would go?



← **Show image 7A-4: Jack getting up to go outside**

“Check,” announced Samuel.

“What?” yelled Jack. “Don’t tell me you’re going to beat me again, Samuel Van Lumen.” Jack stared furiously at the chessboard and tried to find a way out of his predicament.

“Come on, Alfie,” said Jack. “Let’s go play ball.” To the children, he said, “I wasn’t finished telling you about the power of the human voice.”



← **Show image 7A-5: Children playing in the yard**

“I’m coming, too,” Amy announced, and with that the two children and Alfie ran out into Samuel’s backyard. The children played with Alfie for quite a while. Then they stayed for lunch with Samuel and Jack. Finally it was time for them to go home.

“See you on Wednesday at the concert,” said Ethan.

“You will indeed,” said Samuel.

“I’ll continue my lesson then,” threatened Jack.



← **Show image 7A-6: School auditorium**

Before they knew it, Wednesday had arrived. It was a cool day, and rain had been forecast. Samuel and Jack arrived early and took their seats in the front of the school auditorium. Thirty minutes later the auditorium was full, and parents waited anxiously to see their children perform. Samuel’s daughter Anna and her husband, John, had also arrived and were eager to hear Amy and Ethan sing.

7 [Ask a volunteer to point to the image of the Eiffel Tower.] The Eiffel Tower is a real structure in Paris, France. Its designer also helped design the steel framework for the Statue of Liberty in New York City, which was a gift from France to the U.S.

8 Remember, our voices are unique to each of us. We can often recognize each other by voice alone.



← **Show image 7A-7: Everyone at the café**

First up was Ethan’s class singing “Frère Jacques,” a traditional French song. Behind them was a large screen with an image of the Eiffel Tower displayed on it.⁷ The children sang the song perfectly. Samuel and Jack smiled proudly. “I can hear Ethan’s voice distinctly!” said Jack.

Then it was Amy’s class’s turn. They sang “An Irish Lullaby” beautifully. Samuel nodded at Jack and said, “I can hear Amy’s voice, too—nice and strong.”⁸

When the concert was over, the family walked together to the local café for hot chocolate. They took their seats, and minutes later they were all sipping mugs of hot chocolate piled high with marshmallows.

As they talked about the show, Jack complimented the children on their singing.

“My teacher says I have perfect pitch,” said Amy proudly.

“What’s that?” Ethan asked, looking puzzled.

Amy was happy to explain, “When my chorus teacher is ready for my class to sing, she likes us to start on the note of middle C. Instead of her playing it on the piano, I just sing it.”

“Wow!” said Jack. “Did I tell you that the pitch of your voice is determined by the size of your larynx and vocal cords?”

“No, you didn’t,” chimed in Ethan with marshmallow on his top lip.



← **Show image 7A-8: Everyone talking and laughing**

“That’s why a young child’s voice is generally higher in pitch than an adult’s,” explained Jack. “The larger your larynx and vocal cords, the louder and lower your voice is. The pitch of your voice is also determined by the tension of the surrounding muscles. Trained singers learn how to control these muscles to produce **variations** in pitch and intensity.”⁹

9 [Show Image Card 33 (Singer).] Why do you think singers would want to produce variations in the pitch and intensity of their voices?

“Oh, so that’s what it means to train your voice,” said Amy. “And I bet men usually have longer vocal cords than women and that’s why their voices are deeper.”

“You’ve got it!” said Jack.

“You and Granddad are so smart,” said Ethan.

“I’m much smarter than he is,” joked Jack.

“Well,” laughed Samuel, “actions speak louder than words.”

Jack’s eyebrows raised as Samuel made the motions of struggling with a fishing pole.

“You are both very clever,” Amy laughed. “I’m so glad we have been able to spend so much time with *both* of you!”

“Me, too!” shouted Ethan.



← **Show image 7A-9: Thanksgiving dinner in Samuel’s home**



The next day was Thanksgiving. Samuel, Jack, and an array or group of family members and friends gathered in Samuel’s home for dinner. They ate, laughed, and enjoyed each other’s company. They gave thanks for each other and the bonds that Samuel and Jack had nurtured for so many years.

Discussing the Read-Aloud

20 minutes



Comprehension Questions

15 minutes

1. *Evaluative* Were your predictions correct about how your body produces your voice? Why or why not? (Answers may vary.)
2.  *Literal* [Show Image Card 32 (Anatomy of Voice).] What body parts do you see that work together to produce your voice? (lungs, diaphragm, vocal cords, trachea, and larynx or voice box) What is the name of the muscle below the lungs that also helps to produce your voice by allowing air to move in and out of the body? (diaphragm)
3.  *Inferential* How are variations created in voices? (Larger larynxes and voice boxes produce lower sounds; trained singers can learn to produce variations; the way the air passes out of the body affects the vibration and therefore the voice; etc.)

4. *Evaluative* What can you do to make your voice have a higher pitch to it? How can you make your voice have a lower pitch to it? [You may wish to allow students to experiment with their own voices before answering.] (Answers may vary, but may include tightening or relaxing your vocal cords, and changing your breath using your diaphragm.)
5. *Inferential* What were some sources of sound in the read-aloud? (Amy and Ethan singing, music playing, people talking, Alfie barking, etc.)
6. *Evaluative* Have you ever been to a concert like the one Amy and Ethan went to? What adjectives and other words can you use to describe the sounds that you heard? (Answers may vary.)

I am going to ask a question. I will give you a minute to think about the question, and then I will ask you to turn to your neighbor and discuss the question. Finally, I will call on several of you to share what you discussed with your partner.

7.  *Evaluative Think Pair Share:* Are there people whom you can recognize just by voice? What do you think it would be like if we all sounded the same or were not able to produce variations in our voices? (Answers may vary.)
 8. After hearing today's read-aloud and comprehension questions and answers, do you have any remaining questions?
-  You may wish to allow time for individual, group, or class research of the text and/or other resources to answer any remaining questions.

Note: Place Image Cards 32 and 33 on the T-Chart, and briefly review what was learned in the read-aloud about sound and voice. Have students save written work in their Light and Sound Logs throughout the domain.

Note: If you began a KWL chart in the introduction, you may choose to update it now.

Word Work: Variations

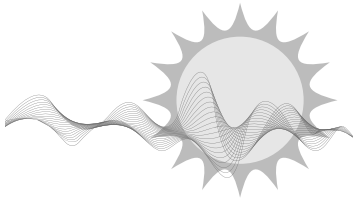
5 minutes

1. In the read-aloud, you heard that, “Trained singers learn how to control these muscles to produce *variations* in pitch and intensity.”
2. Say the word *variations* with me.
3. Variations are changes in the amount, form, or level of something.
4. Marissa was an expert at playing the saxophone because she could make multiple variations, or changes, to the sound of her instrument.
5. Have you ever heard variations in sound? Be sure to use the word *variations* when you tell about it. [Ask two or three students. If necessary, guide and/or rephrase the students’ responses to make complete sentences: “I heard variations in _____” or “The variations were . . .”]
6. What’s the word we’ve been talking about? What part of speech is the word *variations*?

Use a *Listening* activity for follow-up. Have students sit in a circle or in a different seat than usual and close their eyes. Tell them that when you tap them on the shoulder they should say the word *variation*. The rest of the class should guess who is speaking by trying to recognize the voice.



Complete Remainder of the Lesson Later in the Day



Sayings and Phrases:

Actions Speak Louder than Words

5 minutes

Proverbs are short, traditional sayings that have been passed along orally from generation to generation. These sayings usually express general truths based on experiences and observations of everyday life. Although some proverbs do have literal meanings—that is, they mean exactly what they say—many proverbs have a richer meaning beyond the literal level. It is important to help your students understand the difference between the literal meanings of the words and their implied or figurative meanings.

Reread the following excerpt from the read-aloud:

“I’m much smarter than he is,” joked Jack.

“Well,” laughed Samuel, “actions speak louder than words.”

Ask students if they have ever heard anyone else say “actions speak louder than words.” Have the students repeat the proverb. Ask students, “What are actions?” Generate a list of action words (verbs) as a class.

Ask students, “Can any of these actions we listed actually speak? What is the name of the literary device that describes when an animal or a nonliving thing acts like a human?” (*personification*) Explain that actions do not really speak, but the things we do can make more of a statement than the things we say. For example, it can be easy to say that you are someone’s friend, but to actually show this with your actions, perhaps by being loyal, makes a bigger impact.

Instead of saying “actions speak louder than words,” Samuel could have said, “Jack, you may say you are smarter than I am, but your *actions*, such as reeling Alfie in with a fishing pole without realizing it, show that you are not smarter than I am!”

Ask students if they ever faced a situation where someone’s actions made an impression on them and were more powerful than any words that could have been said. Give students an opportunity to share their experiences, and encourage them to use the saying.

Tell students to listen for times when this phrase is appropriate as they continue listening to the story. Try to find other opportunities to use this saying in the classroom.

Writing Informational Paragraphs: Draft (Instructional Masters 6B-1 and 7B-1)

15 minutes

Remind students of the steps of the writing process—plan, draft, revise, edit, and publish. Remind them that in the previous writing session, they completed the planning step of the informational piece. Tell students that today they are going to begin the next step: drafting. Explain that this means that they are going to start putting their ideas into sentences.

Display the brainstorming Venn diagram you previously created as a class. Copy Instructional Master 7B-1 onto chart paper, a chalkboard, or a whiteboard.

Give students their Light and Sound Logs to reference. Tell students that today they are going to use the words and phrases from their brainstorming plan in addition to information in their logs to create sentences for their first draft. Have students share ideas for a title and display these ideas. Tell students that you will revisit these when the first draft is finished to see if one of them is a fitting choice.

Remind students that this informational piece about light and sound will be longer than the piece they wrote about animals because they are writing about two topics and are comparing and contrasting them. Explain that this informational piece will have four paragraphs: one introductory paragraph; one paragraph telling how light and sound are similar; one paragraph telling how light and sound are different; and one concluding paragraph.

Ask, “Who can tell me what a topic sentence is?” Remind students that a topic sentence is the first sentence in a paragraph that tells the reader the main idea of that paragraph. Explain that sometimes in longer pieces of writing, an introductory paragraph, or topic paragraph—*instead of only one topic sentence*—is used to introduce the piece.

Ask students what information they think they will need to write in their topic paragraph. Explain that, just as with a topic sentence, a topic paragraph should tell the reader what the writer is going to write about. Remind students that a paragraph should have at least three sentences. For example, a topic or introductory paragraph could be as follows:

Light and sound are two amazing forms of energy that we experience every day with our senses. Even though they are both forms of energy and have other similarities, light and sound are also different in many ways. I am going to write about three ways that light and sound are similar and three ways that light and sound are different.

Ask students to share ideas for sentences for the topic paragraph, and write these down. Choose the best sentences together, and write them in the first section.

Next, explain that you are going to include two headings for the next two sections of this informational piece: one above the second paragraph, “How Light and Sound Are Similar,” and one above the third paragraph, “How Light and Sound Are Different.” You may wish to show students examples of headings, text boxes, sidebars, etc., in informational texts such as textbooks or the recommended trade books in the classroom book tub. Remind students that these headings and other tools are often used in informational texts to help clearly organize and explain information, and to help the reader quickly reference specific information.

Together, use the information from the brainstorming diagram to write at least three sentences under each heading, explaining how light and sound are similar and how they are different. You may wish to have students include a topic sentence in each paragraph, or you may wish to allow the heading to act as the topic sentence.

As you write these sentences under the two headings, model the use of linking words, such as *additionally*, *because*, *also*, *finally*, *for example*, etc. You may also wish to include additional information that students gathered about light and sound. As you write these sentences, tell students that you are using capital letters at the beginning of your sentences and punctuation at the end. If applicable, tell students that you are using commas between things in a list. Tell students that they will check the grammar and spelling during the editing step, but that they should try to pay attention to these things as they are writing their draft as well. You may wish to intentionally make some minor mistakes to correct during the editing step.

Ask, “Who can tell me what a concluding sentence is?” Remind students that this is the last sentence in the paragraph that wraps up,

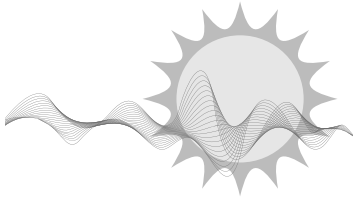
or concludes, the information and often restates the topic sentence in another way. Explain that just as they wrote a topic paragraph instead of only one topic sentence to introduce the informational piece, they are going to write one concluding paragraph instead of only one concluding sentence to end this piece. Remind students that this paragraph should have at least three sentences. For example, a concluding paragraph could be as follows:

Did you ever realize how much light and sound have in common, yet are still very different? These two forces are very important to our everyday lives. It would be difficult to imagine a day without light or sound.

Have students share ideas for sentences for the concluding paragraph, and write these down. Choose the best sentences together, and write them in the last section. As you write this paragraph, remind students that this paragraph lets the reader know that the writer is finished with the main idea stated in the topic paragraph, and that it does not introduce any new supporting information. Tell students that because the concluding paragraph often restates the topic paragraph, this is a good opportunity to use synonyms, or words that have similar meanings, such as *force* or *power* instead of *energy*.

Read the completed piece to the class. Revisit the list of title ideas to see if any of them are a fitting choice. Tell students that you are going to continue to work on this draft together during the next writing session. Encourage students to be thinking of any other title ideas and other changes that they think are needed in the piece. Tell students that you will help them to revise, or make changes to, this piece during the next writing session.

Note: You may wish to have some students use Instructional Master 7B-1 to complete this step of the writing process with partners, in groups, or on their own. You may need to take more than one day to complete this step of the writing process, as this informational piece is longer than some of the other genres previously taught.



Alexander Graham Bell

8

☑ **Lesson Objectives**

Core Content Objectives

Students will:

- ✓ Recall the sense of hearing and the corresponding sensory organ
- ✓ Identify sound as a form of energy that travels in waves
- ✓ Describe how sound waves travel in different mediums
- ✓ Identify sources of sound
- ✓ Describe how the intensity and frequency of vibrations affects the qualities of a sound
- ✓ Identify the parts of the body that create the human voice
- ✓ Explain how the human voice is produced and is able to make a wide range of sounds
- ✓ Describe the life and contributions of Alexander Graham Bell
- ✓ Explain the significance of the invention of the telephone

Language Arts Objectives

The following language arts objectives are addressed in this lesson. Objectives aligning with the Common Core State Standards are noted with the corresponding standard in parentheses. Refer to the Alignment Chart for additional standards addressed in all lessons in this domain.

Students will:

- ✓ Describe the relationship between Samuel Morse's invention of the telegraph and Alexander Graham Bell's invention of the telephone, using language that pertains to time, sequence, and cause/effect (RI.3.3)
- ✓ Determine and distinguish between the literal and figurative meanings of "you hit the nail on the head" (RI.3.4) (L.3.5a)

- ✓ Interpret information from the diagram Anatomy of Voice about the various organs that produce sound in the human body (RI.3.7)
- ✓ Compare and contrast the key features of the telegraph and the telephone as shown in the images (RI.3.9)
- ✓ Compare and contrast the key features of various stages of telephone development as shown in the image (RI.3.9)
- ✓ Identify and use parts of a paragraph, including a topic sentence, supporting details, and a concluding sentence in each paragraph of an informative writing piece (W.3.2a)
- ✓ Use the information categorized in the Venn diagram to group related information as each paragraph is drafted for an informative writing piece comparing and contrasting light and sound (W.3.2a)
- ✓ Continue drafting an informative writing piece comparing and contrasting light and sound and clearly stating ideas, facts, and details (W.3.2b)
- ✓ Use linking words and phrases such as *also*, *another*, *because*, *finally*, and *in addition* to connect ideas within paragraphs (W.3.2c)
- ✓ Provide a concluding paragraph for the informative writing piece comparing and contrasting light and sound (W.3.2d)
- ✓ With guidance and support from peers and adults, use the steps of the writing process such as plan, draft, revise, edit, and publish to create an informative writing piece that will be developed and strengthened over an extended time frame (W.3.5) (W.3.10)
- ✓ With guidance and support from adults, use technology to produce and publish writing (using keyboarding skills) as well as to interact and collaborate with others (W.3.6)
- ✓ Make personal connections to the content presented in “Alexander Graham Bell” (W.3.8)
- ✓ Choose words and phrases that are specific, informative, and interesting as the informative writing piece is revised (L.3.3a)
- ✓ Determine the meaning of the new word formed when a known affix is added to a known word, such as *transmit/transmitter* and *receive/receiver* (L.3.4b)
- ✓ Use the known root *tele-* as a clue to the meaning of unknown words with the same root, such as *telephone*, *telegraph*, *television*, *telescope*, and *telecommunications* (L.3.4c)

- ✓ Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships to describe the development of technology, such as *then*, *long ago*, *now*, *modern*, *improved*, and *developed* (L.3.6)

Core Vocabulary

Note: You may wish to display some of these vocabulary words in your classroom for students to reference throughout the domain. You may also choose to have students write some of these words in a “domain dictionary” notebook, along with definitions, sentences, and/or other writing exercises using these vocabulary words.

deaf, *adj.* Partially or completely lacking the sense of hearing

Example: Over time, Ludwig van Beethoven became completely deaf and could no longer hear his compositions.

Variation(s): none

invention, *n.* Machine, tool, or other device that someone has made, designed, or thought of for the first time

Example: In the early part of the 19th century, the steam-powered engine was an invention that greatly changed people’s ability to travel.

Variation(s): inventions

inventive, *adj.* Skilled at inventing or creating something new; ingenious

Example: Maria was inventive because she loved to create new gadgets and machines.

Variation(s): none

mechanics, *n.* The study of forces and motion, and how they work in the world

Example: As a baseball pitcher, Jose is especially interested in the mechanics of throwing a ball.

Variation(s): none

receiver, *n.* The part of a telephone located in the earpiece that converts electrical signals into sounds

Example: We knew we had to throw away our telephone when the receiver broke because we could no longer hear anything.

Variation(s): receivers

telegraph, *n.* A device that allows a person to send messages over a wire by tapping out coded letters and words


Example: Samuel Morse developed the telegraph in the 1800s, which made it quicker and easier for people to communicate over long distances.

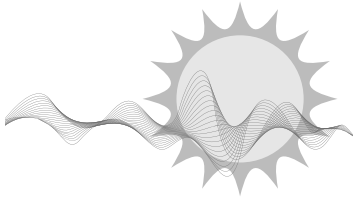
Variation(s): telegraphs

transmitter, n. The part of a telephone that converts sound waves from the human voice into electrical impulses and sends, or transmits, them

Example: “The problem is,” said Raya intently, “that the transmitter has failed to transmit any sound.”

Variations(s): transmitters

<i>At a Glance</i>	Exercise	Materials	Minutes
<i>Introducing the Read-Aloud</i>	What Have We Already Learned?	T-Chart; Light and Sound Logs (optional)	10
	Essential Background Information or Terms	Image Cards 34 and 35; world map or globe	
	Purpose for Listening		
<i>Presenting the Read-Aloud</i>	Alexander Graham Bell	Image Cards 34, 36, 37	20
<i>Discussing the Read-Aloud</i>	Comprehension Questions	Image Cards 34–38; T-Chart; Light and Sound Logs	15
	Word Work: Telegraph		5
 Complete Remainder of the Lesson Later in the Day			
<i>Extensions</i>	Writing Informational Paragraphs: Draft/Revise	Instructional Masters 6B-1, 7B-1, 8B-1, and 8B-2	20



Alexander Graham Bell

8_A

Introducing the Read-Aloud

10 minutes

What Have We Already Learned?

Point to the image cards on the T-Chart, and review with students what was learned in the previous read-aloud about voice. You may wish to have students reference their Light and Sound Logs. You may also wish to ask the following questions as you review:

- What parts of your body help produce your voice? (diaphragm; vocal cords; trachea, or windpipe; and larynx, or voice box)
- Why do voices have variations? (Some larynxes are larger than others and produce lower sounds; the tension of the surrounding muscles affect pitch; etc.)
- How do people communicate who cannot hear well or speak? (sign language, reading lips, writing, and/or technology)

Essential Background Information or Terms

Talk with students about what it means to invent something. Ask students what inventions they are familiar with. Remind students that an invention is a machine, tool, or other device that someone has made, designed, or thought of for the first time.

Ask students to recall two key inventions they heard about in the domain *The Ancient Roman Civilization*. (Answers may include warfare machines, arches, domes such as the famous Pantheon, concrete, bridges such as the Pont du Gard, aqueducts, books with pages and columns, circuses such as the Colosseum, waterwheels, calendars, networks of roads, sewers, public baths, indoor heating, etc.)

Remind students that inventions often build upon earlier inventions as technology becomes better. For example, the ancient Romans improved upon the earlier invention of concrete by adding more ingredients to make it last longer.

Show students Image Card 34 (Alexander Graham Bell). Tell students that today's read-aloud is about a famous inventor named Alexander Graham

Bell. Ask students if they know what an inventor is and if they have ever heard of Alexander Graham Bell. Explain to students that the inventor Alexander Graham Bell was born a long time ago in Scotland. On a world map or globe, have a student volunteer locate Scotland. Ask students if they recall another person they learned about earlier in the year who was from Scotland. Remind students that the author of *The Wind in the Willows*, Kenneth Grahame, was born in Scotland, though he spent much of his time in nearby England.

Show students Image Card 35 (Telegraph), and tell them that Alexander Graham Bell was very interested in something called a *telegraph*. Ask students if they know what a telegraph is. (Students who participated in the Core Knowledge Language Arts program in Grade 2 learned about the invention of the telegraph in the domains *Westward Expansion* and *The U.S. Civil War*.) Explain that the telegraph is a device that was invented many years ago by Samuel Morse. It allows a person to send messages over a wire by tapping out coded letters and words using a system called Morse Code. Morse Code is still used today in emergency situations where communication is difficult.

Ask students to think about what life would have been like before the telegraph was invented. Ask, “What would the invention of the telegraph allow people to do in a new way?”

The invention of the telegraph greatly interested Alexander Graham Bell. The telegraph’s ability to send a signal over a wire caused Bell to wonder if he could send sounds over a wire.

Ask students to consider why it is that certain inventions take a longer time to develop than others. Say, “For example, why didn’t we have planes or computers a long time ago?” Ask students to think about what kinds of inventions there might be in the future. Tell them that they never know who may invent the next great invention—it could be one of them!

Purpose for Listening

Tell students to listen carefully to find out more about the life and contributions of inventor Alexander Graham Bell.



Alexander Graham Bell

- ← Show image 8A-1: Samuel cooking in the kitchen, talking with Jack and the children

About three weeks after the children’s school concert, the first snowfall occurred. Several inches of glistening snow lay like a soft blanket upon the ground. It was a perfect start to the holiday season. It was also the first day of winter, and Samuel was busy preparing for his annual open house event. This was Samuel’s way of welcoming in the forthcoming holidays. He always invited his family, friends, and neighbors to a wonderful evening of festivities. Both he and Jack liked to cook, and Amy and Ethan enjoyed helping them. Jack also entertained the guests by playing the piano.

The children had arrived bright and early, eager to help out in the kitchen. Jack was already there when they appeared. He was sitting at the kitchen table drinking his morning coffee and eating buttered toast. Alfie was sitting next to him, hoping to receive a tasty treat.

“Granddad, can we make cupcakes?” asked Amy.

Before Samuel could reply, the telephone rang.

“That’s the fourth time this morning,” exclaimed Samuel. “I sometimes wish Alexander had invented something other than the telephone!”

“Who’s Alexander?” asked Ethan. “Is he a friend of yours?”

Jack laughed out loud.

“We’re old, but we’re not that old!” he announced. “Alexander Graham Bell invented the telephone in 1876 during the late 19th century.”

“I knew that,” said Amy proudly. “In fact, I know a lot about Alexander Graham Bell because my reading group just wrote a report about him and read it to the class. So, can we make cupcakes?”

“Sure you can. And when you are done with that I would like you guys to make a batch of cookies,” announced Samuel.

“I really liked the chocolate chip cookies you made last year,” said Jack.



← **Show image 8A-2: Amy and Ethan helping with cooking**

Amy and Ethan got to work. They placed flour, baking powder, butter, eggs, oil, sugar, and chocolate and vanilla frosting on the counter top and began to prepare the batter.

“Alexander Graham Bell was Scottish,” continued Amy.¹ “Both his father and his grandfather were speech experts and worked with the **deaf**. His mother taught piano, but she began to lose her hearing. We learned from our research that from a very early age, the science of sound was an important topic of conversation in Alexander’s home. Alexander Graham Bell’s father invented a sound alphabet called Visible Speech. This alphabet was used by deaf people. It is difficult for some deaf people to learn how to speak because they cannot hear spoken words. Visible Speech was a series of pictures to show combinations of sounds from the alphabet.² The pictures were designed to show the person how to shape the mouth to make certain sounds.”

“Babies learn language by imitating others,” chimed in Ethan. “But humans are kind of unique because they can make all kinds of sounds, like laughter. Sound comes out through the mouth because when we breathe in and out, air travels through the larynx in the throat. The air makes the vocal chords vibrate, which creates sound. Then certain parts of the mouth and throat help to shape the sounds into words. I had to take a test on this last semester,” said a confident Ethan.³

“Well, what a pair of smarty-pants you both are,” yelled Jack, and then he chortled to himself. “Amy, are you done teaching us all about Alexander?”

1 [Show Image Card 34 (Alexander Graham Bell).]

2 [Show Image Card 36 (Visible Speech). You may wish to make this image card available for students to examine more closely at another time.]

3 [Point to Image Card 32 (Anatomy of Voice) on the T-Chart.] Who remembers which organ helps air come into the lungs? (diaphragm) Who remembers what determines the pitch of each individual’s voice? (The size of a person’s vocal cords and larynx.)

“As a matter of fact, I’m not,” said Amy, who was not entirely sure she liked being interrupted by her brother. “Because of his father’s work, Alexander decided that when he grew up he wanted to work with deaf people, too. Alexander used his father’s Visible Speech to help deaf children learn to speak more clearly. We also discovered that when Alexander was a boy, he and his brothers were very **inventive** and created many interesting new things. When Alexander Graham Bell was older, he continued to study science, and in particular, sound. So he was kind of like a scientist, too.”

“You are quite the expert,” said Jack enthusiastically. “Did you also learn in your research that Mr. Bell was not only a scientist, but also a musician? When he was a young man, he played and taught the piano. Later, in his work life, he combined these interests. He spent time studying the **mechanics** of the piano, and of tuning forks.⁴ He was particularly interested in how vibrations make sound.”

“Yes,” said Amy who was now holding a large mixing bowl while Ethan used a small hand-held electric whisk to create a light and fluffy batter. At the sound of the electric whisk, Alfie began to bark loudly. The children laughed, but Samuel told Alfie to “pipe down.”

4 [Point to Image Card 21 (Tuning Fork) on the T-Chart. If you have a tuning fork available, you may wish to show it now.] A tuning fork is a simple metal tool used to obtain an exact note. It can be helpful to singers and musicians.



← **Show image 8A-3: Amy telling about Alexander Graham Bell**

“However,” continued Amy over the suppressed barking sounds that Alfie was now making, “we also found out that Alexander Graham Bell began his career in London, working at a school for deaf children. He had private students, too, whom he taught in his home, which was how he met his wife Mabel Hubbard. She was deaf but had learned how to speak. Mr. Bell helped her to speak more clearly.”⁵

“I hope your group got an A on that report,” said Samuel, who had been busy preparing his specialty, chicken parmesan. “Hey, Jack, as soon as I’m finished here, you can get started on that beef stroganoff you have been threatening to cook for us.”

“My beef stroganoff is famous,” replied Jack indignantly. “You should be honored that I have agreed to make it.”

5 Why is it difficult for a deaf person to learn how to speak well? [Pause for a few students to share.]

At that moment the telephone rang again, and Samuel shuffled off to answer it. As Amy and Ethan dropped tablespoons of cupcake batter into paper baking cups, Jack proclaimed, “Well, before you get an A from me, did your report explain how a device that we know very well today—the telephone—came to be invented all those years ago?”



← **Show image 8A-4: Samuel Morse and the telegraph**

“Yes,” replied Amy as she carefully placed the tray of cupcakes inside the oven. “That was the main part of our report. In the 1830s, a man named Samuel Morse invented the **telegraph**. It used different combinations of dots and dashes to tap out messages. His system is called Morse Code.”

“*Telegraph, telephone, television, telecommunicate*—why do all of these words begin with *tele*?” asked Ethan curiously.

“Good question!” yelled Jack while Samuel hovered around him, hoping that he would not cause too much of a mess in his kitchen.

“*Tele* means far or from far away. So that is the root meaning of the first part of all of those words. *Phon* means sound, and *graph* means writing,” explained Jack.

“So *telephone* means faraway sound, and *telegraph* means faraway writing,” said Ethan enthusiastically.

“*Vision* means something you can see, so *television* means faraway image,” continued Amy.⁶

“You hit the nail on the head,” pronounced Samuel.⁷

“The telegraph made it possible for written forms of communication to travel on wires across great distances,” continued Amy. “The only problem was that only one message could be transmitted at one time. Alexander Graham Bell believed that it was possible to invent a kind of telegraph that could transmit many messages at the same time along the same wire. His wife’s father, Mr. Hubbard, believed in him and helped to finance his experiments.”

“Did you also learn about Mr. Watson?” inquired Jack.

6 What do you think it means to *telecommunicate*? (to communicate over a distance using various kinds of devices)

7 What do you think “hit the nail on the head” means? (to do something just right, just as it takes extreme accuracy to hit a nail head on its center)



← **Show image 8A-5: Amy thinking about Bell and Watson**

“Yep! We learned that Thomas Watson built the models of Mr. Bell’s inventive ideas, and together they figured out how to solve problems and improve the designs. Eventually Alexander believed that, instead of a telegraph, it might be possible to build a talking machine. He had studied how air changes as sound waves, or vibrations, move through it. This led him to wonder whether sound waves could change an electric current. If so, spoken words could be sent over a wire. Mr. Bell knew that he was getting closer and closer. He stopped teaching so he could devote more time to his **invention**. Then, on March 10, 1876, during one of their experiments with a **transmitter** and a **receiver**, Mr. Bell and Mr. Watson made their first breakthrough when sound was transmitted and received.⁸ Finally, after improving the design of their talking machine, the telephone was invented when, on March 10, 1876, Alexander Graham Bell spoke to Mr. Watson on their talking machine.”

8 The transmitter is the part of a telephone that converts sound waves from the human voice into electrical signals and transmits, or sends, them to another telephone. The receiver receives the electrical signals and turns them into sounds. [Show Image Card 37 (Man Using Bell’s Phone). Ask a volunteer to point to the transmitter and to the receiver in the image.]

At that very moment the telephone rang.

“That’s either Alexander Graham Bell or Mr. Watson,” said Jack loudly.

All four laughed out loud as Samuel shuffled off to answer the telephone one more time.

Samuel shook his head and smiled as he made his way back to his grandchildren and his old and dear friend Jack.

“The invention of the telephone more than one hundred years ago has forever changed the way we communicate with others,” exclaimed Samuel. “I, for one, am grateful to Mr. Bell’s inventive nature and his understanding of the mechanics of sound!”

As the day progressed, Samuel, Jack, Amy and Ethan baked and cooked up a feast. They continued to talk and laugh and enjoy each other’s company. Samuel’s home was soon filled with wonderful aromas.



← **Show image 8A-6: Holiday gathering at Samuel's house**

As the afternoon turned into evening and the sun began to set, family members, friends, and neighbors began to appear. They arrived with smiling faces, eager to spend time with each other and to celebrate the coming holidays. The children moved through the crowd offering the guests various home-cooked foods. Samuel had made a wonderful log fire that burned brightly. The light from the fire cast a warm, golden glow.

Amy sank into a comfortable chair by the fire. Her mind was filled with thoughts of Samuel Morse and his telegraph and how his invention inspired Alexander Graham Bell to invent the telephone. She thought about the future and began to imagine the possibilities. Amy smiled drowsily and wondered if maybe one day she would work on an invention that would change people's lives.

As the evening wore on, Jack played a number of beautiful melodies on the piano. Afterwards, the two good friends sat together by the fire and gave thanks for the blessings of another year spent with family and friends.



Discussing the Read-Aloud

20 minutes

Comprehension Questions

15 minutes

1. *Literal* What is a telephone? (It is an instrument for sending the sound of the human voice over a distance.)
2. *Literal* [Show Image Card 35 (Telegraph).] What invention did Alexander want to improve upon? (the telegraph) What is a telegraph? (It is a device that allows a person to send messages over a wire by tapping out coded letters and words.)
3. *Evaluative* [Show Image Card 35 (Telegraph) and Image Card 37 (Man Using Bell's Phone).] Compare and contrast the telephone and the telegraph. How are they similar? (They both allowed for long distance communication of a new kind.) How are they different? (The telephone transmits and receives voice sounds; the telegraph transmits and receives signals.)

4. *Inferential* [Show Image Card 37 (Man Using Bell's Phone).] What does the word *transmitter* mean as it relates to the telephone? (The transmitter is the part of a telephone that converts sound waves from the human voice into electrical signals and sends them to another telephone.)
5. *Inferential* What does the word *receiver* mean as it relates to the telephone? (The receiver is the part of a telephone that is in the earpiece and that receives electrical signals and converts them into sounds.)
6. *Literal* What is an invention? (An invention is a machine, tool, or device that is made, designed, or thought of for the first time; often an invention builds on an earlier invention.)
7.  *Evaluative* When was the telephone invented? (Variations may include the late 19th century, during the late 1800s, or a little more than one hundred years ago.) How did the invention of the telephone change the world? (Answers may vary.)
8.  *Evaluative* [Show Image Card 38 (Telephone Development).] The telephone was invented more than one hundred years ago. The design and use of the telephone has changed in many ways over the years. Compare and contrast the telephones shown in this image. In what ways are these telephones similar? (They allow us to speak with others over a long distance.) In what ways are these telephones different? (Answers may vary, but may include some of the following: Today, many people have handheld telephones, or cellular/mobile phones. A cell phone's signal travels by microwaves (or radio waves), whereas a regular (landline) telephone's signal travels through a wire. Modern cellular phones have other functions, too, such as the ability to send and receive e-mails and text messages. These functions allow people to communicate with each other in different ways.) Do you think the improved technology of telephones has improved our lives today? Why or why not? (Answers may vary.)
9. *Literal* What does it mean if a person is deaf? (A deaf person is partly or completely lacking the sense of hearing.)

10. *Evaluative* You heard that Alexander’s mother was deaf and that his father and grandfather were speech teachers. How do you think these circumstances affected Alexander’s later life, especially the work he chose to do? (Answers may vary, but may include some of the following: because of his mother’s deafness and his father’s and grandfather’s work, Alexander wanted to work with deaf children; he became interested in the science of sound; he wanted to invent machines that would help people.)

✈ *Evaluative* [Show Image Card 36 (Visible Speech).] Examine the diagram that Alexander Graham Bell’s father invented and that was used with students to show them how to shape the mouth to make certain sounds. Describe any observations or discoveries you make about the symbols.

I am going to ask a question. I will give you a minute to think about the question, and then I will ask you to turn to your neighbor and discuss the question. Finally, I will call on several of you to share what you discussed with your partner.

11. ✈ *Evaluative Think Pair Share:* What qualities or characteristics do you think are important for an inventor to have? Have you ever thought about inventing something? What would you like to invent, and how would it solve a problem or meet a need? (Answers may vary, but may include having curiosity, imagination, perseverance, and a desire to solve a problem.) [You may wish to allow students to draw a picture of their inventions.]

12. After hearing today’s read-aloud and comprehension questions and answers, do you have any remaining questions?

✈ You may wish to allow time for individual, group, or class research of the text and/or other resources to answer any remaining questions.

Note: Place Image Cards 34–38 on the T-Chart, and briefly review what was learned in the read-aloud about Alexander Graham Bell. Have students save written work in their Light and Sound Logs throughout the domain.

Note: If you began a KWL chart in the introduction, you may choose to update it now.

Word Work: Telegraph

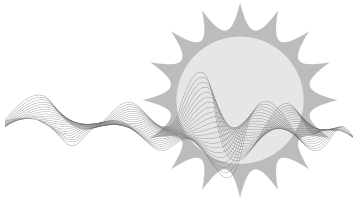
5 minutes

1. In the trade book, you heard that “The telegraph made it possible for written forms of communication to travel on wires across great distances.”
2. Say the word *telegraph* with me.
3. A telegraph is a device that allows a person to send messages over a wire by tapping out coded letters and words.
4. The invention of the telegraph changed the way messages were delivered and eventually caused the Pony Express mail delivery system to end.
5. Have you ever heard of a telegraph? Be sure to use the word *telegraph* when you tell about it. [Ask two or three students. If necessary, guide and/or rephrase the students’ responses to make complete sentences: “I heard about a telegraph . . .” or “A telegraph is . . .”]
6. What is the word we’ve been talking about? What part of speech is the word *telegraph*?

Use a *Word Parts* activity for follow-up. Write the word *telegraph* on a piece of chart paper, a chalkboard, or a whiteboard. Circle the prefix *tele-* and ask students what this part of the word means. (at a distance) Ask what the other part of the word, *-graph*, means. (to write) Tell students that a telegraph is therefore a written message that you send over a distance. Ask students to list other words that have the prefix *tele-*. Answers may include *television*, *televise*, *telephone*, *telegram*, *telescope*, *telecommute*, *telecommunications*, etc. Discuss with students how the meaning *at a distance* relates to the words on the list. As students share, make sure that they use the word *telegraph* and the other words that begin with the prefix *tele-*, in a complete sentence.



Complete Remainder of the Lesson Later in the Day



Alexander Graham Bell

8_B

Extensions

20 minutes

Writing Informational Paragraphs: Draft/Revise (Instructional Masters 6B-1, 7B-1, 8B-1, and 8B-2)

Display the planning and drafting charts created as a class based on Instructional Masters 6B-1 and 7B-1. Remind students that they have completed the planning step of the writing process and that today they are going to continue working on the drafting step together.

Read the draft to the class. Have students share any additional ideas they may have for a title, and add these to the list. Then, tell students that they are going to use a Revision Checklist to help them know what other changes need to be made to the informational piece. Remind students that the word *revise* means change and is a substep of the drafting step. Explain that writers often revise many, many times before they are able to call their final manuscripts, or writing, “finished.” Explain that revising is different from editing: revising often includes making changes to the content and/or the order of the content, whereas editing includes making corrections to grammar, punctuation, and spelling according to the rules of standard English. Tell students that they will complete the editing step the next time you meet to work on writing.

Copy Instructional Master 8B-1 onto chart paper, a chalkboard, or a whiteboard. Read the Revision Checklist to students. Have students refer to the displayed draft and discuss any necessary content revisions. Read the piece aloud to see how the sentences flow. Remind students that in the opinion paragraph they wrote together in *Classic Tales: The Wind in the Willows*, their supporting example sentences were in chronological order because they followed the plot of the story. Explain that with an informational piece, such as the paragraph they wrote for the *Classification of Animals* domain, sometimes the sentences may be rearranged to flow better. You may wish to write the supporting sentences of each paragraph onto strips and move them around to see which order helps the paragraph flow best.

Explain also that with writing that has more than one paragraph, sometimes the paragraphs may also be rearranged to flow better. Emphasize that the topic and concluding paragraphs may not be moved because they are acting as the introduction and conclusion of the piece, but that the middle two paragraphs may be rearranged. You may wish to switch the order of these two paragraphs to see which order flows best.

Once the class has decided upon the necessary revisions, tell students that the last substep of the drafting step is to write a second draft of the piece, incorporating the changes made during the revision substep. Copy Instructional Master 8B-2 onto chart paper, a chalkboard, or a whiteboard, and rewrite the revised sentences, telling students once again that you are using capital letters at the beginning of sentences and the appropriate punctuation at the end of sentences.

Read the final draft aloud to the class. Revisit the list of ideas for a title to see if any of them are a fitting choice. Encourage students to keep thinking about any other title ideas. Tell students that they will complete the editing step of the writing process together the next time you meet to work on writing, and that you will decide on a final title then.

Note: You may wish to have some students use Instructional Masters 8B-1 and 8B-2 to complete this step of the writing process with partners, in groups, or independently. You may need to take more than one day to complete this step of the writing process, as this informational piece is longer than some of the other genres previously taught.

Note: This is the last read-aloud of this domain. Please refer to the schedule in the introduction to guide you in planning the remaining five days. The editing and publishing steps of this informational piece have been placed at the beginning of Pausing Point 2. **It is highly recommended that you regard this part of Pausing Point 2 as *required* in order to most accurately align with the writing requirements of the Common Core State Standards.**

An example informational piece is provided on the following page.

“Energy All Around Us”

Light and sound are two amazing forms of energy that we experience every day with our senses. Even though they are both forms of energy and have other similarities, light and sound are different in many ways. I am going to write about three ways that light and sound are similar and three ways that light and sound are different.

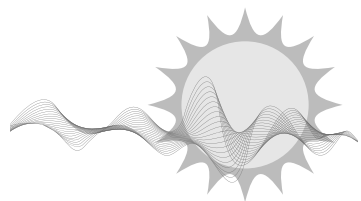
How Light and Sound Are Similar

Light and sound are similar in many ways. One way that light and sound are similar is that they both travel in waves that can be measured by wavelength and frequency. Another way is that they both travel from a source to a receiver, such as light traveling from the sun to Earth or sound traveling from a vibrating guitar string to an audience. Also, both of these forms of energy travel through solids, liquids, and gases. Finally, light and sound are similar because they are both received by sensory organs: light is received by the eyes, and sound is received by the ears.

How Light and Sound Are Different

Light and sound are also different in many ways. Light is able to travel through a vacuum, a space that has no matter in it, but sound cannot because it needs to have matter bumping into other matter to cause vibrations. This is why there is no sound in outer space. Also, light travels more slowly through solids, but sound travels fastest through them. Finally, light has the special characteristic of causing us to see colors by how much light is reflected off objects and how much light is absorbed, whereas sound has the special characteristic of having a different pitch, depending on how fast the pieces of matter are moving that are causing the vibrations.

Did you ever realize how much light and sound have in common, yet are still very different? These two forces are very important to our everyday lives. It would be difficult to imagine a day without light or sound.



Pausing Point 2

PP₂

Note to Teacher

Students have now heard all of the read-alouds in the *Light and Sound* domain. In the second portion of the domain, students have studied the main features of sound and voice, the way sound travels in waves, and how variations in sound can be made. Students have also compared and contrasted light and sound as two forms of energy. It is highly recommended that you pause here and spend three days reviewing, reinforcing, or extending the material taught thus far.

You may have students do any combination of the activities listed below. The activities may be done in any order. You may wish to do one activity on successive days. You may also choose to do an activity with the whole class or with a small group of students who would benefit from the particular activity.

Core Content Addressed in This Domain

Students will:

- ✓ Recall the five senses and their corresponding sensory organs
- ✓ Identify the sun as Earth's main source of light and name other light sources
- ✓ Identify light as a form of energy that travels in waves
- ✓ Explain why light is so important
- ✓ Describe how light waves travel in different mediums
- ✓ Explain how shadows are formed
- ✓ Explain how light is absorbed, reflected, or transmitted
- ✓ Describe the three types of mirrors: plane, concave, and convex
- ✓ Compare and contrast the terms *concave* and *convex*
- ✓ Compare and contrast transparent, translucent, and opaque objects
- ✓ Describe how mirrors and lenses are used in a variety of instruments
- ✓ Explain how light is refracted

- ✓ Explain that color is determined by how light is absorbed and reflected
- ✓ Explain what causes a rainbow to occur
- ✓ Identify the spectrum of colors that makes up white light
- ✓ Recall the sense of hearing and the corresponding sensory organ
- ✓ Identify sound as a form of energy that travels in waves
- ✓ Describe how sound waves travel in different mediums
- ✓ Identify sources of sound
- ✓ Compare and contrast light and sound
- ✓ Describe how the intensity and frequency of vibrations affects the qualities of a sound
- ✓ Identify the parts of the body that create the human voice
- ✓ Explain how the human voice is produced and is able to make a wide range of sounds
- ✓ Describe the life and contributions of Alexander Graham Bell
- ✓ Explain the significance of the invention of the telephone

Activities



Writing Informational Paragraphs: Edit/Final Copy (Instructional Masters 6B-1, 7B-1, 8B-1, 8B-2, PP2-1, PP2-2)

Display the plan and drafts created as a class based on Instructional Masters 6B-1 and 7B-1. Remind students that they have completed the planning and drafting steps of the writing process together and have worked on revisions. Tell students that today they are going to complete the editing step. Tell students that this is also the time to decide on a final title.

Tell students that they are going to use an Editing Checklist to help them know if any further corrections are needed. Explain that writers often edit their drafts many, many times before they are able to call their final manuscripts “finished.” Remind students that editing is different from revising; revising often includes making changes to the content and/or order of content, whereas editing often includes making corrections to grammar, punctuation, and spelling to follow the rules of standard English.

Copy Instructional Master PP2-1 onto chart paper, a chalkboard, or a whiteboard. Read the Editing Checklist to the class. Have students refer to the most recent draft and discuss any necessary edits to grammar, punctuation, or spelling. As you make corrections to the draft and check off the items on the checklist, you may wish to model basic proofreading marks for students.

Tell students that after editing and deciding on a title, the last substep before publishing the informational piece is to create a final copy. You may wish to handwrite this final copy using Instructional Master PP2-2, or you may wish to type this final copy, modeling for students keyboarding skills, including spell-check and dictionary and thesaurus functions.

Tell students that they have now completed the editing step, including the substep of creating the final copy, and that they will complete the publishing step the next time they meet to work on writing. Explain that this means they are going to create a presentation of the final copy, possibly together with illustrations and/or other graphic aids, to display and share with others. Encourage students to be thinking of any illustrations they would like to include with this informational piece during the publishing step.

Note: You may wish to have some students use Instructional Master PP2-1 and PP2-2 to complete this step of the writing process with partners, in groups, or on their own. You may need to take more than one day to complete this step of the writing process, as this informational piece is longer than some of the other genres previously taught.

Writing Informational Paragraphs: Publish **(Instructional Masters PP2-2 and PP2-3)**

Remind students that they have completed the editing step of their informational piece, including the substep of creating the final copy. Display this final copy and tell students that they will now complete the publishing step of the writing process. Explain that this means they will create a presentation of their informational piece to share.

You may wish to provide groups of students with copies of the final piece they created as a class and allow them to create various ways to publish it. For example, some students may wish to use technology to add computer graphics such as illustrations, text boxes, and sidebars to aid in the presentation of information. Some students may wish to create

a PowerPoint presentation. Other students may wish to create an artistic format of the paragraph, perhaps with handwritten text and handmade illustrations.

You may wish to show students once again examples of headings, text boxes, sidebars, etc., in informational texts such as textbooks or the recommended trade books in the classroom book tub. Explain that these headings and other tools are often used in informational text to help clearly organize and explain information and to help the reader quickly reference specific information.

Encourage students to be creative. If you choose to have students work in groups, have them share their published pieces with the class. You may also wish to share the class piece(s) within the school and/or community.

Note: You may also choose to have some students complete this step of the writing process with partners, in groups, or on their own. You may wish to use Instructional Master PP2-3 to assess students' formal informational writing. You may need to take more than one day to complete this step of the writing process, as this informational piece is longer than some of the other genres previously taught.

Image Review

Show the images from any read-aloud again, and have students retell the read-aloud using the images.

Image Card Review

Materials: Image Cards 1–38

In your hand, hold Image Cards 1–38 fanned out like a deck of cards. Ask a student to choose a card but to not show it to anyone else in the class. The student must then give a clue about the picture s/he is holding. For example, for Alexander Graham Bell, a student may say, “I was a famous inventor who found a way to design a telephone to communicate with others far away.” The rest of the class will guess who or what is being described. Proceed to another card when the correct answer has been given.



Domain-Related Trade Book or Student Choice

Materials: Trade book

Read an additional trade book to review light and sound, their features, how they are studied, and related devices used today; refer to the books listed in the domain introduction. You may also choose to have the students select a read-aloud to be heard again.

If students listen to a read-aloud a second time, you may wish to have them take notes about a particular topic. Be sure to guide students in this important method of gathering information. You may wish to model how to take notes, construct an outline, etc.

Key Vocabulary Brainstorming

Materials: Chart paper, a chalkboard, or a whiteboard

Give students a key domain concept or vocabulary word such as *transmitter*. Have them brainstorm everything that comes to mind when they hear the word, such as *a device that sends information, sends out a signal, connected with a receiver, created by Alexander Graham Bell*, etc. Record their responses on a piece of chart paper, a chalkboard, or a whiteboard for reference.



You may also wish to have students do this brainstorming activity individually or with a partner.

10 Riddles for Core Content

Ask students riddles such as the following to review core content:

- I am a type of energy. I am unable to travel through a vacuum because there are no particles to disturb. What am I? (sound)
- I am a famous inventor who created a device that lets you talk with someone far away. Who am I? (Alexander Graham Bell)
- I am located in the earpiece of a telephone and receive the signal that is sent by a distant transmitter. What am I? (receiver)
- I am a type of doctor that studies hearing. I try to find ways to help people with hearing loss. What am I? (an audiologist)
- I am a part of the larynx that allows you to make sounds. What am I? (vocal cords)

- I am what is produced by rapid movements in the air which create sound. What am I? (vibrations)
- I am a quality of sound that is determined by the frequency of the vibrations that are produced. I can be high or low. What am I? (pitch)
- I am a quality of sound that is determined by the amount of energy that is used to create a sound. I can be loud or soft. What am I? (intensity)
- I am a device that allows someone to hear better when he or she has hearing loss. What am I? (hearing aid)
- I am the sheet of muscle below the lungs that assists in breathing. What am I? (diaphragm)




Multiple Meaning Word Activity: Instrument

1. In the introduction to the read-aloud “Refraction and Lenses” you heard the word *instruments* as in, “Sometimes inventors design and build special tools or instruments that use lenses and mirrors to bend light in useful ways.” Who can tell me some of the examples of this kind of instrument that were given in the read-alouds? (telescope, microscope, binoculars, magnifying glass, camera) You may wish to point to the image cards on the T-Chart as students share.
2. In the introduction to the read-aloud “Qualities of Sound” you heard the word *instruments* as in, “An orchestra is made up of a group of musicians who play a variety of instruments.” Musical instruments are tools of artistic expression with a special purpose—creating music! Who can tell me some of the examples of this kind of instrument that were given in the read-alouds? (guitar, recorder, bass, violin, drum) You may wish to point to the image cards on the T-Chart as students share.
3. There are other kinds of tools that are called *instruments*. Instruments don’t have to have mirrors and lenses, and they don’t have to be musical. Usually, instruments are tools that are used for delicate, or precise, scientific or medical purposes. Do you think a microscope is used for a scientific or medical purpose? What about binoculars? Can you think of a kind of medical instrument that you have seen or heard about that a doctor might need or use?

4. I am going to name an object. Think about whether that object is an instrument used for a scientific and/or medical purpose, or a musical instrument used for artistic expression. [Students may think of other uses for these instruments besides those listed. You may wish to further explore their ideas.]
- a flute (That is for artistic expression.)
 - a dentist drill (That is for a medical purpose.)
 - a thermometer (That is used for a scientific or a medical purpose.)
 - a tiny camera used in heart surgery (That is used for a medical purpose.)
 - a harmonica (That is used for artistic expression.)
 - a scale for measuring the weight of an object (That is used for a scientific or a medical purpose.)
 - a tuning fork (That is used for artistic expression.)
 - a camera used for taking pictures of landscapes (That is used for artistic expression.)

With your neighbor, talk about other examples of instruments you know about or instruments that someone may one day design. Remember to be as descriptive as possible and use complete sentences. I will call on a few of you to share your sentences.

 You may have heard another form of the word *instrument*. The word *instrumental* is used when a person or event is important in helping something be better understood or made to happen more successfully. For the examples listed below, tell who or what was instrumental. Then tell what it was they helped to make happen.

- Carmen’s pitching skills were instrumental in her softball team’s season win. (Carmen’s pitching skills; won the season)
- Charles, our school custodian, played an instrumental role in starting our school’s recycling program. (Charles; started the recycling program)
- Think of another example that uses the word *instrumental*.

Note: You may wish to revisit Multiple Meaning Word Activity: Energy, from Pausing Point 1, now that students have learned about sound energy.

Class Book: Light and Sound

Materials: Drawing paper, drawing tools

Tell the class or a group of students that they are going to make a class book to help them remember what they have learned thus far in this domain. Have the students brainstorm important information about light and sound, especially how sound can be used, devices that use light or sound, and how sound is created. Have each student choose one idea to draw a picture of and ask him or her to write a caption for the picture. Bind the pages to make a book to put in the class library for students to read again and again.

Creating Educational Posters

Brainstorm with the class ways that students may hurt their ears and hearing. Research additional information and share the findings. Record the ideas on chart paper, a chalkboard, or a whiteboard. Based on the chart, instruct students to make posters educating other students about ways to protect their hearing. On the poster, have students write a short paragraph about why it is important to protect hearing, and what parts of the ear might be damaged. Post these as public service announcements around the school.

Can You Guess My Sound?

Have students write a paragraph describing a sound without naming the sound, such as a telephone ringing or a bird's song. What is the sound like? What is its pitch and intensity? What kind of rhythm does it have? How do people respond when they hear this sound? Invite students to read their descriptions. After the reading, have other students try to guess what sound has been described. They can play "20 Questions" if the sound is not immediately apparent.

Venn Diagram

Materials: Instructional Master PP2-4; chart paper, a chalkboard, or a whiteboard

Tell students that together you are going to compare and contrast two things students have learned about related to sound and voice by asking how they are similar and how they are different. Use Instructional Master PP2-4 to list two items at the top of the diagram and to capture information provided by students. Choose from the following list, or create a pair of your own.

- light and sound
- light waves and sound waves
- an orchestra and the sounds of a city street
- the telegraph and the telephone

You may wish to create several copies of the Venn diagram to compare and contrast several things. You may also wish to have students use these diagrams as brainstorming information for further writing.

- ✈ You may wish to have some students use Instructional Master PP2-4 to complete this activity independently. You may also wish to have some students create three-way Venn diagrams to compare and contrast three things, such as sight, hearing, and speaking.

Vibration and Sound

Materials: Tuning fork


Have students listen to the vibration of a tuning fork. Then ask them what part of the human throat allows us to create vibrations like the tuning fork. Remind the students about the vocal cords and voice box (larynx). Have students place their hands on their throats, and let them feel the vibrations produced when they speak or hum. Afterwards, have students write about how their voice box is similar to the tuning fork.

Seeing Sound

Materials: Variety of boxes the size of a shoe box and smaller, rubber bands of different widths and sizes, bowl, plastic wrap, salt, computer with Internet access (optional)

Briefly review what a vibration is and how vibrations make sound. Experiment with sound variations by making a simple guitar out of a shoe box and some rubber bands. Stretch one large rubber band around the box. Have a student strum the rubber band with his or her finger. Strum the rubber band harder, and then strum it softly. Have students tighten and loosen the rubber band, strumming it again to hear the differences in pitch. Have students discuss what they see and hear happening. You may wish to experiment with different size boxes and different size rubber bands. Some students may wish to create a rubber band guitar. Have students record the different outcomes.


Tightly stretch plastic wrap over a bowl and place some salt on top of the plastic wrap. Have a volunteer clap his or her hands. The salt and the plastic wrap will vibrate. Discuss how the invisible sound waves travel through the air. Experiment by having multiple students clap loudly or softly to see if that makes a difference in how the salt shakes on top of the plastic wrap.

 You may wish to have some students write more extensively about these experiments and outcomes.

Making Music With Bottles

Materials: Several glass bottles that are alike in shape, water

Fill each bottle with a different amount of water. Arrange the bottles in a row going from most filled to least filled. Choose one student volunteer for each bottle. Then have the students come up one at a time and blow across his or her bottle. The sounds should be like a scale of musical notes. After that, have students discuss with each other what causes the sound to change in the bottles.

 You may also wish to have some students write about the experiment.



Listening to Music

Play a piece of music. Have students listen carefully for changes in pitch and volume. Instruct students to write about this experience of listening carefully to the music. What are they able to hear? What musical instruments can they identify? What types of music do they like to listen to? What about the sound of the music makes it enjoyable? You may wish to allow students to bring in appropriate examples of music and have them identify the different pitches, sounds, and instruments with the piece.



Play a piece of music. Ask students to listen and think about what the music makes them think of and how the music makes them feel. What colors does the music bring to mind? What kind of setting would this kind of music be in? Have students create an illustration that goes with the music.

Bringing Live Music to the Classroom


Invite a choir or chorus from a local middle school or high school to perform in your classroom. Have each section of the choir explain their vocal range, such as soprano, alto, tenor, or bass. Have those students sing a short piece to illustrate the different range of their voices. You may also want to invite any instrumentalists in the group to bring their instruments and demonstrate how the instruments make sounds when played.

Creating Your Own Telephone

Materials: Two paper cups; a long piece of twine; a hammer; a nail

Make one hole in the center of the bottom of each cup using a nail and a hammer. Have students thread the ends of the twine through the holes in the two paper cups and tie a knot in each end. Make sure that the twine is long enough for two people to step apart from each other with the two cups still connected. Make sure the string is held tight. Have one student speak into the cup, and have the other student listen on the other end. Then have students switch their roles. After they are done, have students discuss what happened in this experiment.

Ask students to predict, “What do you think would happen if the string was allowed to dangle loosely between the cans?” Allow students to repeat this activity after they make their predictions. (It does not work because the string is no longer acting like a solid so it absorbs the vibrations instead of transmitting them.)

 You may also wish to have some students write about the experiment. Have students explain and/or write about how this experiment relates to the experiment conducted by Alexander Graham Bell when he invented the telephone.

Research Activity: Audiologists

Give students the opportunity to research audiologists—such as Alexander Graham Bell—and their contributions. You may also wish to have students research inventions that have provided helpful improvements to people with hearing loss. Allow students the time to share their findings with a group or with the class.

Research Activity: Journey of Telephone Technology

Give students the opportunity to further examine Image Card 38 (Telephone Development). Ask students to think about what improvements have been made to the telephone. Ask which telephones shown in the image are familiar to students. Explain to students that there were many other versions of the telephone in-between those that are shown.

You may wish to point out to students one important difference between Alexander Graham Bell's telephone and the modern cell phone. Bell's telephone relied on a wire connection using electricity to transmit the signal. The cell phone uses a wireless signal which is transmitted by microwaves or radio waves which, like x-rays, are invisible light waves that can travel through air.

Give students the opportunity to research telephone technology. Some may wish to create drawings of the phones they find and make a timeline of telephone development. Allow students the time to share their findings with a group or with the class.

Research Activity: The Visible Speech Alphabet and Sign Language

Give interested students the opportunity to further explore the Visible Speech alphabet and sign language. Students may wish to examine Image Card 36 (Visible Speech) or learn sign language letters and words. Students may also wish to explain or demonstrate what they learn to a small group or with the class.

Research Activity: The First Telephone

Some students may wish to learn more about Bell's first talking machine. What words were the first spoken over his device? How did his "talking machine" come to be called the telephone? When was the Bell Telephone Company started? Allow students the time to share their findings with the class or a small group.

Research Activity: Modern Telecommunications Devices

Provide students with the opportunity to research the development of other telecommunications devices, such as the fax, Skyping, the Internet, and GPS (global positioning system).

Research Activity: The Ever Changing Nature of Technology

Tell students that Morse Code, which was invented by Samuel Morse, has evolved into all kinds of telecommunication technologies that likely were never in Samuel Morse's wildest dreams! Even so, it is still used today by the military, etc.

Allow students to research Samuel Morse's early development of the electric telegraph. What inspired Morse? What other early devices did Morse build his ideas upon?

You may wish to discuss with students the ways in which an inventor builds upon earlier discoveries and devices to create something new and perhaps improved.

Give students the opportunity to share their findings with a small group or with the class. Some may wish to write or draw about their findings.

Light and Sound Play

Materials: T-Chart; Light and Sound Logs; writing piece; trade books

Tell students that they have learned a lot about light and sound, how they are similar and different, how they are studied, and devices that have helped improve a person's ability to see and hear better. Remind students that they have learned about the properties of light and sound through a narrative with characters observing light and sound in their daily lives. Tell students that they will now have the opportunity to write a play using light and sound as characters. Tell students that they could also write a play from the perspective of devices that manipulate light and sound, such as a prism or a hearing aid. Have students refer to their Light and Sound Logs,

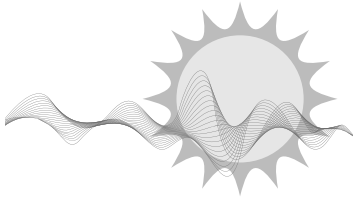
the T-Chart, the informational piece that was created as a class, and any related trade books from the classroom book tub. Encourage students to be creative in their dialogue and to use domain-related vocabulary they have learned. You may also wish to model this writing activity or have students work with partners or groups.

Writing Prompts

Materials: Image Card 28 (Lincoln Center)

Students may be given an additional writing prompt such as the following:

- The most interesting thing I've learned thus far is _____ because . . .
 - My favorite device that uses sound is _____ because . . .
 - Describe what Samuel Morse's telegraph did. How did it work?
 - Light is similar to sound because . . .
 - Light is different from sound because . . .
 - Light without sound . . .
 - (Name a sound) _____ makes me think of . . .
- [Show Image Card 28 and/or flip book Image 6A-2.] Imagine that you are about to go into the Lincoln Center to enjoy a concert. Who is with you? How are you dressed? How did you arrive? What are you going to see? How are you feeling as you approach Lincoln Center?
- [Show flip book Images 6A-3, 6A-5, and/or 6A-9.] Imagine that you are watching and listening to a concert at Lincoln Center. Describe the orchestra, the music, the inside of the concert hall, and your reaction to the experience.



Domain Assessment

DA

This domain assessment evaluates each student's retention of the core content targeted in *Light and Sound*.

10 Domain Assessment

Note: You may wish to have some students do the three parts of this assessment in two or three sittings. Some students may need help reading the questions. You may wish to allow some students to respond orally.

Part I (Instructional Master DA-1)

Directions: I am going to read some statements to you about light and sound. Listen carefully as I read. If the statement is true, circle the letter 'T.' If the statement is false, circle the letter 'F.'

1. Light and sound are both forms of energy. (T)
2. Light travels faster than sound. (T)
3. Sound travels well in a vacuum, a space with no particles. (F)
4. Sound is made from vibrations that travel in waves. (T)
5. The earth's main source of light is the sun. (T)
6. Shadows are formed because light cannot bend around objects. (T)
7. Light that is reflected is absorbed, or soaked up, into something. (F)
8. A straw that seems to bend or break apart in a glass of water is an example of refraction. (T)
9. The setting of the narrative you heard is in Florida in the winter. (F)
10. The point of view of the narrative is told from the first person, using the words *I*, *me*, *my*, and *mine* for the narration. (F)

Part II (Instructional Master DA-2)

Directions: We will read each question and the optional answers together. Circle the letter that best answers each question or completes each statement.

1. What parts of your body produce your voice? (A. diaphragm, trachea, and larynx)
2. Objects that do not allow light to pass through them are called _____. (C. opaque)
3. The frequency of vibrations affects the _____ of a sound. (B. pitch)
4. Color is determined by how light is transmitted, reflected, and _____. (B. absorbed)
5. A lens is a _____ object that light can pass through and that is used in many instruments, such as eyeglasses and cameras. (A. transparent)

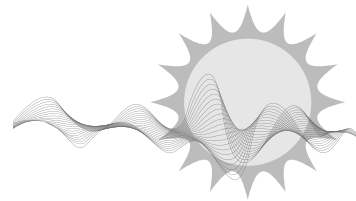
Part III (Instructional Master DA-3)

Directions: We will read these questions and statements together. Write two or three sentences to respond to each question or statement.

Note: You may wish to have some students write more sentences or have some students focus only on responding to one or two questions or statements.

1. Why is light so important?
2. Compare and contrast light and sound.
3. What is a rainbow, and how is it formed?
4. Compare and contrast concave and convex objects.
5. Describe Alexander Graham Bell's most famous invention and why it is so important to us today.

For Teacher Reference Only:
Copies of *Tell It Again! Workbook*



Name: _____

Directions: In the left-hand column, write or draw facts about light; in the right-hand column, write or draw facts about sound.

Light	Sound

Light (cont.)

Sound (cont.)

Name: _____



Dear Family Members,

Over the next several days, your child will be learning about the properties of light, how it travels, and how it can be recognized, studied, and manipulated through experimentation. Your child will be introduced to the types of light—both visible and invisible—and how visible light can be broken down to create a spectrum of different colors. S/he will also learn about instruments that we use today that utilize light.

Below are some suggestions for activities that you may do at home to reinforce what your child is learning about the characteristics of light.

1. The Light Spectrum

Take a bowl of water, and place a mirror inside of it. Reflect the light from the mirror onto a piece of paper. Show your child the rainbow effect on the paper. Explain to your child how when light is bent, or refracted, it shows the many colors that create the light spectrum. Explain that when raindrops refract light, a rainbow is formed. You may want to look around your home for other examples of prism-like objects such as compact discs and crystals that break apart white light to form the spectrum of colors.

2. Lighting Up Water

Take an empty two-liter plastic bottle, and cover it with tin foil. Use tape to hold it all in place. Make sure that you don't cover the base or the top of the bottle. Next, take a screwdriver and make a hole in the side of the bottle, preferably around the top. Cover the hole with your thumb and fill the bottle with water. Finally, after putting the top back on, take a flashlight and shine it into the base of the bottle. Turn the bottle upside down and remove your thumb to let the water pour out. The water should be lit up from the light of the flashlight as it pours out. Explain to your child that this is caused by the light bouncing, or reflecting, off the tin foil. The light continues reflecting throughout the inside of the bottle, making the water appear to light up.

3. Draw and Write

Have your child draw and write what s/he has learned about light, such as what a light wave looks like, what the spectrum looks like, or the types of lenses (concave and convex) that can manipulate light. Ask questions to help your child use the vocabulary learned at school. Ask your child to describe and draw what s/he has learned about the refraction of light to create a spectrum and to describe how a rainbow is formed. Your child will learn the term *prism*, a typically triangular transparent object that refracts visible light into its spectrum of colors. Your child will also learn the acronym "ROY G BIV" for the colors of the spectrum in their order: red, orange, yellow, green, blue, indigo, and violet.

4. Opaque, Translucent, and Transparent

Your child will be learning about the different types of materials that light can travel through and not travel through. Explain to your child that different objects allow different amounts of light to pass through them. Discuss with your child what types of objects and materials are considered opaque, translucent, and transparent. Discuss with your child that an opaque object, like a piece of wood or cardboard, does not allow light through, so we cannot see through it. Next, discuss with your child that a translucent object, like wax paper or stained glass, allows some light through. Therefore, you can see light or a blurry image through translucent material. Finally, discuss with your child how a transparent object is one that lets most light through, like a window or water, allowing us to see all the way through it. You may wish to have your child find random household objects and determine if they are opaque, translucent, or transparent.

5. Words to Use

Below are several of the words that your child will be learning about and using. Try to use these words as they come up in everyday speech with your child.

- *concave*—The concave eyeglass lenses Tatiana’s optometrist prescribed help correct her nearsightedness.
- *convex*—The dome of the White House in Washington, D.C., inspired by Greek and Roman architecture, has a convex shape when viewed from the outside.
- *energy*—Nassir felt exhausted after walking two miles, leaving him with very little energy to cook dinner.
- *opaque*—While reading outside in the sun, Madeline held the book out in front of her to block out the light, and the opaque object kept the light from coming through.
- *spectrum*—When I put my flashlight up to the prism, I saw an amazing spectrum of the colors of a rainbow: red, orange, yellow, green, blue, indigo, and violet.
- *transparent*—Paolo looked through the transparent window to see that everything outside was covered in a beautiful blanket of white snow.

6. Read Aloud Each Day

It is very important that you read with your child every day. Set aside time to read to your child and to listen to your child read to you. I have attached a list of recommended trade books related to the properties of light that may be found at the library, as well as a list of informational websites.

Be sure to praise your child whenever s/he shares what has been learned at school.

Name: _____

Take-Home
Worksheet

Recommended Resources for Light and Sound

Trade Book List

1. *Alexander Graham Bell*, by Victoria Sherrow (Millbrook Press Inc., 2001) ISBN 9781575055336
2. *Alexander Graham Bell: An Inventive Life*, by Elizabeth MacLeod (Scholastic Inc., 1999) ISBN 0439130468
3. *Alexander Graham Bell: Inventor of the Telephone*, by the editors of Time for Kids, with John Micklos, Jr. (HarperCollins Publishers Inc., 2006) ISBN 9780060576189
4. *Alexander Graham Bell: Setting the Tone for Communication*, by Mike Venezia (Children's Press, 2009) ISBN 0531222071
5. *Dazzling Science Projects with Light & Color*, by Robert Gardner and Tom LaBaff (Enslow Elementary, 2006) ISBN 076602587X
6. *Did You Invent the Phone Alone, Alexander Graham Bell?*, by Melvin and Gilda Berger (Scholastic Inc., 2007) ISBN 0439833817
7. *Experiments with Light and Sound*, by Trevor Cook (The Rosen Publishing Group, Inc., 2009) 9781435828087
8. *Light & Sound*, by Clint Twist (Bearport Publishing Company, Inc., 2006) ISBN 1597160601
9. *Light (Science Alive)*, Darlene Lauw and Lim Cheng Puay (Crabtree Publishing Company, 2002) ISBN 0778706060
10. *Light and Color (Making Sense of Science)*, by Peter Riley (Smart Apple Media, 2005) ISBN 1583407154
11. *Light and Color (Straightforward Science)*, by Peter Riley (Franklin Watts, 1998) ISBN 0531153711
12. *Light and Dark (Science Alive)*, by Terry Jenkins (Smart Apple Media, 2009) ISBN 9781599202709
13. *Light and Sound*, by Dr. Mike Goldsmith (Kingfisher Publications, 2007) ISBN 9780753462812
14. *Light and Sound (Real World Science)*, by John Clark (Gareth Stevens Publishing, 2006) ISBN 0836863062
15. *Light and Sound (Science Fact Files)*, by Steve Parker (Raintree Steck-Vaughn Publishers, 2001) ISBN 0739810111
16. *Listen Up!: Alexander Graham Bell's Talking Machine*, by Monica Kulling (Random House Children's Books, 2007) ISBN 9780375831157
17. *A Picture Book of Thomas Alva Edison*, by David A. Adler (Holiday House, 1999) ISBN 0823414140
18. *Sound*, by Terri Jennings (Smart Apple Media, 2009) ISBN 9781599202754
19. *Sound and Hearing*, by Julie Murray (Abdo Consulting Group, Inc., 2007) 9781596798311
20. *Sound, Heat & Light: Energy At Work*, by Melvin Berger (Scholastic Inc., 2002) ISBN 0590461036
21. *Sounds and Vibrations (Making Sense of Science)*, by Peter Riley (Smart Apple Media, 2005) ISBN 1583407189
22. *The Thomas Edison Book of Easy and Incredible Experiments*, by The Thomas Alva Edison Foundation (John Wiley & Sons, Inc., 1988) ISBN 0471620904
23. *Thomas Edison: Young Inventor (Childhood of Famous Americans Series)*, by Sue Guthridge (Aladdin, 1986) ISBN 0020418507
24. *What Is Light?*, by Richard and Louise Spilsbury (Enslow Elementary, 2008) ISBN 0766030970
25. *What's Faster than a Speeding Cheetah?*, by Robert E. Wells (Albert Whitman and Company, 2007) ISBN 9780807522813
26. *Why Do We See Rainbows?*, by Melissa Stewart (Marshall Cavendish Corporation, 2009) ISBN 9780761429197

Websites

General

27. Science News for Kids
<http://www.sciencenewsforkids.org>
28. ZOOM Science Activities
<http://pbskids.org/zoom/activities/sci>

Light

29. Make Your Own Kaleidoscope (National Geographic Kids)
<http://kids.nationalgeographic.com/kids/activities/funscience/be-dazzled>
30. PBS Kids Light Experiments: Periscope Experiment
www.PBSkids.org
31. Science Games for Kids: Light and Dark
<http://www.sciencekids.co.nz/gamesactivities/lightdark.html>
32. Science Games for Kids: Sun, Light, and Shadows
<http://www.sciencekids.co.nz/gamesactivities/lightshadows.html>
33. Science Kids at Home: Sundial Experiment
www.sciencekidsathome.com

Sound

34. Bottled Music (National Geographic Kids)
<http://kids.nationalgeographic.com/kids/activities/funscience/sounds-great>
35. How Loud Is Too Loud?
<http://www.dangerousdecibels.org/virtualexhibit/3howloudistooloud.html>
36. Science Games for Kids: Changing Sounds
<http://www.sciencekids.co.nz/gamesactivities/changingsounds.html>
37. What Is Sound?
<http://www.dangerousdecibels.org/virtualexhibit/1whatsthatssound.html>

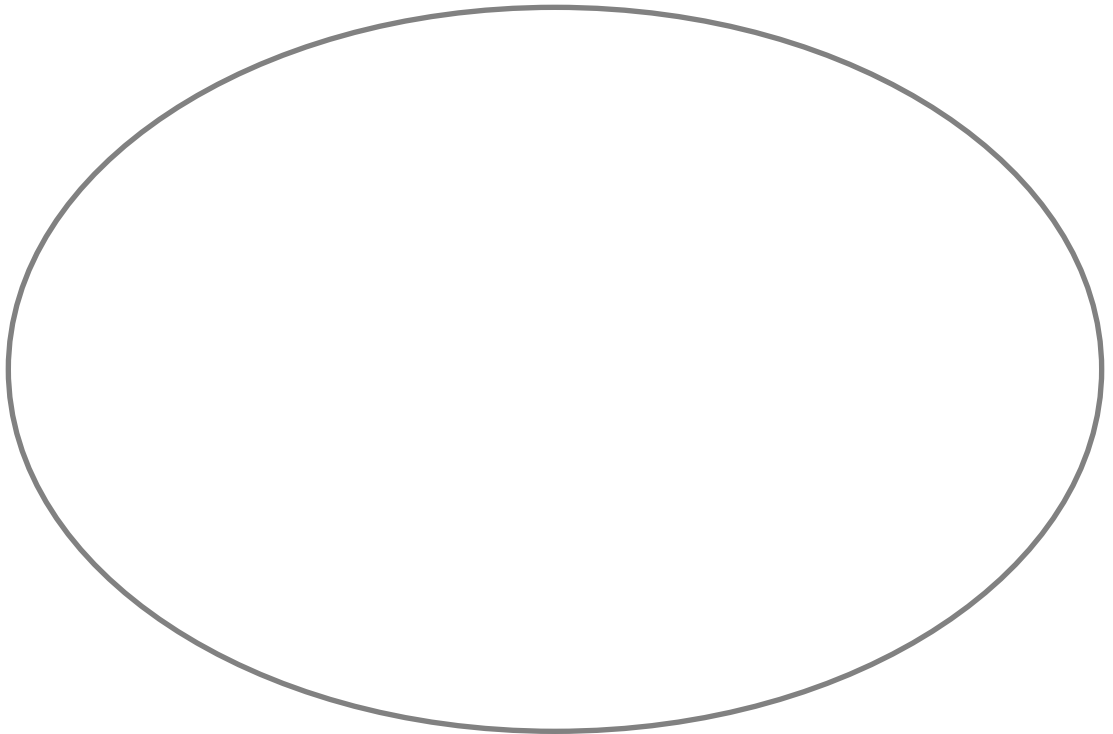
Name: _____

Take-Home
Worksheet

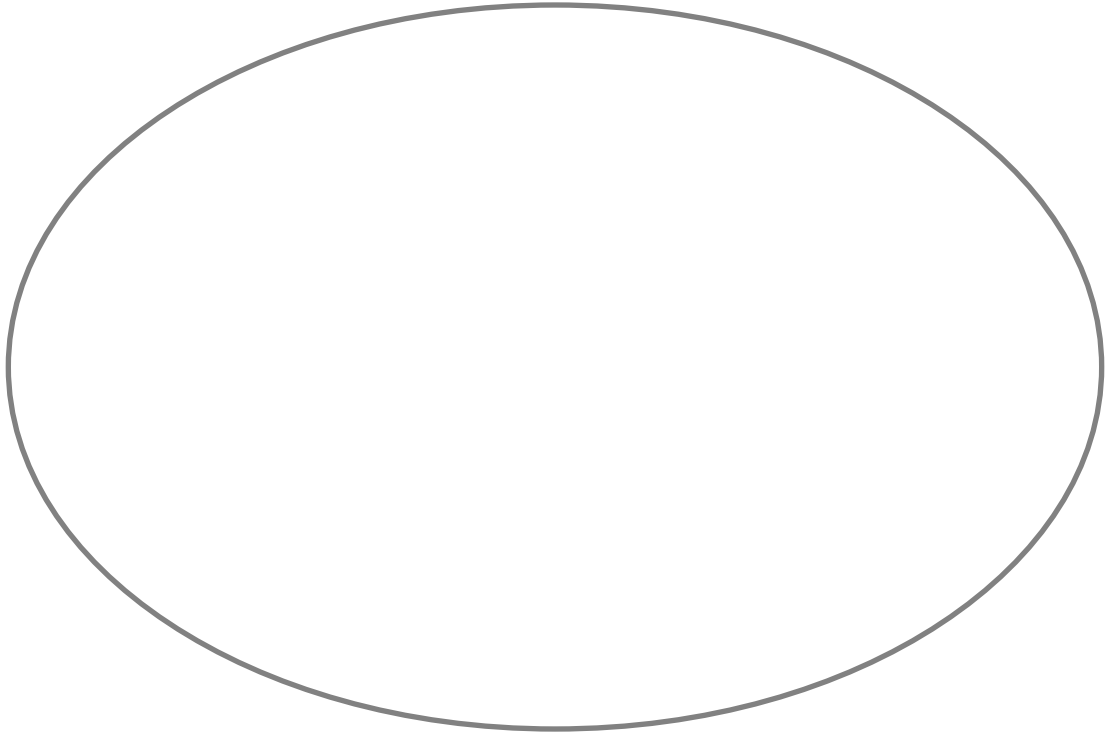


Directions: First, look at the convex side of the spoon, and draw a picture of your reflection in the first oval. Then look at the concave side of the spoon, and draw a second picture of your reflection in the second oval. Use the back of the worksheet for additional drawings.

CONVEX

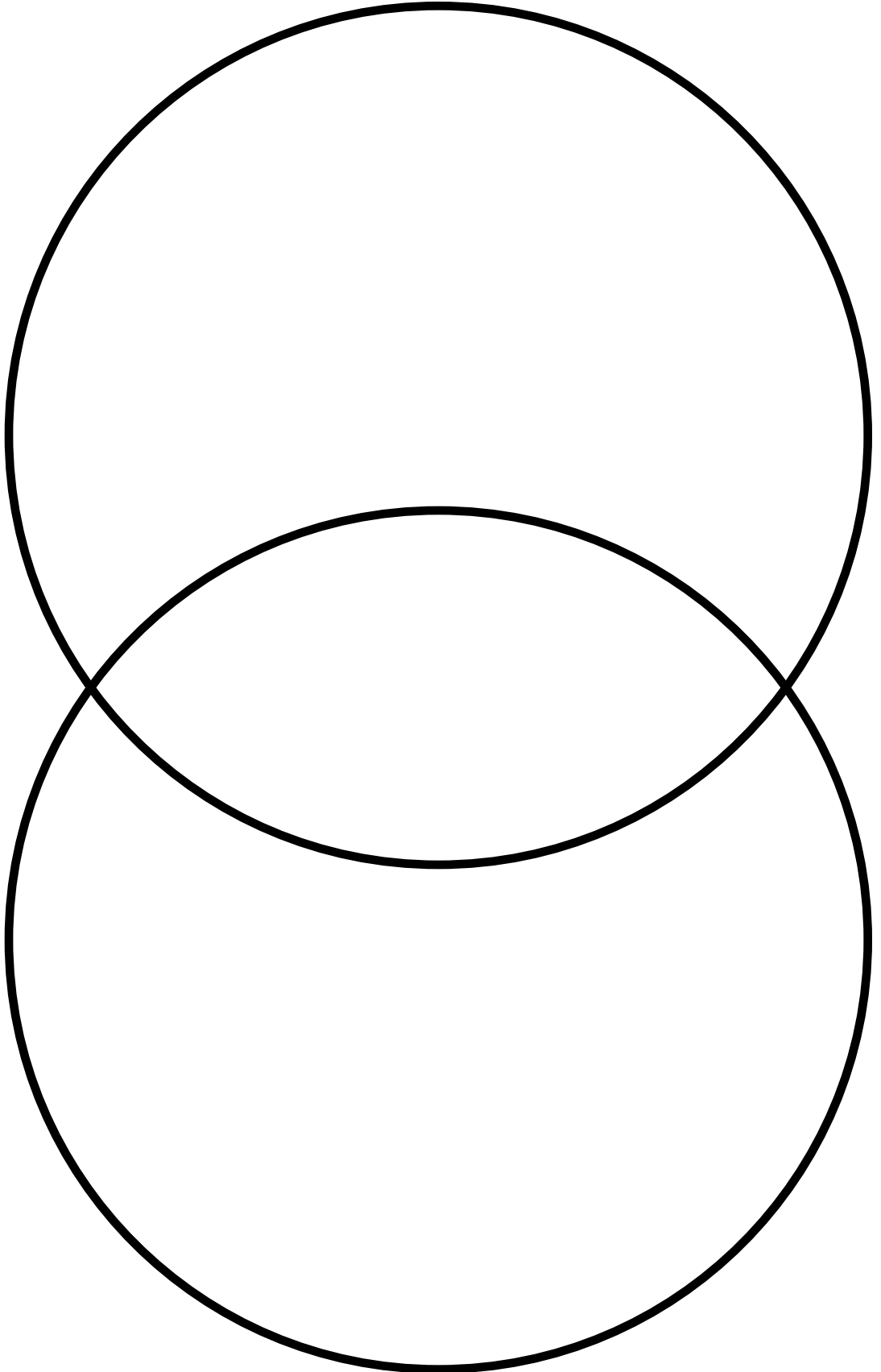


CONCAVE



Name: _____

Directions: On the line over each circle, write the name of each of the two things being compared and contrasted. Write how the two things you are comparing are alike in the overlapping part of the Venn diagram. Write how the two things you are contrasting are different in the nonoverlapping part of each circle.



Name: _____



Dear Family Members,

During the next several days, your child will be learning about the properties of sound, how it travels in waves, like light, and how it can be manipulated and used in certain devices. Your child will be introduced to how sound is produced, how sounds change, the similarities and differences between light and sound, and the parts of the human body that allow us to speak. S/he will also learn about the work of Alexander Graham Bell, the inventor of the telephone. Below are some suggestions for activities that you may do at home to reinforce what your child is learning about in class.

1. Sayings and Phrases: His Bark Is Worse Than His Bite/Actions Speak Louder Than Words

You child will be learning the sayings “his bark is worse than his bite,” and “actions speak louder than words.” Ask your child to explain what s/he has learned about these phrases. Discuss with your child that the literal meaning of the phrase “his bark is worse than his bite” is in reference to how a dog is more likely to bark loudly and viciously than it is likely to injure someone. The phrase can be used in reference to a person who may speak loudly or harshly, but who is actually quite harmless. Talk with your child about a time when you have used this phrase in reference to an animal or person. Discuss with your child the meaning of “actions speak louder than words.” Explain that actions are personified in this phrase, because actions cannot physically speak. Discuss how the things we do can make more of a statement than the things we say. Talk with your child about a time when this phrase has been applicable to a situation you experienced. Find opportunities to use these sayings.

2. Sound Waves

For this experiment, stretch some plastic wrap over the top of an empty bowl. Sprinkle some dry rice grains or salt over the plastic wrap. Next, have your child clap his or her hands or take two nonbreakable objects and bang them together over the bowl. The rice should bounce every time the objects bang together. Explain to your child that this experiment shows how sound moves in waves. Discuss with your child how every time hands are clapped or the objects are banged together, the sound waves move through the air causing the plastic wrap to vibrate and the rice to bounce on the plastic wrap. You may wish to have your child write a brief summary explaining what happened in the experiment and why.

3. Bottle Music

Use five identical glass or plastic bottles. Glass cola bottles would probably work best for this experiment, but plastic will also be fine. Fill the bottles with different amounts of water. Then, place the bottles in order from most filled to least filled. After that, have your child blow across the top of a bottle to create a sound. Have your child blow across a different bottle

and discuss the differences in pitch. Discuss with your child that this is how certain musical instruments work, like an organ or flute. Discuss with your child how the amount of air in the bottle affects the quality of sound that is produced. These differences create a change in pitch. When there is more air and less water in the bottle, the pitch is lower. A smaller amount of air in the bottle, and more water, produces a higher pitch. The difference in pitch creates variations in sound. You may wish to have your child write a brief summary explaining what happened in the experiment and why.

4. Words to Use

Below is a list of some of the words that your child will be learning about and using. Try to use these words as they come up in everyday speech with your child.

- *cacophony*—The car alarm created a cacophony because it was very loud and harsh sounding, causing the dogs in the area to bark.
- *frequency*—If you are near a jet engine, you need to wear equipment to protect your ears because of the very high frequency of the sound waves.
- *medium*—Sound waves travel more easily through a solid medium like a brick wall than through a liquid medium like water.
- *pitch*—When we went to the opera, the singer on stage sang in a very high pitch.
- *receiver*—A satellite dish is an example of a receiver because it receives signals from satellites so that we can get different channels on our television set.
- *transmitter*—The transmitter in my telephone broke, which made it impossible for a person on the other end of the phone line to hear anything that was said.
- *variations*—While singing or playing a musical instrument, one can create smooth variations between sounds, or produce different musical notes.

5. Read Aloud Each Day

It is very important that you read with your child every day. Set aside time to read to your child and to listen to your child read to you. Please refer back to the list of recommended resources related to the properties of light and sound that may be found at the library, as well as a list of informational websites.

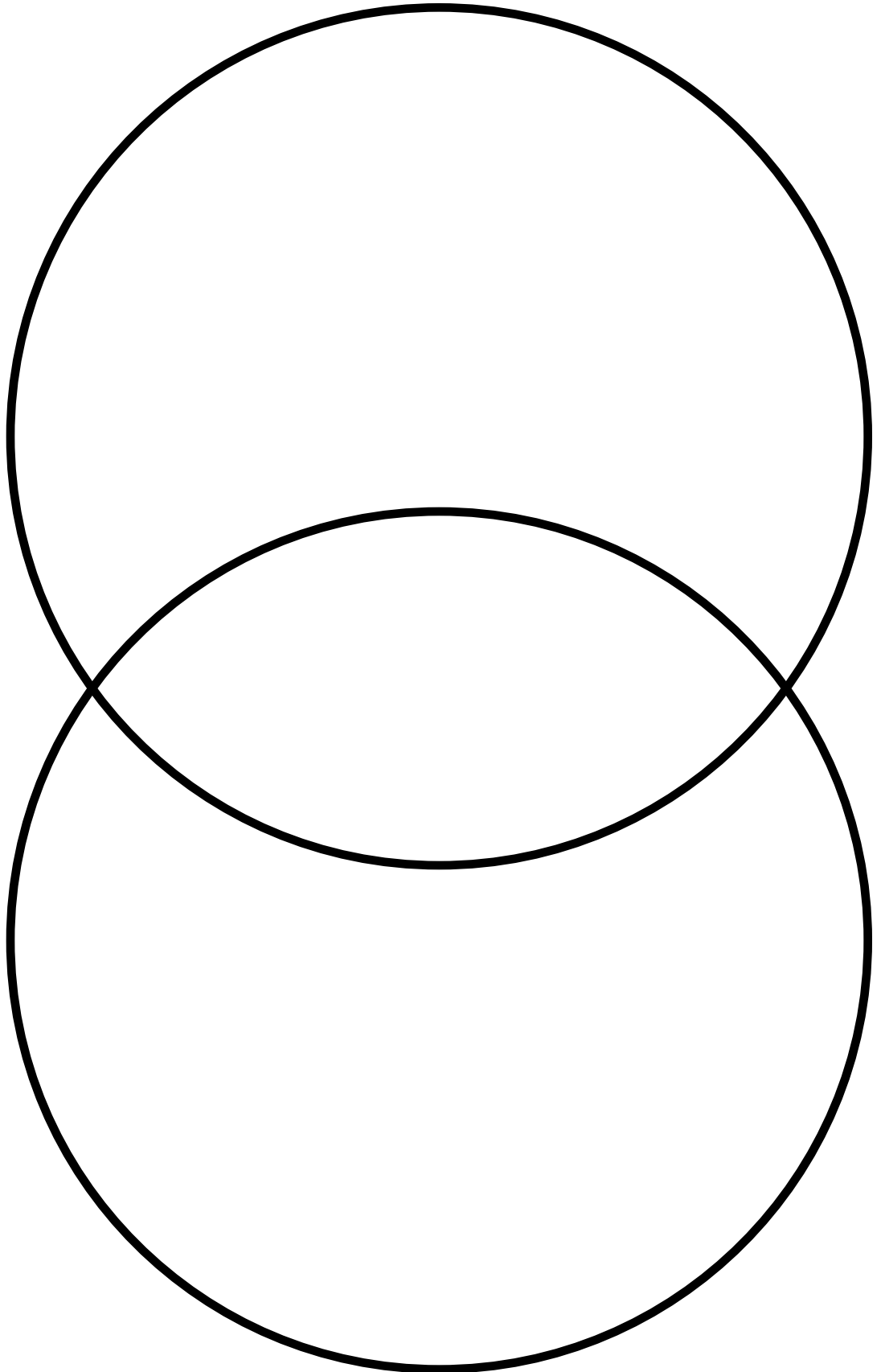
Be sure to praise your child whenever s/he shares what has been learned at school.

Name: _____

Directions: Write how light and sound are alike in the overlapping part of the Venn diagram. Write how light and sound are different in the nonoverlapping part of each circle for each topic.

Light

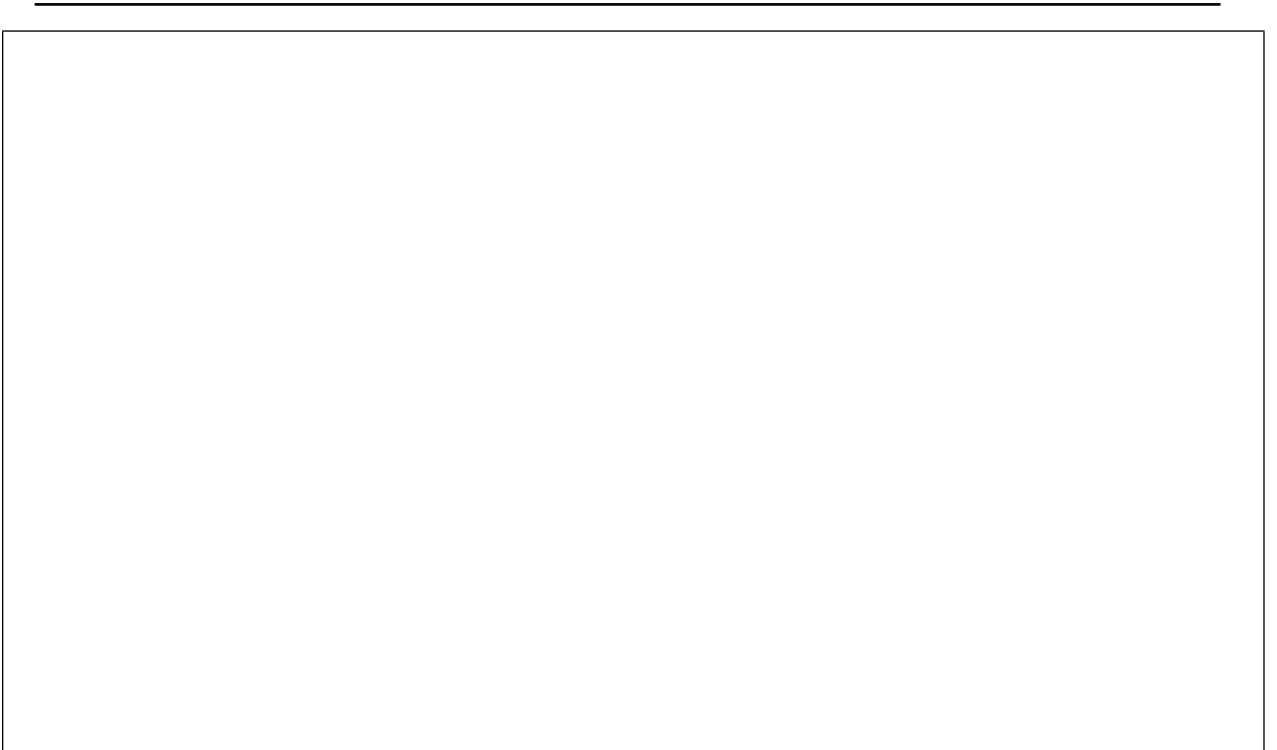
Sound



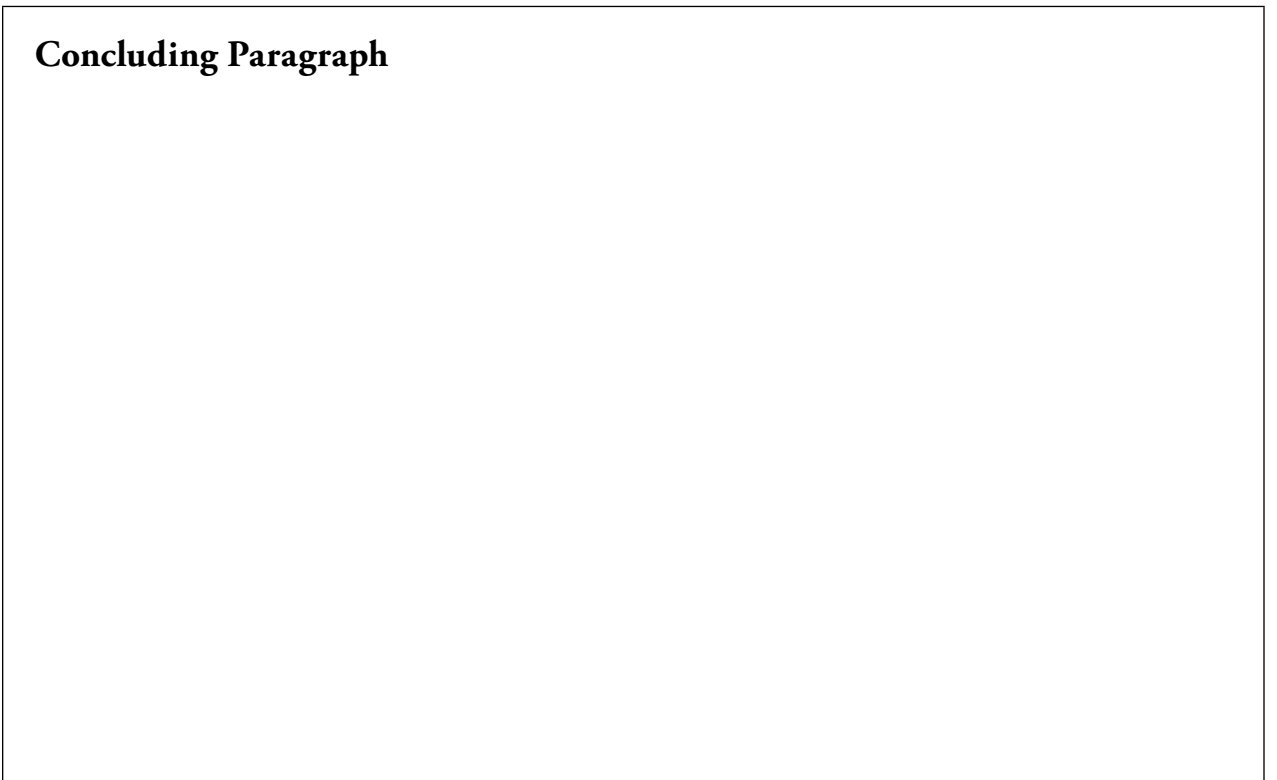
Name: _____

Directions: Write your topic or introductory paragraph in the first rectangle. Write the heading for the second paragraph on the line above the second rectangle. Write your sentences about how light and sound are similar in the second rectangle. Write the heading for the third paragraph on the line above the third rectangle. Write your sentences about how light and sound are different in the third rectangle. Write your concluding paragraph in the fourth rectangle.

Topic/Introductory Paragraph



Concluding Paragraph



Name: _____

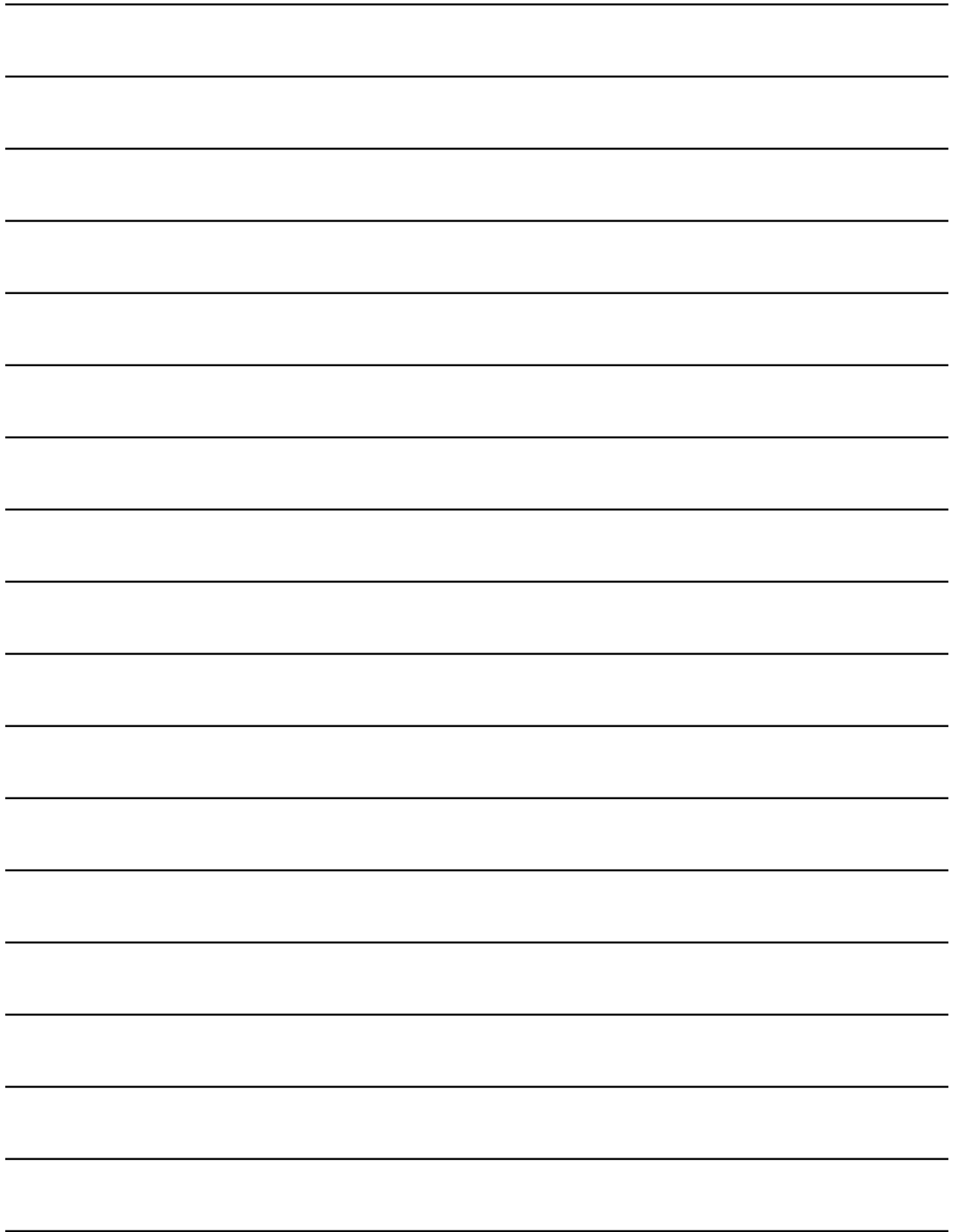
Revision Checklist

Ask yourself these questions as you revise your paragraphs.

1.	Do I have a good topic paragraph?	
2.	Do I have a good concluding paragraph?	
3.	Are there any parts that do not make sense?	
4.	Do my sentences flow well in this order?	
5.	Do I have a good variety of sentence structure?	
6.	Could I combine any of my sentences?	
7.	Do I have a good variety of descriptive words?	
8.	Do my paragraphs include three ways that light and sound are similar and three ways that they are different?	
9.	Is this my best work?	

Name: _____

Directions: Write your working title on the top line. Write the second draft of your paragraphs on the lines below. Be sure to include your two headings.



Name: _____

Editing Checklist

Ask yourself these questions as you edit your paragraphs.

1.	Do I have a fitting title?	
2.	Do all of my sentences start with capital letters?	
3.	Do all of my sentences end with the correct punctuation?	
4.	Have I spelled all of my words correctly?	
5.	Have I used correct grammar?	
6.	Does each sentence and paragraph provide a complete thought?	

Name: _____

Directions: Write your working title on the top line. Write the final draft of your paragraphs on the lines below. Be sure to include your two headings.

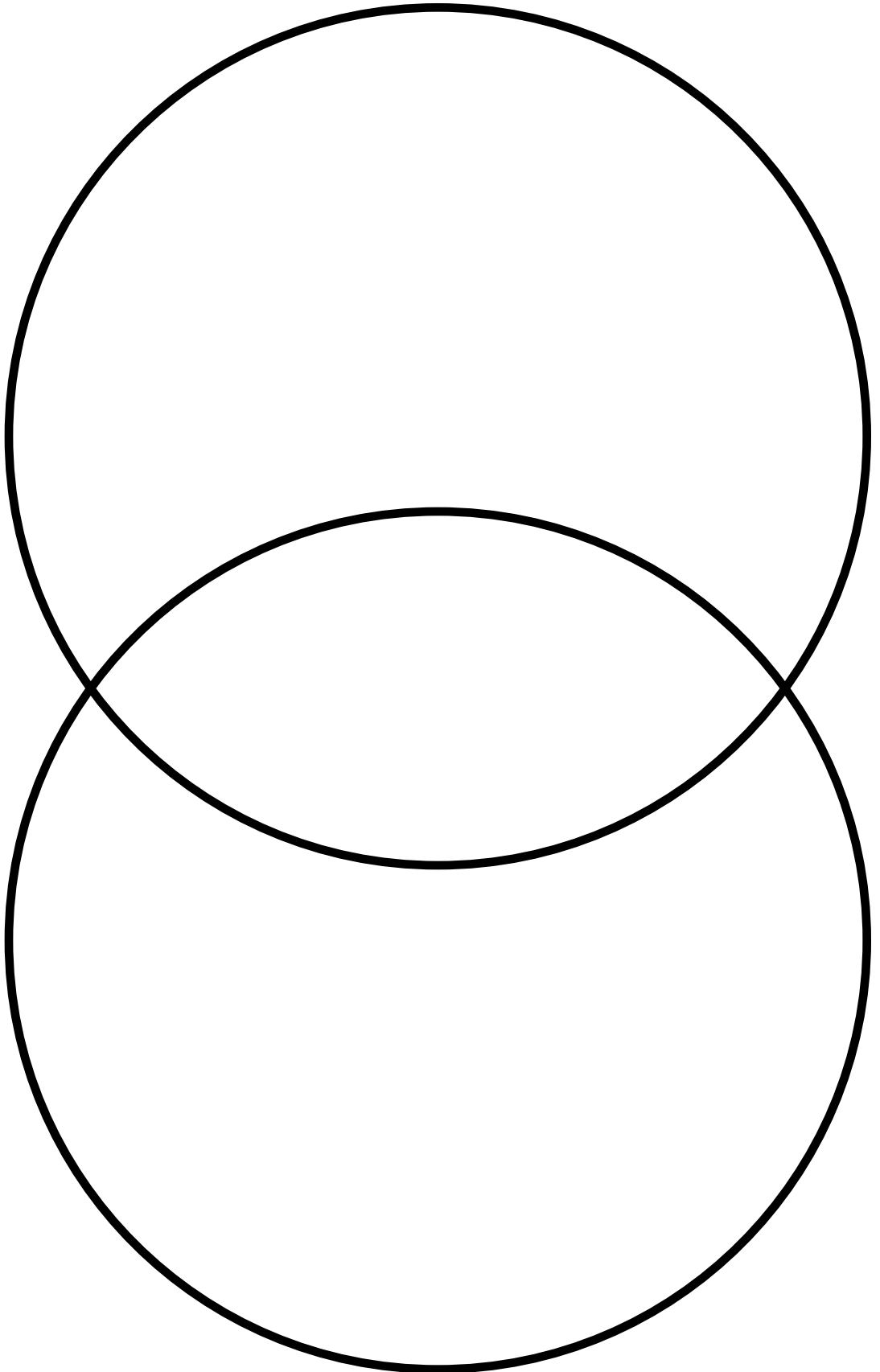
Writing Rubric

4	<p>The piece includes a strong topic paragraph that is indented.</p> <p>The two paragraphs that compare and contrast have multiple sentences with details supporting the topic paragraph.</p> <p>Supporting sentences in each paragraph are organized in a coherent order.</p> <p>The piece has a strong concluding paragraph.</p> <p>There are no errors in grammar, capitalization, or punctuation.</p>
3	<p>The piece includes a topic paragraph that is indented.</p> <p>The two paragraphs that compare and contrast have multiple sentences with details supporting the topic paragraph.</p> <p>Supporting sentences in each paragraph are organized in a coherent order.</p> <p>The piece has a good concluding paragraph.</p> <p>There are few errors in grammar, capitalization, or punctuation.</p>

2	<p>The piece includes a topic paragraph, but it may not have been indented.</p> <p>The two paragraphs that compare and contrast have sentences with some details supporting the topic paragraph.</p> <p>Some supporting sentences in the paragraphs are not properly sequenced.</p> <p>The piece has a weak concluding paragraph.</p> <p>There are some errors in grammar, capitalization, or punctuation.</p>
1	<p>The topic paragraph is missing or unclear.</p> <p>The two paragraphs that compare and contrast have few sentences with details supporting the topic paragraph.</p> <p>Supporting sentences in the paragraphs are not properly sequenced.</p> <p>The concluding paragraph is missing or unclear.</p> <p>There are many errors in grammar, capitalization, or punctuation.</p>
<p>Teacher Comments:</p>	

Name: _____

Directions: On the line over each circle, write the name of each of the two things being compared and contrasted. Write how the two things you are comparing are alike in the overlapping part of the Venn diagram. Write how the two things you are contrasting are different in the nonoverlapping part of each circle.



Name: _____

Directions: Listen carefully to the statements your teacher reads about light and sound. If the statement is true, circle the letter 'T.' If the statement is false, circle the letter 'F.'

1. T F

2. T F

3. T F

4. T F

5. T F

6. T F

7. T F

8. T F

9. T F

10. T F

Directions: Listen carefully to the statements your teacher reads about light and sound. If the statement is true, circle the letter 'T.' If the statement is false, circle the letter 'F.'

1. T F

2. T F

3. T F

4. T F

5. T F

6. T F

7. T F

8. T F

9. T F

10. T F

1. T Light and sound are both forms of energy.
2. T Light travels faster than sound.
3. F Sound travels well in a vacuum, a space with no particles.
4. T Sound is made from vibrations that travel in waves.
5. T The earth's main source of light is the sun.
6. T Shadows are formed because light cannot bend around objects.
7. F Light that is reflected is absorbed, or soaked up, into something.
8. T A straw that seems to bend or break apart in a glass of water is an example of refraction.
9. F The setting of the narrative you heard is in Florida in the winter.
10. F The point of view of the narrative is told from the first person, using the words *I*, *me*, *my*, and *mine* for the narration.

Name: _____

Directions: Read each question or statement and the optional answers together with your teacher. Circle the letter that best answers each question or completes each statement.

1. What parts of your body produce your voice?
 - A. diaphragm, trachea, and larynx
 - B. stomach, diaphragm, and mouth
 - C. trachea, tongue, and teeth

2. Objects that do not allow light to pass through them are called _____.
 - A. vacuums
 - B. transparent
 - C. opaque

3. The frequency of vibrations affects the _____ of a sound.
 - A. color
 - B. pitch
 - C. light

4. Color is determined by how light is transmitted, reflected, and _____.
 - A. described
 - B. absorbed
 - C. ignored

5. A lens is a _____ object that light can pass through and that is used in many instruments, such as eyeglasses and cameras.
 - A. transparent
 - B. vibrating
 - C. white

Answer Key

Name: _____

Directions: Read each question or statement and the optional answers together with your teacher. Circle the letter that best answers each question or completes each statement.

1. What parts of your body produce your voice?
 A. diaphragm, trachea, and larynx
B. stomach, diaphragm, and mouth
C. trachea, tongue, and teeth
2. Objects that do not allow light to pass through them are called _____.
A. vacuums
B. transparent
 C. opaque
3. The frequency of vibrations affects the _____ of a sound.
A. color
 B. pitch
C. light
4. Color is determined by how light is transmitted, reflected, and _____.
A. described
 B. absorbed
C. ignored
5. A lens is a _____ object that light can pass through and that is used in many instruments, such as eyeglasses and cameras.
 A. transparent
B. vibrating
C. white

Name: _____

1. Why is light so important?

2. Compare and contrast light and sound.

3. What is a rainbow, and how is it formed?

Directions: Write two or three complete sentences to answer each question or statement.

4. Compare and contrast concave and convex objects.

5. Describe Alexander Graham Bell's most famous invention and why it is so important to us today.

Tens Recording Chart

Use this grid to record Tens scores. Refer to the Tens Conversion Chart that follows.

Name							

Tens Conversion Chart

Number Correct

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0	10																			
2	0	5	10																		
3	0	3	7	10																	
4	0	3	5	8	10																
5	0	2	4	6	8	10															
6	0	2	3	5	7	8	10														
7	0	1	3	4	6	7	9	10													
8	0	1	3	4	5	6	8	9	10												
9	0	1	2	3	4	6	7	8	9	10											
10	0	1	2	3	4	5	6	7	8	9	10										
11	0	1	2	3	4	5	5	6	7	8	9	10									
12	0	1	2	3	3	4	5	6	7	8	8	9	10								
13	0	1	2	2	3	4	5	5	6	7	8	8	9	10							
14	0	1	1	2	3	4	4	5	6	6	7	8	9	9	10						
15	0	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10					
16	0	1	1	2	3	3	4	4	5	6	6	7	8	8	9	9	10				
17	0	1	1	2	2	3	4	4	5	6	6	7	7	8	8	9	9	10			
18	0	1	1	2	2	3	3	4	4	5	6	6	7	7	8	8	9	9	10		
19	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	
20	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10

Simply find the number of correct answers the student produced along the top of the chart and the number of total questions on the worksheet or activity along the left side. Then find the cell where the column and the row converge. This indicates the Tens score. By using the Tens Conversion Chart, you can easily convert any raw score, from 0 to 20, into a Tens score.

Please note that the Tens Conversion Chart was created to be used with assessments that have a defined number of items (such as written assessments). However, teachers are encouraged to use the Tens system to record informal observations as well. Observational Tens scores are based on your observations during class. It is suggested that you use the following basic rubric for recording observational Tens scores.

9–10	Student appears to have excellent understanding
7–8	Student appears to have good understanding
5–6	Student appears to have basic understanding
3–4	Student appears to be having difficulty understanding
1–2	Student appears to be having great difficulty understanding
0	Student appears to have no understanding/does not participate

CORE KNOWLEDGE LANGUAGE ARTS

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