

Grade 1 Science

Unit 3: Exploring Light and Sound

20 lessons and a unit quiz. Use this pack with the **Exploring Light and Sound Student Reader** (print it, or download it once from the course) to teach the whole unit without the internet.

What is in this pack

- A lesson plan for each chapter: the Big Question, words to know, which pages to read, questions to talk over and the activity pages.
- The unit quiz, ready to print.
- Answers for the teacher at the back: every discussion question and the quiz key.

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Lesson schedule

Two or three lessons a week, about 30 minutes each. Tick each one off as you go.

	Lesson	Reader pages	Activity pages
☐	Getting started: Meet the Big Question	PDF pages 6–7	—
☐	Lesson 1.1: Observing Sounds	PDF pages 8–11	AP 1.1.1
☐	Lesson 1.2: Causing Sound	—	AP 1.2.1
☐	Lesson 1.3: Causing Objects to Vibrate	—	AP 1.3.1
☐	Lesson 1.4: Relationships Between Sound and Science	—	AP 1.4.1
☐	Lesson 1.5: Lesson 1 Roundup: Vibrations During a Performance	—	AP 1.5.1
☐	Lesson 2.1: Seeing in the Dark	PDF pages 12–19	AP 2.1.1
☐	Lesson 2.2: Observing Light Sources	—	AP 2.2.1, AP 2.2.2
☐	Lesson 2.3: Comparing Visibility	—	AP 2.3.1, AP 2.3.2
☐	Lesson 2.4: Reasoning About Light	—	AP 2.4.1
☐	Lesson 2.5: Lesson 2 Roundup: Investigating Light Sources	—	AP 2.5.1
☐	Lesson 3.1: Seeing Shadows	PDF pages 20–27	AP 3.1.1
☐	Lesson 3.2: Making Shadows	—	AP 3.2.1, AP 3.2.2
☐	Lesson 3.3: Comparing Materials That Let Light Pass Through	—	AP 3.3.1
☐	Lesson 3.4: Changing the Direction of Light	—	AP 3.4.1, AP 3.4.2
☐	Lesson 3.5: Lesson 3 Roundup: Using Light in a Stage Performance	—	AP 3.5.1, AP 3.5.2
☐	Lesson 4.1: Communicating over Long Distances	PDF pages 28–33	AP 4.1.1, AP 4.1.2
☐	Lesson 4.2: Putting on a Play	—	AP 4.2.1
☐	Lesson 4.3: Describing the Problem	—	AP 4.3.1
☐	Lesson 4.4: Lesson 4 Roundup: Building and Testing a Device	PDF pages 34–42	AP 4.4.1, AP 4.4.2

	Lesson	Reader pages	Activity pages
☐	Unit review and assessment	—	AP UO.1
☐	Words quiz	—	—

Page numbers are the PDF page numbers of the Student Reader file, so they match what your PDF reader shows.

Getting started: Meet the Big Question

THE BIG QUESTION

What happens in a stage performance so that people can see and hear the show?

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 24–30: the steps, materials and timing for this lesson.

Read

Read Student Book, Chapter 1: “A Trip to a Musical Concert”: PDF pages 6–7. Look at the pictures and maps together.

Talk it over

1. How might an audience experience light and sound during a performance?
2. Ruiz says, “Let’s investigate to find out!” 3 LITERAL—What is going on in this theater?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What happens in a stage performance so that people can see and hear the show?

Lesson 1.1: Observing Sounds

THE BIG QUESTION

What are some patterns in sounds?

Words to know

- **hearing** — the sense that enables the detection of sound
- **volume** — the loudness of a sound

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 31–38: the steps, materials and timing for this lesson.

Read

Read Student Book, Chapter 2: “Sound and Vibration”: PDF pages 8–11. Look at the pictures and maps together.

Talk it over

1. Ask students, What are some patterns in sounds?
2. CHALLENGE—Challenge students to consider that soft sounds can become loud and loud sounds can become soft. 30 EXPLORING LIGHT AND SOUND Ask students, Are there any sounds that are medium in volume?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What are some patterns in sounds?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 1.1.1: Loud and Soft Sounds — Teacher Guide PDF page 186

Lesson 1.2: Causing Sound

THE BIG QUESTION

What can vibrations do?

Words to know

- **materials** — matter that makes up different things
- **matter** — anything that takes up space, even when you cannot see it
- **vibration** — rapid back-and-forth motion

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 39–44: the steps, materials and timing for this lesson.

Talk it over

1. Give students a copy of What Causes Sound?
2. make humming noises as we move PE 1-PS4-1 SEP 3 CCC 2 DCI PS4.A Monitor Progress Formative Assessment Review student responses to What Causes Sound?
3. EXPLORING LIGHT AND SOUND • Ask, How can you find out what vibrations do?
4. Show the fork to a volunteer, and ask, What do you see now?
5. Encourage students to add more questions to the board, based on the work they did today. • Have students stand and model tuning forks once more. • Ask, What should we do to show what vibrations can do?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What can vibrations do?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 1.2.1: What Causes Sound? — Teacher Guide PDF page 187

Lesson 1.3: Causing Objects to Vibrate

THE BIG QUESTION

What can sound do to objects and materials?

Words to know

- **materials** — matter that makes up different things
- **matter** — anything that takes up space, even when you cannot see it
- **vibration** — rapid back-and-forth motion

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 45–50: the steps, materials and timing for this lesson.

Talk it over

1. Give students a copy of What Causes Objects to Vibrate?
2. See the Online Resources Guide for a link to the recommended audio file:
www.coreknowledge.org/cksci-online-resources • Ask students, How do you feel/react when you hear a loud siren like this?
3. CCC 2 DCI PS4.A • Ask, Do loud sounds do anything to objects that are nearby?
4. Place the cup next to the speaker, and invite the members of the team to observe how the salt seems to dance around (vibrate) with the music. • Ask students, How can you explain what happened?
5. Ask, How do you answer this question based on your work as scientists today?
6. Ask, When have you listened to loud music or other sounds in a performance and covered your ears?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What can sound do to objects and materials?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 1.3.1: What Causes Objects to Vibrate? — Teacher Guide PDF page 188

Lesson 1.4: Relationships Between Sound and Science

THE BIG QUESTION

What are sound and vibrations?

Words to know

- **sound** — vibrations detected by the sense of hearing

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 51-58: the steps, materials and timing for this lesson.

Talk it over

1. The triangle vibrates. EXTEND—Which instruments have parts made of stringlike materials that vibrate?
2. LESSON 1.4 | RELATIONSHIPS BETWEEN SOUND AND SCIENCE 47 LITERAL—Why do you think the people in the homes below hear the jet?
3. INFERENTIAL—Ask, What other very big sounds have you heard near your home or our school?
4. The vibrating air causes the windows to rattle or vibrate. 5 48 EXPLORING LIGHT AND SOUND SUPPORT—Ask, What does the drawing show about the photo of the boy strumming a guitar?
5. EXTEND—Ask, What does the picture of the drum show about vibrations?
6. Discuss the final question on page 6 by asking, How did the sound get to the last row of the auditorium?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What are sound and vibrations?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 1.4.1: Show Causes and Effects — Teacher Guide PDF page 189

Lesson 1.5: Lesson 1 Roundup: Vibrations During a Performance

THE BIG QUESTION

What are sound and vibrations?

Words to know

- **materials** — matter that makes up different things
- **matter** — anything that takes up space, even when you cannot see it
- **vibration** — rapid back-and-forth motion

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 59–64: the steps, materials and timing for this lesson.

Talk it over

1. LESSON 1.5 | LESSON 1 ROUNDUP: VIBRATIONS DURING A PERFORMANCE 55 • Ask, How does the sound of your voice affect the waxed paper?
2. Ask, How can you answer the question of why this happens now?
3. Ask, How will you know that the instruments you make are vibrating?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What are sound and vibrations?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 1.5.1: What Do Sound and Vibrations Do? — Teacher Guide PDF page 190

Lesson 2.1: Seeing in the Dark

THE BIG QUESTION

Why is it hard to find a pencil in a dark room?

Words to know

- **cause** — to make something happen (n. the reason for an outcome)
- **darkness** — the condition of having little or no light
- **effect** — a change that happens because of a cause

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 65–72: the steps, materials and timing for this lesson.

Read

Read Student Book, Chapter 3: “Light”: PDF pages 12–19. Look at the pictures and maps together.

Talk it over

1. NGSS Elements • Why do the explorers put on a hard hat?
2. Ask, What would a light walk be like if it were nighttime?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: Why is it hard to find a pencil in a dark room?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 2.1.1: A Light Walk at Night — Teacher Guide PDF page 191

Lesson 2.2: Observing Light Sources

THE BIG QUESTION

What objects give off their own light, and what objects do not?

Words to know

- **compare** — to examine characteristics of two or more things, particularly looking for similarities
- **contrast** — to look for differences between two things
- **darkness** — the condition of having little or no light

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 73–77: the steps, materials and timing for this lesson.

Talk it over

1. question board How Bright Is That Light?
2. smartphone Does It Give Off Light?
3. Give each student a copy of Does It Give Off Light?
4. Ask, Where did we go, and what did we see?
5. SEP 6 DCI PS4.B CCC 2 Monitor Progress • Ask students, What objects on our walk did not give off light?
6. See the Online Resources Guide for a link to the recommended video: www.coreknowledge.org/cksci-online-resources NGSS Elements Ask students the following: • What can fireflies do that many other animals cannot do?
7. SEP 6 DCI PS4.B • When is the best time of day to see the light from fireflies?
8. NGSS Elements • Ask students, What objects from around our classroom do not give off light?
9. SEP 6 DCI PS4.B CCC 2 3D Learning • Ask, How can you test this?
10. Invite another student to look through the eyehole and report what they see to the rest of the class. • Have the small groups test their ideas about other classroom objects. • Ask, Was your claim supported by evidence from your test?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What objects give off their own light, and what objects do not?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 2.2.1: How Bright Is That Light? — Teacher Guide PDF page 192
- Activity Page 2.2.2: Does It Give Off Light? — Teacher Guide PDF page 193

Lesson 2.3: Comparing Visibility

THE BIG QUESTION

How does the amount of light affect how well we can see something?

Words to know

- **cause** — to make something happen (n. the reason for an outcome)
- **darkness** — the condition of having little or no light
- **effect** — a change that happens because of a cause

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 78–82: the steps, materials and timing for this lesson.

Talk it over

1. See the Online Resources Guide for a link to the recommended video:
www.coreknowledge.org/cksci-online-resources NGSS Elements Ask students the following:
 - Why is it hard to see under the covers at night?
2. SEP 6 DCI PS4.B Differentiation
 - If you want to read a book under the covers, what do you need?
3. Ask, How can you see the people on the stage when the theater is dark?
4. I observed that light makers can be seen when there is darkness around them.
 - Ask students, What caused the light maker to be seen?
5. Ask, How do you know when the show is about to begin?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How does the amount of light affect how well we can see something?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 2.3.1: Let the Light Shine In — Teacher Guide PDF page 194
- Activity Page 2.3.2: Testing Light Makers — Teacher Guide PDF page 195

Lesson 2.4: Reasoning About Light

THE BIG QUESTION

How does light affect what you see?

Words to know

- **cause** — to make something happen (n. the reason for an outcome)
- **compare** — to examine characteristics of two or more things, particularly looking for similarities
- **darkness** — the condition of having little or no light
- **effect** — a change that happens because of a cause
- **object** — a thing made of material

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 83–95: the steps, materials and timing for this lesson.

Talk it over

1. crayons or markers What's in the Closet?
2. LITERAL—What is the younger brother looking for?
3. The brain interprets these signals as images that you “see.” LESSON 2.4 | REASONING ABOUT LIGHT 81 INFERENTIAL—What objects give off light?
4. LITERAL—What are the examples of bright light?
5. At night, light from lamps shines on objects. 12 LITERAL—Where does light come from that shines on people and dogs?
6. How will she see her dog and where she is going?
7. It's just some shoes, some shirts, some dresses, and toys in there! 13 LITERAL—What can you see in the picture of the dark closet?
8. DCI PS4.B 14 LITERAL—What does a dimmer switch do?
9. Where have you seen dimmer switches used?
10. SEP 6 CCC 2 DCI PS4.B Differentiation • How does having the sunshine in the daytime affect what you see?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How does light affect what you see?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 2.4.1: What's in the Closet? — Teacher Guide PDF page 196

Lesson 2.5: Lesson 2 Roundup: Investigating Light Sources

THE BIG QUESTION

Why is it hard to find a pencil in a dark room?

Words to know

- **brightness** — the quality of intensity of light
- **cause** — to make something happen (n. the reason for an outcome)
- **compare** — to examine characteristics of two or more things, particularly looking for similarities
- **darkness** — the condition of having little or no light
- **effect** — a change that happens because of a cause

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 96–100: the steps, materials and timing for this lesson.

Talk it over

1. Ask, Where on the floor of the dark room was the younger brother looking for the pencil?
2. Monitor Progress • Why was he looking there?
3. Ask students the following: • What is the job of an usher in a theater?
4. CCC 2 DCI PS4.B Differentiation • Why might a person who comes late to the theater have trouble finding their seat?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: Why is it hard to find a pencil in a dark room?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 2.5.1: Draw a Funny Dark and Light Comic — Teacher Guide PDF pages 197–198

Lesson 3.1: Seeing Shadows

THE BIG QUESTION

Where and when can you see shadows?

Words to know

- **materials** — matter that makes up different things
- **record** — to collect and keep information

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 101–109: the steps, materials and timing for this lesson.

Read

Read Student Book, Chapter 4: “Light and Materials”: PDF pages 20–27. Look at the pictures and maps together.

Talk it over

1. NGSS Elements • How do young children react to seeing their shadows for the first time?
2. SEP 6 CCC 2 • DCI PS4.B What could you tell a younger child about shadows to make them feel better?
3. Invite students to share any experience with shadow puppets, and ask, What materials make the best shadow puppets?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: Where and when can you see shadows?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 3.1.1: Shadow Walk — Teacher Guide PDF page 199

Lesson 3.2: Making Shadows

THE BIG QUESTION

What materials make the darkest shadows?

Words to know

- **evidence** — a detail that supports a claim or helps prove an idea is true
- **observe** — to watch something and notice details about it (observation, n. the process of noticing details or a specific detail that is noticed)
- **opaque** — describing materials that do not allow light to pass through them
- **record** — to collect and keep information

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 110–115: the steps, materials and timing for this lesson.

Talk it over

1. SEP 3 DCI PS4.B • Ask students, How can you test this material to see if it makes a dark shadow?
2. CCC 2 • Allow volunteers to demonstrate how they would do their test, and discuss the results. • Ask, Could we use the same test on other materials?
3. LESSON 3.2 | MAKING SHADOWS 107 • Ask, If you hold these materials in front of your eyes, can you see through them?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What materials make the darkest shadows?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 3.2.1: Shadow Makers — Teacher Guide PDF page 200
- Activity Page 3.2.2: Planning and Carrying Out Investigations — Teacher Guide PDF page 201

Lesson 3.3: Comparing Materials That Let Light Pass Through

THE BIG QUESTION

What happens when light shines on different materials?

Words to know

- **evidence** — a detail that supports a claim or helps prove an idea is true
- **observe** — to watch something and notice details about it (observation, n. the process of noticing details or a specific detail that is noticed)
- **opaque** — describing materials that do not allow light to pass through them
- **surface** — the outside part or uppermost layer of an object
- **translucent** — describing materials that allow some light to pass through them
- **transparent** — describing materials that allow light to freely pass through them and that can be seen through

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 116–122: the steps, materials and timing for this lesson.

Talk it over

1. Give each student a copy of What Happens to a Light Beam When Materials Are Placed in Its Path?
2. SEP 6 DCI PS4.B • What were some of the materials you tested that made dark shadows?
3. CCC 2 Differentiation • What happened to the light from the flashlight that caused the dark shadows?
4. Ask, How can we test what happens to the light beam when a material is placed in its path?
5. Ask students, What will you be able to learn when you carry out this investigation?
6. Which did not?
7. SEP 3 and 4 DCI PS4.B CCC 2 Monitor Progress • Which materials blocked all the light beam?
8. Recording data as white, gray, or black has a visual impact and may help some students quickly answer questions about the properties of these materials. 114 EXPLORING LIGHT AND SOUND • Which materials let all the light pass through?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What happens when light shines on different materials?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 3.3.1: What Happens to a Light Beam When Materials Are Placed in Its Path? — Teacher Guide PDF page 202

Lesson 3.4: Changing the Direction of Light

THE BIG QUESTION

What materials change the direction of a light beam?

Words to know

- **evidence** — a detail that supports a claim or helps prove an idea is true
- **observe** — to watch something and notice details about it (observation, n. the process of noticing details or a specific detail that is noticed)
- **reflect** — to redirect or send back a light beam

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 123–128: the steps, materials and timing for this lesson.

Talk it over

1. cardboard squares (1 per group) What Materials Can Change the Direction of Light?
2. Give each student a copy of What Materials Can Change the Direction of Light?
3. What is your evidence for this?
4. Ask students the following: • How did using the first Activity Page help you do science?
5. SEP 3, 4, and 6 • DCI PS4.B Which materials caused a light beam to change direction?
6. The light beam changed direction when we put the mirror and foil in its path. • How did using the second Activity Page help you?
7. LESSON 3.4 | CHANGING THE DIRECTION OF LIGHT 121 • What is it about these materials that makes them able to change the direction of light?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What materials change the direction of a light beam?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 3.4.1: How We Will Find Materials That Change the Direction of Light — Teacher Guide PDF page 203
- Activity Page 3.4.2: What Materials Can Change the Direction of Light? — Teacher Guide PDF page 204

Lesson 3.5: Lesson 3 Roundup: Using Light in a Stage Performance

THE BIG QUESTION

What happens when light shines on different materials?

Words to know

- **opaque** — describing materials that do not allow light to pass through them
- **translucent** — describing materials that allow some light to pass through them
- **transparent** — describing materials that allow light to freely pass through them and that can be seen through

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 129–142: the steps, materials and timing for this lesson.

Talk it over

1. See the Online Resources Guide for a link to the recommended video:
www.coreknowledge.org/cksci-online-resources CCC 2 Monitor Progress • Ask students, What is it about the light from the flashlight that makes it possible to tag people?
2. LITERAL—What three things are needed to make a shadow?
3. LITERAL—What are the examples of materials that block light?
4. SEP 3 DCI PS4.B CCC 2 20 LITERAL—Do the balloons completely block the light from the sun?
5. You can see a long way into the sky. 21 LITERAL—How do you know that light can pass through the water and clear glass?
6. INFERENTIAL—Where do you think the light source is in this photo?
7. LITERAL—What can mirrors do to a light beam?
8. How do you know that the light has reflected?
9. If you tested them, which would make a darker shadow, a wood baseball bat or a glass aquarium filled with water?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What happens when light shines on different materials?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 3.5.1: Our Investigation of Light and Materials — Teacher Guide PDF page 205
- Activity Page 3.5.2: Mapping Our Ideas — Teacher Guide PDF page 206

Lesson 4.1: Communicating over Long Distances

THE BIG QUESTION

How do people communicate over long distances?

Words to know

- **device** — something planned or built for a specific purpose
- **engineer** — a person who uses science to design solutions to problems, especially by constructing tools or devices (v. to design and build)
- **signal** — a piece of information sent to communicate

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 143–150: the steps, materials and timing for this lesson.

Read

Read Student Book, Chapter 5: “Solving Problems with Light or Sound”: PDF pages 28–33. Look at the pictures and maps together.

Talk it over

1. Ask students the following: Monitor Progress • How do people in the last row at a concert or play hear the music or players?
2. Activity Page • What was the problem Samuel Morse wanted to solve?
3. How did the new telegraph make people's lives better than before?
4. For each invention, ask students, How did this make people's lives different?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How do people communicate over long distances?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 4.1.1: Use Morse Code — Teacher Guide PDF page 207
- Activity Page 4.1.2: Tools for Communicating over Long Distances — Teacher Guide PDF page 208

Lesson 4.2: Putting on a Play

THE BIG QUESTION

How do students putting on a play communicate?

Words to know

- **communicate** — to give information to someone
- **microphone** — a device that picks up sound, for recording or to make it louder
- **opaque** — describing materials that do not allow light to pass through them
- **solution** — a process, action, or device that fixes a problem

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 151–161: the steps, materials and timing for this lesson.

Talk it over

1. Ruiz's class want to put on for the rest of their school?
2. Ask, What characters do these masks show?
3. EVALUATIVE—How could the class use a spotlight in their show?
4. Ruiz's class wants to solve?
5. LITERAL—What does the solution to our problem have to do?
6. Ruiz's students with their show?
7. INFERENTIAL—What are the children in the picture doing?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How do students putting on a play communicate?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 4.2.1: How to Solve a Problem — Teacher Guide PDF page 209

Lesson 4.3: Describing the Problem

THE BIG QUESTION

How can you describe a problem about communicating during a play?

Words to know

- **device** — something planned or built for a specific purpose
- **reflection** — a visible image bounced back by a shiny surface
- **requirement** — something that is necessary or needed
- **useful** — helpful for a specific purpose

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 162–166: the steps, materials and timing for this lesson.

Talk it over

1. Ruiz's class had in Student Book Chapter 5?
2. Ask, How and at what point in the play should your audience get involved?
3. SEP 1 DCI PS4.C • How was it helpful to ask questions about the problem?
4. ETS1.A Monitor Progress • Why was it important to measure the space where the play will be performed?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can you describe a problem about communicating during a play?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 4.3.1: Ask Questions About the Problem — Teacher Guide PDF page 210

Lesson 4.4: Lesson 4 Roundup: Building and Testing a Device

THE BIG QUESTION

How do students use light and sound to communicate during a play?

Words to know

- **engineer** — a person who uses science to design solutions to problems, especially by constructing tools or devices (v. to design and build)

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 167–183: the steps, materials and timing for this lesson.

Read

Read Student Book, Chapter 6: “Science in Action”: PDF pages 34–42. Look at the pictures and maps together.

Talk it over

1. They can be used to scan bar codes, perform surgery, and cut metal. LITERAL—What did Gordon Gould want to know about light?
2. how light behaves UNIT SUPPLEMENT | SCIENCE IN ACTION: USING LIGHT AS A TOOL 175 INFERENTIAL—What do you think would be different if a laser were never invented?
3. NGSS Elements Have students use their data displays to answer the following questions: • How many tools were tested?
4. SEP 4 DCI PS4.C and ETS1.C • How many of the teams made tools that use light to communicate?
5. Then ask about each device: • How did this tool solve the problem?
6. Sample answer: The beans made noise when I shook the shaker. • How was working as a team helpful?
7. UNIT SUPPLEMENT | SCIENCE IN ACTION: USING LIGHT AS A TOOL 171 LITERAL—What does the dentist show the students?
8. LITERAL—What can a laser do to your teeth?
9. LITERAL—What else can lasers do?
10. Science Addresses Questions About the Natural and Material World LITERAL—What did Gordon Gould study?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How do students use light and sound to communicate during a play?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 4.4.1: How We Solved the Problem — Teacher Guide PDF page 211
- Activity Page 4.4.2: Comparing Solutions — Teacher Guide PDF page 212

UNIT REVIEW

Unit review and assessment

- Activity page answer key (for the teacher): Teacher Guide PDF pages 213–215
- Activity Page UO.1 — Teacher Guide PDF page 185

WORDS QUIZ

Exploring Light and Sound

Name: _____ Date: _____

Circle the letter of the best answer.

1. Which word means “a piece of information sent to communicate”?
 - a) lit
 - b) signal
 - c) shiny
 - d) see
2. Which word means “a medical procedure that involves cutting into the body to repair it”?
 - a) reflection
 - b) record
 - c) volume
 - d) surgery
3. Which word means “describing sound that is of low volume, the opposite of loud”?
 - a) soft
 - b) block
 - c) dim
 - d) record
4. Which word means “the quality of intensity of light”?
 - a) brightness
 - b) transparent
 - c) see
 - d) materials
5. Which word means “an open space in something; a hole”?
 - a) invent
 - b) object
 - c) cavity
 - d) see
6. Which word means “the sense that enables the detection of sound”?
 - a) evidence
 - b) surface
 - c) loud
 - d) hearing

7. Which word means “the ability to cause change d words and phrases are unit that you should model for se in isolated drill or memorization”?

- a) energy
- b) reflect
- c) light
- d) surgery

8. Which word means “a person who uses science to design solutions to problems, especially by constructing tools or devices (v. to design and build)”?

- a) solve
- b) reflection
- c) surface
- d) engineer

9. Which word means “a communication”?

- a) requirement
- b) code
- c) hearing
- d) message

10. Which word means “a visible image bounced back by a shiny surface”?

- a) requirement
- b) engineer
- c) light beam
- d) reflection

11. Which word means “giving off a lot of light”?

- a) code
- b) message
- c) vibration
- d) bright

12. Which word means “giving off or illuminated by little light (v. to reduce an amount of light)”?

- a) matter
- b) direction
- c) dim
- d) energy

Answers

Getting started: Meet the Big Question

1. **How might an audience experience light and sound during a performance?**
See Know the Standards 2.
2. **Ruiz says, “Let’s investigate to find out!” 3 LITERAL—What is going on in this theater?**
A musical concert is being performed. INFERENTIAL—Are Mr. Ruiz’s students pleased with their seats after all?

Lesson 1.1: Observing Sounds

1. **Ask students, What are some patterns in sounds?**
Sounds can be made by animals. Sounds can be made by machines. Sounds can be short, like a screech. Sounds can be long, like a desk being dragged on the floor.
2. **CHALLENGE—Challenge students to consider that soft sounds can become loud and loud sounds can become soft. 30 EXPLORING LIGHT AND SOUND**
Ask students, Are there any sounds that are medium in volume?
Sounds that are neither loud nor soft might include people talking, water running from a sink faucet, or a bird chirping. Have interested students list sound makers that can change volume from very soft to very loud and present their ideas to the class. (See Know the Science.)

Lesson 1.2: Causing Sound

1. **Give students a copy of What Causes Sound?**
AP 1.2.1
2. **make humming noises as we move PE 1-PS4-1 SEP 3 CCC 2 DCI PS4.A**
Monitor Progress Formative Assessment Review student responses to What Causes Sound?
AP 1.2.1
3. **EXPLORING LIGHT AND SOUND • Ask, How can you find out what vibrations do?**
Watch a video, read a book, ask an expert, make our own vibrations. Accept all reasonable answers, and explain that there are many ways to answer science questions but that one of them is to do your own tests. (See Know the Standards 1.)
4. **Show the fork to a volunteer, and ask, What do you see now?**
The two points of the tuning fork are moving back and forth quickly.
5. **Encourage students to add more questions to the board, based on the work they did today. • Have students stand and model tuning forks once more. • Ask, What should we do to show what vibrations can do?**
Make humming noises as we move

Lesson 1.3: Causing Objects to Vibrate

1. **Give students a copy of What Causes Objects to Vibrate?**
AP 1.3.1
2. **See the Online Resources Guide for a link to the recommended audio file: www.coreknowledge.org/cksci-online-resources • Ask students, How do you feel/react when you hear a loud siren like this?**
It makes me want to cover my ears; it gets me excited; it makes me stop what I am doing and pay attention.
3. **CCC 2 DCI PS4.A • Ask, Do loud sounds do anything to objects that are nearby?**
Accept all answers at this point.
4. **Place the cup next to the speaker, and invite the members of the team to observe how the salt seems to dance around (vibrate) with the music. • Ask students, How can you explain what happened?**
The sound made the salt jump around.
5. **Ask, How do you answer this question based on your work as scientists today?**
Sound can make objects, such as salt crystals, vibrate.
6. **Ask, When have you listened to loud music or other sounds in a performance and covered your ears?**
Accept all reasonable answers. Explain that inside their ears are parts that vibrate. When they cover their ears, they can stop some of the sound from making their ears vibrate.

Lesson 1.4: Relationships Between Sound and Science

1. **The triangle vibrates. EXTEND—Which instruments have parts made of stringlike materials that vibrate?**
See Know the Standards 2.
2. **LESSON 1.4 | RELATIONSHIPS BETWEEN SOUND AND SCIENCE 47**
LITERAL—Why do you think the people in the homes below hear the jet?
Because the jet is flying very low to the ground
3. **INFERENTIAL—Ask, What other very big sounds have you heard near your home or our school?**
Answers may include low-flying helicopters, trains, squealing bus brakes, or noise from a construction site. Page 5 If you pluck a guitar string, it will vibrate. To vibrate means to move back and forth quickly. A moving string causes the air to vibrate. The moving air causes parts of your ears to vibrate. So, a vibrating string causes a sound you can hear with your ears.
4. **The vibrating air causes the windows to rattle or vibrate. 5 48 EXPLORING LIGHT AND SOUND SUPPORT—Ask, What does the drawing show about the photo of the boy strumming a guitar?**
It shows one string of the guitar vibrating. It shows the air vibrating next to it. It shows the vibrations going into the ear of the person. Activity Page

5. **EXTEND—Ask, What does the picture of the drum show about vibrations?**
It shows that vibrations come off the drum in all directions and move through the air. Make sure students understand that vibrations move away from their source in all directions.
6. **Discuss the final question on page 6 by asking, How did the sound get to the last row of the auditorium?**
The sound caused vibrations in the air, and the vibrations moved throughout the auditorium in all directions.

Lesson 1.5: Lesson 1 Roundup: Vibrations During a Performance

1. **LESSON 1.5 | LESSON 1 ROUNDUP: VIBRATIONS DURING A PERFORMANCE 55**
 - **Ask, How does the sound of your voice affect the waxed paper?**
It makes the waxed paper vibrate. (See Know the Science.) **SUPPORT**—Some students may still be unsure how to recognize vibrations. Hold up a piece of cardboard, and wave it back and forth as fast as you can. Let them know that this is an example of a kind of motion called vibration. Explain that when an object vibrates, it moves back and forth in place.
2. **Ask, How can you answer the question of why this happens now?**
It happens because sound can make objects vibrate! **EXTEND**—Explain that very loud sounds can be harmful to people’s ears. This is because the sound makes parts inside the ear vibrate such that they can be damaged. Ask students to act out hearing a very loud sound and how they would react. When students cover their ears, explain that this stops some of the vibrations made by the loud noise. Point out that people who work in places where sound is loud often wear ear protectors.
3. **Ask, How will you know that the instruments you make are vibrating?**
They will make sound.

Lesson 2.1: Seeing in the Dark

1. **NGSS Elements • Why do the explorers put on a hard hat?**
To protect their heads from being bumped by the rock inside the cave
2. **Ask, What would a light walk be like if it were nighttime?**
Accept all reasonable answers.

Lesson 2.2: Observing Light Sources

1. **question board How Bright Is That Light?**
AP 2.2.1
2. **smartphone Does It Give Off Light?**
AP 2.2.2
3. **Give each student a copy of Does It Give Off Light?**
AP 2.2.2
4. **Ask, Where did we go, and what did we see?**
We went to the main office and saw lights on phones, copy machines, and computers. We went to the kitchen and saw lights in refrigerators and on stoves. We saw light

bulbs on the ceilings of the hallways.

5. **SEP 6 DCI PS4.B CCC 2 Monitor Progress • Ask students, What objects on our walk did not give off light?**

Sample answers: chairs, desks, pencils, people

6. **See the Online Resources Guide for a link to the recommended video: www.coreknowledge.org/cksci-online-resources NGSS Elements Ask students the following: • What can fireflies do that many other animals cannot do?**

They give off their own light.

7. **SEP 6 DCI PS4.B • When is the best time of day to see the light from fireflies?**

When it is just getting dark.

8. **NGSS Elements • Ask students, What objects from around our classroom do not give off light?**

Sample answers: pencils, paper, erasers, staplers, people SUPPORT—Clarify the differences between giving off light and reflecting light for students. Shine a flashlight with the class lights off, and explain that the flashlight gives off light. Then shine the light on a mirror or other shiny surface so students can see the light reflecting off the object.

9. **SEP 6 DCI PS4.B CCC 2 3D Learning • Ask, How can you test this?**

Put the object in a dark room or another dark space. If you cannot see it, it does not give off light.

10. **Invite another student to look through the eyehole and report what they see to the rest of the class. • Have the small groups test their ideas about other classroom objects. • Ask, Was your claim supported by evidence from your test?**

Sample answer: yes, because I could not see the object inside the dark space

Lesson 2.3: Comparing Visibility

1. **See the Online Resources Guide for a link to the recommended video: www.coreknowledge.org/cksci-online-resources NGSS Elements Ask students the following: • Why is it hard to see under the covers at night?**

Because it is dark there

2. **SEP 6 DCI PS4.B Differentiation • If you want to read a book under the covers, what do you need?**

A light source such as a flashlight

3. **Ask, How can you see the people on the stage when the theater is dark?**

Someone who works in the theater must turn on lights that make it easier to see.

4. **I observed that light makers can be seen when there is darkness around them. • Ask students, What caused the light maker to be seen?**

I could see it because it makes its own light. (See Know the Standards 2.)

5. **Ask, How do you know when the show is about to begin?**
Lights turn on over the stage, and we can now see the performers.

Lesson 2.4: Reasoning About Light

1. **crayons or markers What's in the Closet?**
AP 2.4.1
2. **LITERAL—What is the younger brother looking for?**
His pencil INFERENTIAL—When the older brother asks, “Are you sure you lost it here by the lamp?” what is he thinking about where the pencil might be?
3. **The brain interprets these signals as images that you “see.” LESSON 2.4 | REASONING ABOUT LIGHT 81 INFERENTIAL—What objects give off light?**
The sun
4. **LITERAL—What are the examples of bright light?**
A fire
5. **At night, light from lamps shines on objects. 12 LITERAL—Where does light come from that shines on people and dogs?**
The sun
6. **How will she see her dog and where she is going?**
She will see if there is light from streetlights, the moon, and car headlights. Page 13
7. **It's just some shoes, some shirts, some dresses, and toys in there! 13 LITERAL—What can you see in the picture of the dark closet?**
A few hangers and maybe some clothes Can you tell what kinds of clothes are hanging there? Explain.
8. **DCI PS4.B 14 LITERAL—What does a dimmer switch do?**
It makes a light dim or bright.
9. **Where have you seen dimmer switches used?**
Sample answers: at home, in a theater, in a store, in an office SUPPORT—Some students may not have experienced the effects of dimmers. If so, use a smartphone screen brightness controller to slowly dim or brighten the screen's light so that students can see these effects.
10. **SEP 6 CCC 2 DCI PS4.B Differentiation • How does having the sunshine in the daytime affect what you see?**
Sunshine is very bright, so I can see everything very well.

Lesson 2.5: Lesson 2 Roundup: Investigating Light Sources

1. **Ask, Where on the floor of the dark room was the younger brother looking for the pencil?**
Under a lamp
2. **Monitor Progress • Why was he looking there?**
Because that was the only place in the room with enough light to see a pencil
3. **Ask students the following: • What is the job of an usher in a theater?**
Showing people to their assigned seats

4. **CCC 2 DCI PS4.B Differentiation • Why might a person who comes late to the theater have trouble finding their seat?**

The theater may be dark, and this makes it hard to read the text on the ticket to know where to sit.

Lesson 3.1: Seeing Shadows

1. **NGSS Elements • How do young children react to seeing their shadows for the first time?**

They can be troubled or confused.

2. **SEP 6 CCC 2 • DCI PS4.B What could you tell a younger child about shadows to make them feel better?**

I would say that a shadow is not a real object. It is only a place where there is much less light.

3. **Invite students to share any experience with shadow puppets, and ask, What materials make the best shadow puppets?**

Accept all reasonable answers, and return to this question after completing Lesson 3.2.

Lesson 3.2: Making Shadows

1. **SEP 3 DCI PS4.B • Ask students, How can you test this material to see if it makes a dark shadow?**

You can turn on the flashlight and shine the light beam right at the cloth. Then you can check the floor or wall to see if it made a shadow.

2. **CCC 2 • Allow volunteers to demonstrate how they would do their test, and discuss the results. • Ask, Could we use the same test on other materials?**

Yes (See Know the Science 1.)

3. **LESSON 3.2 | MAKING SHADOWS 107 • Ask, If you hold these materials in front of your eyes, can you see through them?**

No

Lesson 3.3: Comparing Materials That Let Light Pass Through

1. **Give each student a copy of What Happens to a Light Beam When Materials Are Placed in Its Path?**

AP 3.3.1

2. **SEP 6 DCI PS4.B • What were some of the materials you tested that made dark shadows?**

Cardboard, poster board, wood, a mirror, and aluminum foil

3. **CCC 2 Differentiation • What happened to the light from the flashlight that caused the dark shadows?**

The light was blocked by the materials we put in the path of the light beam.

SUPPORT—Explicitly reinforce new vocabulary by displaying a picture glossary to help English language learners and other students. Draw and label pictures to represent the terms shadow, dark, and block. Some of these words have multiple meanings, so

the pictures you draw will focus on the meaning needed for this lesson. For the word materials, attach a few small samples of materials to the word card.

4. **Ask, How can we test what happens to the light beam when a material is placed in its path?**

Turn on the flashlight. Hold the material in the path of the light beam. Then, see what happens on the other side of the material. Invite two students to demonstrate their plan, asking the following:

5. **Ask students, What will you be able to learn when you carry out this investigation?**

Which materials let the entire light beam pass through, which ones let part of the light beam pass through, and which ones do not let any part of the light beam pass through

6. **Which did not?**

Some may agree and others not. (See Know the Standards.)

7. **SEP 3 and 4 DCI PS4.B CCC 2 Monitor Progress • Which materials blocked all the light beam?**

The cardboard, wood, aluminum foil, and mirror

8. **Recording data as white, gray, or black has a visual impact and may help some students quickly answer questions about the properties of these materials. 114 EXPLORING LIGHT AND SOUND • Which materials let all the light pass through?**

The clear plastic, clear glass, and clear cup of water

Lesson 3.4: Changing the Direction of Light

1. **cardboard squares (1 per group) What Materials Can Change the Direction of Light?**

AP 3.4.2

2. **Give each student a copy of What Materials Can Change the Direction of Light?**

AP 3.4.2

3. **What is your evidence for this?**

How do you know?

4. **Ask students the following: • How did using the first Activity Page help you do science?**

It gave us a place to show our plan for testing materials.

5. **SEP 3, 4, and 6 • DCI PS4.B Which materials caused a light beam to change direction?**

The plastic mirror and a piece of aluminum foil

6. **The light beam changed direction when we put the mirror and foil in its path. • How did using the second Activity Page help you?**

We wrote down what happened during the tests so we could look at it later and answer questions.

7. **LESSON 3.4 | CHANGING THE DIRECTION OF LIGHT 121 • What is it about these materials that makes them able to change the direction of light?**
They are smooth and shiny.

Lesson 3.5: Lesson 3 Roundup: Using Light in a Stage Performance

1. **See the Online Resources Guide for a link to the recommended video: www.coreknowledge.org/cksci-online-resources CCC 2 Monitor Progress • Ask students, What is it about the light from the flashlight that makes it possible to tag people?**
Light travels in a straight line and shines on the person it's pointed at. (See
2. **LITERAL—What three things are needed to make a shadow?**
A light source
3. **LITERAL—What are the examples of materials that block light?**
Rubber
4. **SEP 3 DCI PS4.B CCC 2 20 LITERAL—Do the balloons completely block the light from the sun?**
No, some light passes through. CHALLENGE—What materials tested in your investigations let some light pass through?
5. **You can see a long way into the sky. 21 LITERAL—How do you know that light can pass through the water and clear glass?**
Because you can see through both and because we tested those materials with a flashlight INFERENTIAL—Think about the photographer who took the photo of the people with the kites. What could they see through the air?
6. **INFERENTIAL—Where do you think the light source is in this photo?**
It is at the top of the photo where sunlight enters the canyon. EXTEND—When did you work with light beams in your investigations?
7. **LITERAL—What can mirrors do to a light beam?**
They can change its direction or reflect it. What materials can mirrors be made from?
8. **How do you know that the light has reflected?**
We can see it light up a surface that is behind the light source.
9. **If you tested them, which would make a darker shadow, a wood baseball bat or a glass aquarium filled with water?**
Baseball bat

Lesson 4.1: Communicating over Long Distances

1. **Ask students the following: Monitor Progress • How do people in the last row at a concert or play hear the music or players?**
The instruments or people make sounds, and the sounds make vibrations that people's ears can feel.
2. **Activity Page • What was the problem Samuel Morse wanted to solve?**
How to send people urgent messages faster

3. **How did the new telegraph make people’s lives better than before?**

It allowed people to send urgent messages very fast. For example, if someone were very sick, people could get the message right away and go to be with the sick person. CHALLENGE—Challenge interested students to draw what the telegraph would print in Morse code for their name or a simple word, such as cat. Give these students a copy of Use Morse Code (AP 4.1.1), which shows the dots and dashes next to each letter of the alphabet.

4. **For each invention, ask students, How did this make people’s lives different?**

Answers will vary. EXTEND—Print additional copies of Activity Page 4.1.2 if the class comes up with more than six devices for long-distance communicating.

Lesson 4.2: Putting on a Play

1. **Ruiz’s class want to put on for the rest of their school?**

The Little Red Hen Online Resources

2. **Ask, What characters do these masks show?**

A dog, a cat, a chicken, and a duck INFERENTIAL—These masks are made of materials such as paper and cardboard. What will happen to a light beam from the spotlight when the mask is held up?

3. **EVALUATIVE—How could the class use a spotlight in their show?**

They could shine the spotlight on each character as they speak. Or they could shine the spotlight on the seeds, plants, wheat, sack of flour, and baked bread the Little Red Hen works with. EXTEND—Remind students that materials that block light and make dark shadows are called opaque. LESSON 4.2 | PUTTING ON A PLAY

4. **Ruiz’s class wants to solve?**

How to signal the audience that it is time to participate in the show

CHALLENGE—Replay the online video of The Little Red Hen, and ask, Where should I pause the video so that the audience can say “Uh oh!”?

5. **LITERAL—What does the solution to our problem have to do?**

Signal the audience

6. **Ruiz’s students with their show?**

Have signs to hold up when the audience is supposed to make sounds

7. **INFERENTIAL—What are the children in the picture doing?**

They are working with materials and tools to make something that can signal to the audience.

Lesson 4.3: Describing the Problem

1. **Ruiz’s class had in Student Book Chapter 5?**

They wanted to put on a school play of The Little Red Hen and signal the audience when to participate by saying “Uh oh!”

2. **Ask, How and at what point in the play should your audience get involved?**

We want them to stand up and say “Watch out!” when the villain appears.

3. **SEP 1 DCI PS4.C • How was it helpful to ask questions about the problem?**
It helped us understand what we could and could not do to solve it.
4. **ETS1.A Monitor Progress • Why was it important to measure the space where the play will be performed?**
If we know how far away the last row is, we can try out our solutions in a hallway and make sure they work.

Lesson 4.4: Lesson 4 Roundup: Building and Testing a Device

1. **They can be used to scan bar codes, perform surgery, and cut metal.**
LITERAL—What did Gordon Gould want to know about light?
See Know the Standards 3.
2. **how light behaves UNIT SUPPLEMENT | SCIENCE IN ACTION: USING LIGHT AS A TOOL 175 INFERENTIAL—What do you think would be different if a laser were never invented?**
See Know the Standards 4.
3. **NGSS Elements Have students use their data displays to answer the following questions: • How many tools were tested?**
To answer, have students count the names of the teams.
4. **SEP 4 DCI PS4.C and ETS1.C • How many of the teams made tools that use light to communicate?**
To answer, have students count the number of teams for which they wrote “light.”
5. **Then ask about each device: • How did this tool solve the problem?**
It made sounds by making beans inside a box vibrate.
6. **Sample answer: The beans made noise when I shook the shaker. • How was working as a team helpful?**
We shared ideas and talked about them. We took turns testing our solution to make sure it really works well. **EXTEND—**Give students a chance to solve the same problem without restricting them to the materials listed in this lesson. Have them meet in their teams, come up with a different signaling system for their school play, and draw on poster paper a diagram to explain how it works.
7. **UNIT SUPPLEMENT | SCIENCE IN ACTION: USING LIGHT AS A TOOL 171 LITERAL—What does the dentist show the students?**
What she uses to care for patients’ teeth **SUPPORT—**Remind students that light is what makes things visible. Light can come from the sun, and it can also come from human-made things, like lamps and flashlights. Page 31
8. **LITERAL—What can a laser do to your teeth?**
It can cut through teeth. **LITERAL—What do dentists use lasers for?**
9. **LITERAL—What else can lasers do?**
They can be used to scan bar codes, perform surgery, and cut metal. **LITERAL—What did Gordon Gould want to know about light? (See Know the Standards 3.)**
10. **Science Addresses Questions About the Natural and Material World LITERAL—What did Gordon Gould study?**

Matter and energy LITERAL—What was Gould especially interested in?

Unit quiz key

1. b 2. d 3. a 4. a 5. c 6. d 7. a 8. d 9. d 10. d 11. d 12. c