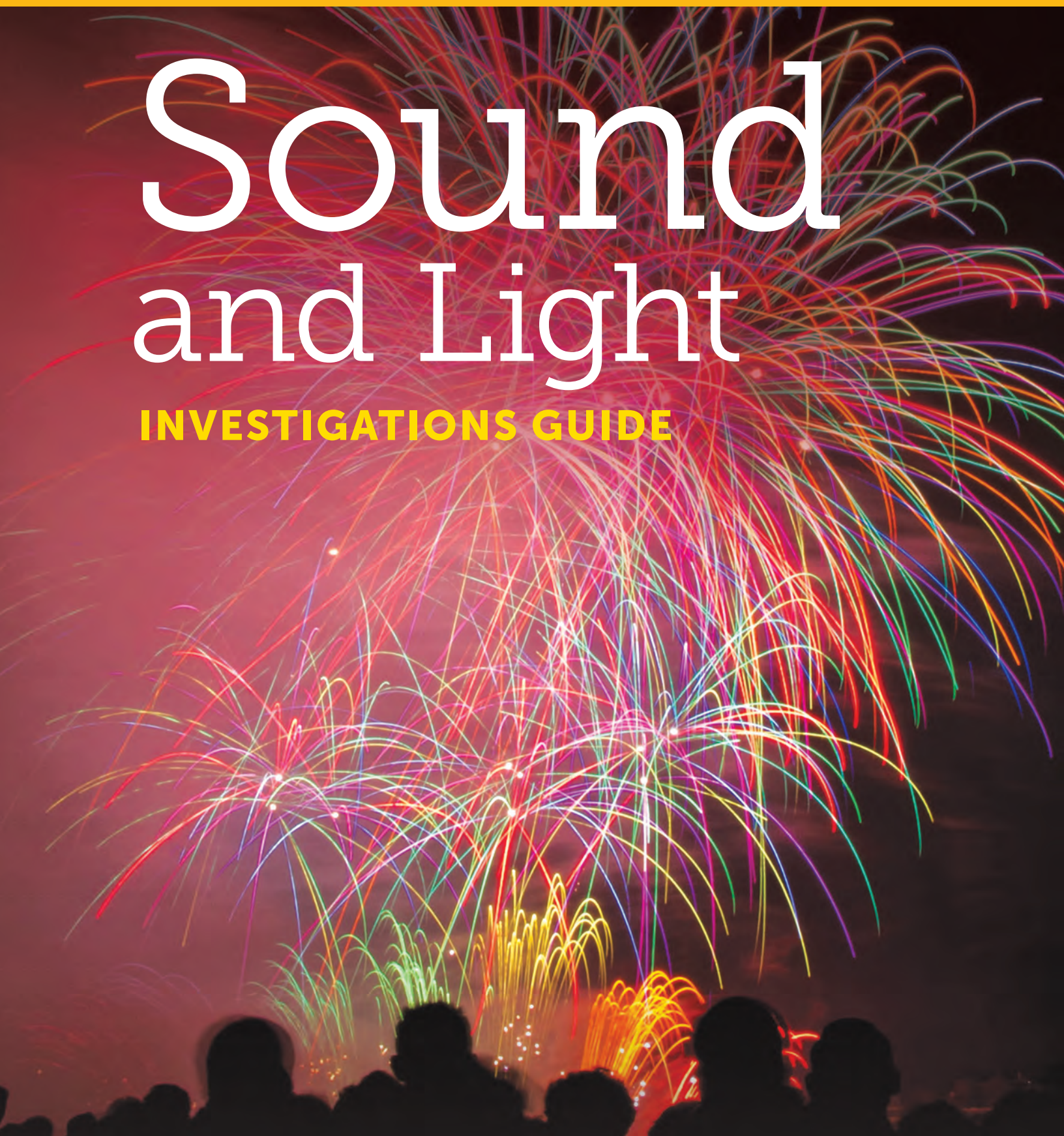
SAMPLER

Sound and Light

INVESTIGATIONS GUIDE



FOSS PATHWAYS™
Developed at
The Lawrence Hall of Science

PreK–5 science that meets the challenge of our time

Welcome to new FOSS® Pathways™. Now as never before, the world needs scientific thinkers—to view the world thoughtfully, approach challenges analytically, and embrace opportunities enthusiastically. For educators to help unlock this potential in their students, they need powerful tools that work for the needs of today. A program that engages students of all backgrounds and experiences. Fully leverages modern digital technology. And does it all in the hours available.

A major advancement from a proven leader

FOSS®, a longtime leader in science education, has stepped forward to meet that challenge with the newly streamlined FOSS Pathways™. Pathways was designed to provide teachers with everything they need to meet standards in the time they have allotted to teach science. In these pages, you will see how Pathways:

Aligns to national science standards using three-dimensional teaching, learning, and assessment

Incorporates the digital tools for a flexible multimedia experience

Lends flexibility to teach in the class time allotted for science

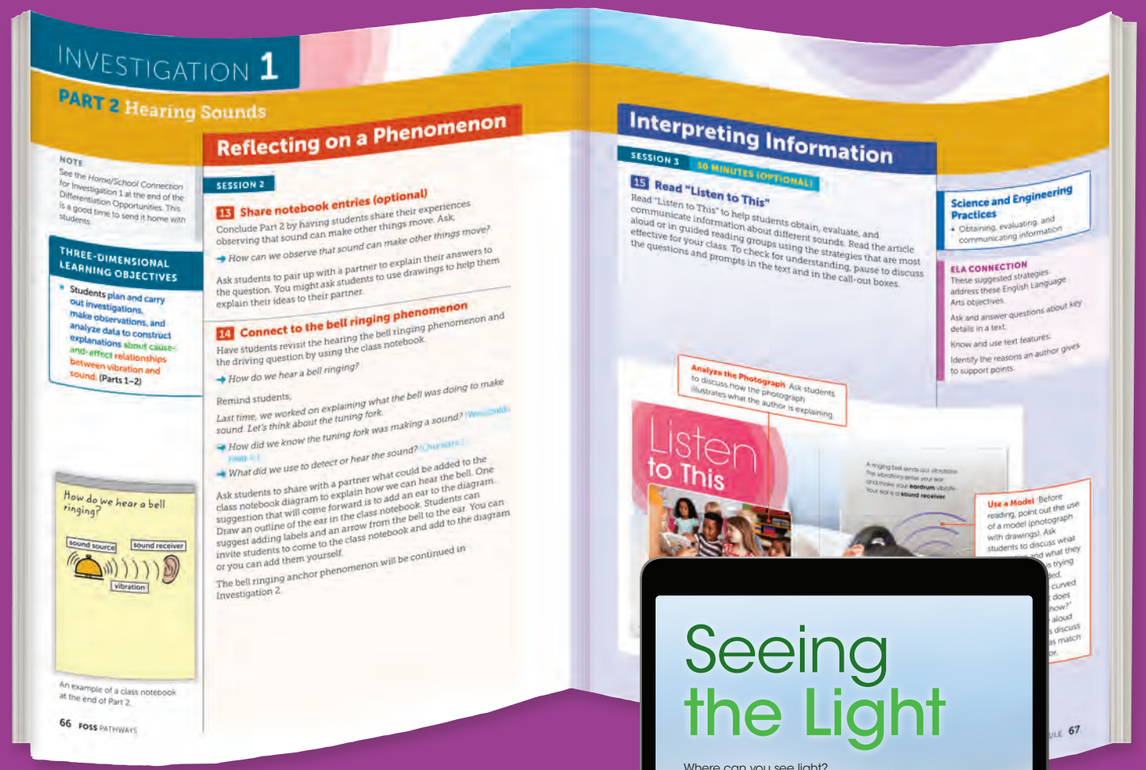
Utilizes a multimodal approach to resonate with every student

Immerses students in figuring out local and relevant phenomena and engineering problems

Provides unmatched teacher support to teach phenomena-based science

How Pathways develops the scientific thinkers of tomorrow

New FOSS Pathways supports today's demand to develop scientifically literate thinkers and problem solvers in a multitude of ways.



A logical progression

Students develop core ideas in a relevant and coherent learning progression that allows them to construct an explanation of the phenomena they have experienced.

Support for students

Comprehensive support and multimodal instructional experiences engage learners of all languages and cultures, taking advantage of prior experiences so all students can reason scientifically.

Evidence of learning

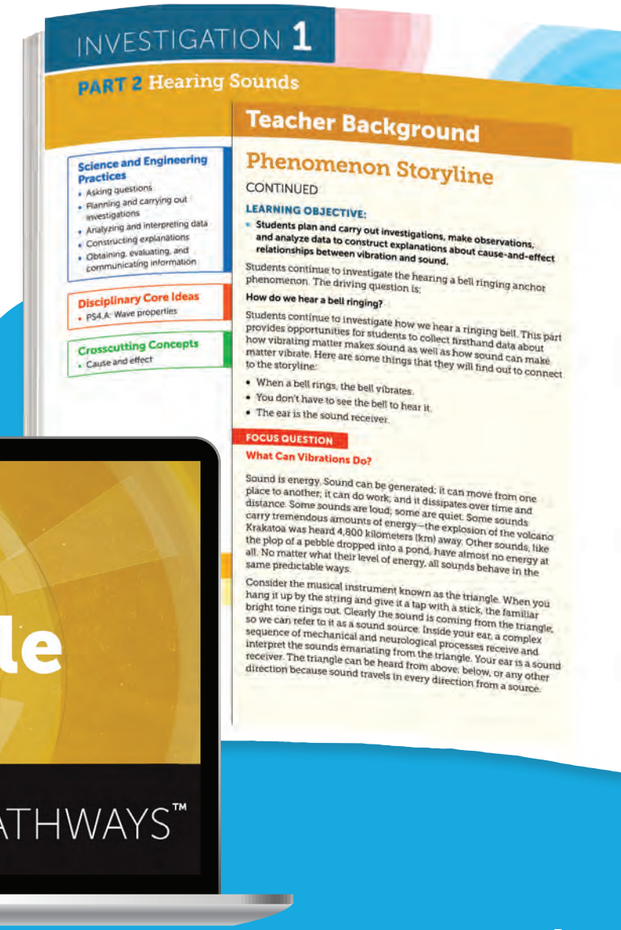
Research-based and field-tested assessments accurately measure student learning and progress. A variety of formative assessment tools provide evidence of students' use of the three dimensions and their knowledge of phenomena.

Support for teachers

Phenomena-based instruction is facilitated by appropriate educative support. This includes explicit background information needed for teachers to engage students in making the connection between the anchor phenomenon being investigated and the core ideas being exposed.

Rich digital resources

Digital resources for students and teachers are provided through FOSSweb on ThinkLink™. These multimedia materials are purposefully designed to enhance the learning experience and lend the flexibility to keep active science teaching viable if classroom circumstances change.



How FOSS Pathways aligns with today's standards

In this Sampler, pages 9-19 and 21-47 are provided from the teacher *Investigations Guide*. As you review, you will begin to witness the numerous ways that FOSS Pathways supports the development of tomorrow's scientists, engineers, and informed citizens. You'll see examples for:

Investigations driven by local, relevant phenomena and real-world problems

Instruction led by multimodal experiences that cognitively engage students to figure out phenomena

Identification of performances to meet targeted learning goals and elicit evidence of students' use of all three dimensions

Instructional support for teachers that provides an explicit connection between the phenomenon, three-dimensional learning, and multimodal learning experiences

Clear integration of ELA/ELD skills and practices, with ties to standards and resources for engaging multilingual students

Cross-curricular activities that give students a choice and voice to differentiate instruction

▶ Images on this page include actual components, resources and/or materials provided in FOSS kits.

How FOSS aligns to NGSS Performance Expectations

Grade 1 NGSS Performance Expectations	FOSS Sound and Light Module	
	Investigation(s)	Benchmark Assessment
1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.	**Investigation 1** **Investigation 2**	• Investigations 1–2 I-Check
1-PS4-2. Make observations to construct an evidence-based account that objects can be seen only when illuminated.	**Investigation 4**	• Investigation 3–4 I-Check
1-PS4-3. Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.	**Investigation 3** **Investigation 4**	• Investigation 3–4 I-Check
1-PS4-4. Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.	**Investigation 2** **Investigation 4**	• Investigations 1–2 I-Check • Investigation 3–4 I-Check
K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.	**Investigation 2** **Investigation 4**	• Investigations 1–2 I-Check • Investigation 3–4 I-Check
K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	**Investigation 2** **Investigation 4**	• Investigations 1–2 I-Check • Investigation 3–4 I-Check
K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	**Investigation 2**	• Investigations 1–2 I-Check

Sound and Light Investigations

Investigation 1: Sound and Vibration

Part 1: Making Sounds
Part 2: Hearing Sounds

Investigation 2: Using Sound

Part 1: Spoong-Gong Systems
Part 2: Sound Challenges

Investigation 3: Light and Materials

Part 1: Making Shadows
Part 2: Transmitting Light

Investigation 4: Eyes and Vision

Part 1: Reflections
Part 2: Seeing with Light
Part 3: Designing with Light

Sound and Light

▶ Start here to begin your review of the Grade 1 Sound and Light Investigations Guide.

Introduction

Sound comes from vibrating objects. Sounds travel from a source to a receiver. Light also has sources and receivers.

Students explore how to change sound volume and develop simple models for how a sound travels from a source to a receiver. They find out what happens when materials are placed near a sound source. With light, students find out what happens when materials with different properties are placed in a beam of light and explore how to create and change shadows and reflections. Students explore how to use sound and light devices to communicate information and compare the ways that animals use their senses (ears and eyes) to gather information about their environment. Students use their knowledge to investigate these phenomena:

- Anchor phenomenon 1—Hearing a bell ringing
- A problem to solve 2—Designing a string phone
- Anchor phenomenon 3—A shadow appears
- A problem to solve 4—Use light to get information and communicate

Students engage in science and engineering practices by collecting data and by designing and using tools to solve problems and answer questions. Students gain experiences that contribute to their understanding of these crosscutting concepts: patterns; cause and effect; systems and system models; and structure and function.

CONTENTS

The NGSS Performance Expectations bundled in this module include:

Physical Sciences
1-PS4-1
1-PS4-2
1-PS4-3
1-PS4-4

Engineering, Technology, and Applications of Science
K–2 ETS1-1
K–2 ETS1-2
K–2 ETS1-3

NOTE

The three modules for grade 1 in FOSS Pathways are:

- Changes in the Sky
- Sound and Light
- Plants and Animals

Module Matrix
At a Glance

Phenomenon and Storyline	Driving Question and Focus Questions	Content and Disciplinary Core Ideas	Practices and Crosscutting Concepts	NGSS PEs
INV. 1 Sound and Vibration **Phenomenon 1—Hearing a bell ringing:** After closing their eyes, students hear a ringing bell. **Storyline:** Students observe the phenomenon of sound using a table fiddle, tuning forks, a tone generator, cups, sticks, and rubber bands. Students look for vibrations at the sound source. Students observe the effects the vibrations from a tone generator have on small objects. They explore the effects of vibrations from a tuning fork to a table-tennis ball and water. Students make the connection that vibrations can move other objects.	*How do we hear a bell ringing?* **FOCUS QUESTIONS:** **What causes sound?** **What can vibrations do?**	**PS4.A:** Wave properties • Vibration is a rapid back-and-forth motion. • Vibrating objects make sound; sound always comes from a vibrating object. • Objects stop making sound when they stop vibrating. • Sound can make other objects vibrate. • Ears are one kind of sound receiver.	**Science and Engineering Practices** Asking questions Planning and carrying out investigations Analyzing and interpreting data Constructing explanations Obtaining, evaluating, and communicating information **Crosscutting Concepts** Cause and effect Systems and system models	**1-PS4-1:** Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
INV. 2 Using Sound **Continue Phenomenon 1—Hearing a bell ringing:** After closing their eyes, students hear a ringing bell. **A Problem to Solve 2—Designing a string phone:** A student wanted to turn a spoon gong into a device to talk with a friend a short distance away. She handed her friend the cup to listen but she couldn't figure out how to talk into the spoon to get it to vibrate. **Storyline:** Students use a simple instrument (xylophone) to investigate how to change the volume of sound (loud and soft). Using a spoon gong, students develop a model to explain the phenomenon of sound traveling from a source to a receiver. Students use this model to explain how we hear the ringing bell in the anchor phenomenon scenario. The problem to solve is directly related to the spoon-gong system students use. They redesign the spoon gong to engineer a device to communicate with sound.	*How do we hear a bell ringing?* *How can we make a new system to send messages back and forth?* **FOCUS QUESTIONS:** **How does sound travel from the source to the receiver?** **How can we use sound to communicate over long distances?**	**PS4.A:** Wave properties **PS4.C:** Information technologies and instrumentation **ETS1.A:** Defining and delimiting engineering problems **ETS1.B:** Developing possible solutions **ETS1.C:** Optimizing the design solution • Vibration is a rapid back-and-forth motion. • Vibrating objects make sound; sound always comes from a vibrating source. • Volume is how loud or soft a sound is. • A system is made of parts that work together. • Sound vibrations travel through objects and the air. • Drawings can show how sound travels from a source to the receiver. • Engineers design communication devices.	**Science and Engineering Practices** Asking questions and defining problems Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations and designing solutions **Crosscutting Concepts** Cause and effect Systems and system models Structure and function	**1-PS4-1:** Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate. **1-PS4-4:** Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance. **K–2 ETS1-1:** Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. **K–2 ETS1-2:** Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a problem. **K–2 ETS1-3:** Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Module Matrix
At a Glance CONTINUED

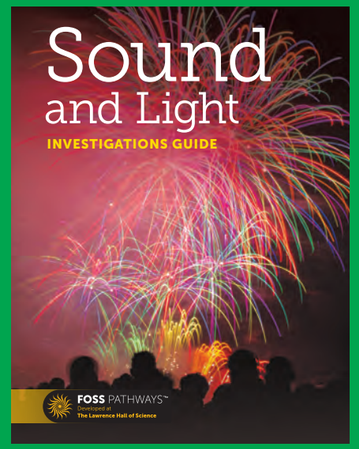
Phenomenon and Storyline	Driving Question and Focus Questions	Content and Disciplinary Core Ideas	Practices and Crosscutting Concepts	NGSS PEs
INV. 3 Light and Materials **Phenomenon 3—A shadow appears:** In a dark room, a light is turned on and a dark shape appears on the wall. **Storyline:** Students use flashlights, sunlight, and solid materials that block light to explore the phenomena of light and shadows. They create and change shadows and investigate how light interacts with objects that are transparent, translucent, and opaque. Students use their understanding of light and materials to explain the dark shape on the wall.	***What causes the dark shape to appear on the wall?*** **FOCUS QUESTIONS:** **What makes a shadow?** **What happens when different materials block light?**	**PS4.B:** Electromagnetic radiation • Light sources are objects that give off light (radiate), such as lamps, flashlights, candles, and the Sun. • Light travels away from a source in all directions. • Shadows are the dark areas that result when light is blocked. • To make a shadow, you need a light source, an object to block the light, and a surface in back of the object. The size of the shadow on the surface changes as the object moves closer to the light source. • Materials that are opaque block light. Materials that are transparent allow light to pass through them. Materials that are translucent allow some light to pass through them.	**Science and Engineering Practices** Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations **Crosscutting Concepts** Cause and effect	**1-PS4-3:** Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.
INV. 4 Eyes and Vision **A Problem to Solve 4—Use light to get information and communicate:** Two boaters are stranded on a beach along a river with no cell service and need help. They need to let the rescue team flying in a helicopter know where they are. **Storyline:** Students explore the phenomenon of light travel by positioning mirrors to reflect images. They investigate how to use mirrors to redirect light to different locations. Students experience the phenomenon that objects can be seen only when light is available. They explore the shapes and location of eyes on different animals. They apply their understandings of redirecting light with mirrors to solve engineering problems dealing with using light to gather information and communicate.	***How can they use light to get information and communicate to others for a rescue?*** **FOCUS QUESTIONS:** **How can we redirect a light beam?** **What can be seen with no light?** **How can we redirect light around a corner?**	**PS4.B:** Electromagnetic radiation **PS4.C:** Information technologies and instrumentation **ETS1.A:** Defining and delimiting engineering problems **ETS1.B:** Developing possible solutions • Light travels in straight lines. • Light sources are objects that give off light (radiate), such as lamps, flashlights, candles, and the Sun. • Mirror images are the result of light reflected from a surface. An image produced by something that reflects, such as a mirror, is always reversed. • Light is necessary for animals to see. • Animal eyes are not all the same. • Light can be used to communicate over long distances. Flashing lights of different colors communicate different information.	**Science and Engineering Practices** Asking questions and defining problems Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations and designing solutions Obtaining, evaluating, and communicating information **Crosscutting Concepts** Patterns Cause and effect Systems and system models Structure and function	**1-PS4-2:** Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated. **1-PS4-3:** Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light. **1-PS4-4:** Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance. **K–2 ETS1-1:** Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. **K–2 ETS1-2:** Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a problem.

FOSS Pathways includes:

Investigations Guide

The *Investigations Guide* is a spiral-bound guide containing everything you need to teach the module. FOSS active investigation lesson plans include:

- Three-dimensional learning objectives
- Relevant and local phenomena storylines with driving questions
- Sense-making discussions
- Embedded assessment and “What to Look For” guidance
- Vocabulary reviews
- English language support strategies
- ELA strategies and connections



Science Resources Student Book

The *FOSS Science Resources* student book contains readings developed to reinforce, extend, or apply core ideas covered during FOSS active investigations. Readings give students opportunities to:

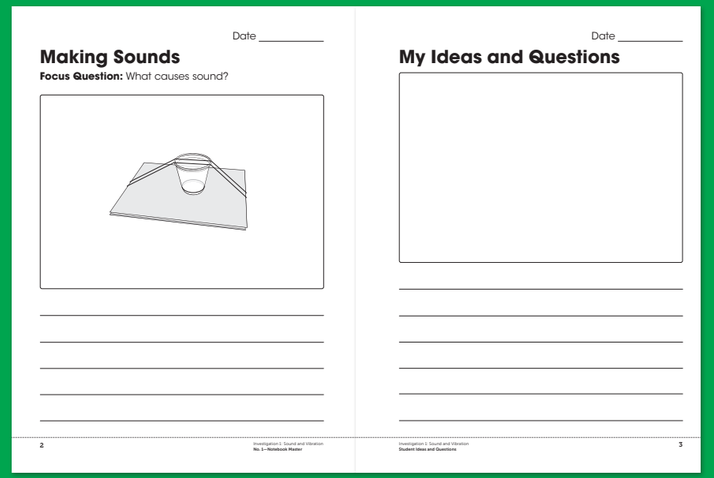
- Use text to obtain, evaluate, and communicate information
- Use evidence to support their ideas during sense-making discussions and focus question responses
- Integrate information from multiple sources
- Interpret graphs, diagrams, and photographs to build understanding

Available in print and as an interactive eBook in English and Spanish.

▶ Images on this page include actual components, resources and/or materials provided in FOSS kits.

Consumable Booklets

FOSS Booklets contain the Science Notebook Masters in a convenient booklet along with additional pages for writing and/or drawing opportunities and anchor phenomena explanations. There is one copy included in the kit. Additional copies are sold separately.

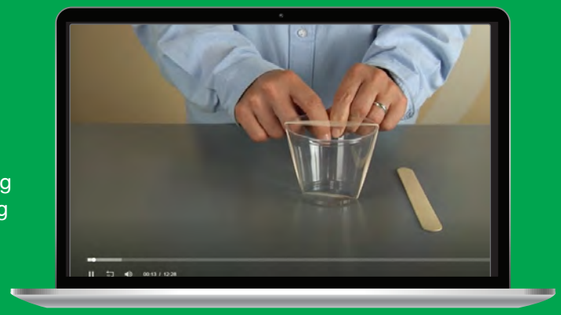


Equipment Kit

FOSS provides the equipment needed for all the investigations, including metric measuring tools. Our high-quality, classroomtested materials are long-lasting and packaged by investigation to facilitate preparation and clean up. There is enough permanent equipment in each kit for 24 students. Consumable materials are supplied for three uses. Convenient grade-level and refill kits are available.

Technology

Online resources include duplication masters, eInvestigations Guide, teaching slides, FOSSmap online assessment, streaming videos, virtual investigations, and tutorials, as well as a library of teacher resources, including access and equity, three-dimensional teaching and learning, and environmental literacy.



SCAN HERE FOR A TOUR OF FOSSWEB!

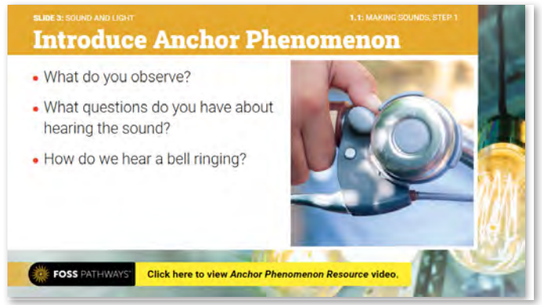
FOSSweb

FOSSweb digital resources are delivered on School Specialty's curriculum platform called ThinkLink.

- Supports single sign-on and class management with Google classroom and learning management systems.
- Provides access to both teacher and student digital resources, including duplication masters, teaching slides, FOSSmap online assessment, streaming videos, and online activities.

Teaching Slides

Downloadable and editable slides from FOSSweb can be used to facilitate each part of each investigation. Teaching slides are available as Google slides in English and Spanish.

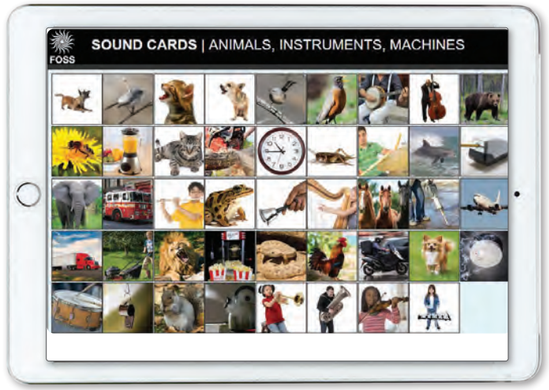


Streaming Videos

New engaging content videos in English and Spanish were developed to specifically support FOSS investigations.

Online Activities

New engaging simulations developed to address core ideas in FOSS, and interactive virtual investigations and tutorials offer additional content support for students.



Interactive eBooks

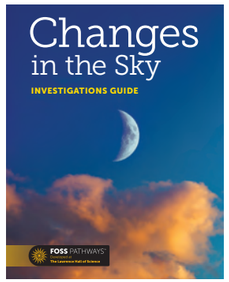
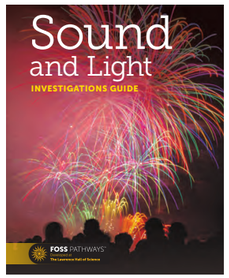
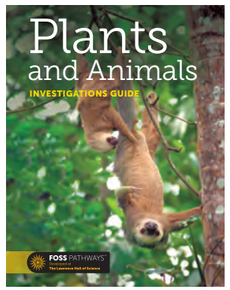
Keep your students engaged while teaching literacy skills with interactive *FOSS Science Resources* eBooks. The eBooks include integrated audio with text syncing and links to online activities and videos that bring the photos to life.

FOSSmap Online Assessment

Students in grades 3–5 can take summative assessments online with automatic coding of most responses. Student- and class-level reports help you identify the need for instructional next steps.

Grade Level Planning Guide

FOSS Pathways Modules Grade 1

FOSS Module	Module Overview/Bundled Performance Expectations	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts
 Earth Science * Still in development	In the Changes in the Sky Module, students turn their focus upward to explore that some objects in the sky change position in predictable ways. They make observations and record data about sunrise and sunset at different times of year to relate the amount of daylight to the seasons. They use observations of the Sun, Moon, and stars to describe patterns that can be predicted and discover that the Moon can be seen in the day and night skies. **NGSS PEs:** **Earth Sciences:** **1-ESS1-1** **1-ESS1-2**	**ESS1.A:** The universe and its stars **ESS1.B:** Earth and the solar system	• Asking questions • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations • Obtaining, evaluating, and communicating information	• Patterns • Cause and effect • Stability and change
 Physical Science	The Sound and Light Module provides students with experiences to explore how to change sound volume and develop simple models for how a sound travels from a source to a receiver. With light, students find out what happens when materials with different properties are placed in a beam of light and explore how to create and change shadows and reflections. Students explore how to use sound and light devices to communicate information and compare the ways in which animals use their senses to gather information about their environment. **NGSS PEs:** **Physical Sciences:** **1-PS4-1** **1-PS4-2** **1-PS4-3** **1-PS4-4** **ETAS:** **K-2-ETS1-1** **K-2-ETS1-2** **K-2-ETS1-3**	**PS4.A:** Wave properties **PS4.B:** Electromagnetic radiation **PS4.C:** Information technologies and instrumentation **ETS1.A:** Defining and delimiting engineering problems **ETS1.B:** Developing possible solutions **ETS1.C:** Optimizing the design solution	• Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Constructing explanations and designing solutions • Obtaining, evaluating, and communicating information	• Patterns • Cause and effect • Systems and system models • Structure and function
 Life Science * Still in development	The Plants and Animals Module provides experiences with young plants and animals and the structures and behaviors that help them grow and survive in their habitat. Students explore structure and function relationships in nature and use that knowledge to develop models. They learn about the behaviors of animal parents to support their offspring. **NGSS PEs:** **Life Sciences:** **1-LS1-1** **1-LS1-2** **1-LS3-1** **ETAS:** **K-2-ETS1-2**	**LS1.A:** Structure and function **LS1.B:** Growth and development of organisms **LS3.A:** Inheritance of traits **LS3.B:** Variation of trait **ETS1.A:** Defining and delimiting engineering problems **ETS1.B:** Developing possible solutions	• Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Constructing explanations and designing solutions • Obtaining, evaluating, and communicating information	• Patterns • Cause and effect • Systems and system models • Structure and function

FOSS® Pathways™ is an engaging PreK–5 science program developed at the Lawrence Hall of Science for the Next Generation Science Standards (NGSS). This sampler will introduce you to the major components of the program and show examples from FOSS Pathways Sound and Light Investigations Guide.

Recommended Scope and Sequence

FOSS Pathways

GRADE	PHYSICAL SCIENCE	EARTH SCIENCE	LIFE SCIENCE
PK		Observing Nature	
K	Materials and Forces	Trees and Weather	Animals Two by Two
1	Sound and Light	Changes in the Sky	Plants and Animals
2	Solids and Liquids	Water and Landforms	Insects and Plants
3	Motion	Water and Climate	Structures of Life
4	Energy	Soils, Rocks, and Landforms	Senses and Survival
5	Mixtures and Solutions	Earth and Sun	Living Systems

Learn more at **FOSSPathways.com**

Scan the QR code and explore additional FOSS Pathways Samplers today.

Developed at:
The Lawrence Hall of Science
UNIVERSITY OF CALIFORNIA, BERKELEY

Published & distributed by:
Delta Education
School Specialty