

SAMPLER

Earth and Sun

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

The Full Option Science System™ (FOSS) was conceived to enlist students not as passive recipients of information, but as active investigators of phenomena. That principle has proven its worth for 150,000 teachers and 4 million students across all 50 states, building a legacy of student engagement and test-score improvement. Now FOSS takes science education another significant step forward, with FOSS Pathways. This new PreK–5 core curriculum:



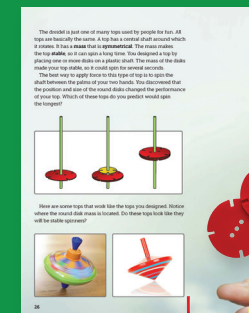
Aligns with today's national science standards and is adaptable to meet state and local requirements



Incorporates the digital tools for a flexible multimedia experience



Lends flexibility to teach in the class time allotted for science



Teaches through a multimodal approach to resonate with every student



Engages students through coherent phenomenon storylines that are local and relevant



Provides unmatched educative 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.

INVESTIGATION 1
Earth's Atmosphere
At a Glance

Performance Expectations

5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen.
5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Investigation Part	Sessions	Practices and Crosscutting Concepts	Disciplinary Core Ideas	Interpreting Information	Assessment
Part 1 Air in the Atmosphere FOCUS QUESTION: What are the properties of air and Earth's atmosphere? Students are introduced to the anchor phenomenon and the beach scenario. Students start to gather information to explain the phenomenon by taking a close look at the air surrounding us. They explore the properties of air by working with syringes and tubes to discover that air takes up space and is compressible. Students discuss evidence that air is matter and has mass. Students study Earth's atmosphere, using media and a reading. They are introduced to the atmosphere as a mixture of gases with properties that change with distance above Earth's surface and that the thin layer closest to Earth (the troposphere) is where weather happens.	SURVEY SESSION 1* Steps 1-12 (Step 11 optional) SESSION 2 Steps 13-21 (Steps 17 and 21 optional) *A session is 45 minutes.	Practices • Asking questions • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Constructing explanations • Engaging in argument from evidence • Obtaining, evaluating, and communicating information Crosscutting Concepts • Cause and effect • Scale, proportion, and quantity • Systems and system models	PS1.A: Structure and properties of matter ESS2.A: Earth materials and systems • Air is a mixture of gases held by gravity near Earth's surface. • Air is made of tiny particles too small to see. Air has mass, takes up space, and is compressible. • Most of Earth's air resides in the troposphere, the layer of the atmosphere closest to Earth's surface. • Weather happens in the troposphere. • Weather is the condition of Earth's atmosphere at a given time in a given place.	Science Resources Book "What Is Air?" Other Media Anchor Phenomenon Resource Video 1 Videos (all optional): Ball on a Scale Fizz Keeper Experiment Soda Can Experiment Air in the Atmosphere Tutorial: "Air and Atmosphere" (optional)	Benchmark Assessment Survey Embedded Assessment Performance assessment NGSS Performance Expectation addressed in this investigation 5-PS1-1
Part 2 Heating Earth Materials FOCUS QUESTION: What is the effect of sunlight on earth materials? Students set up an investigation to monitor temperature changes when solar energy is transferred to two earth materials: water and dry soil. Students record the temperature of the two materials in sunshine and in shade. They graph the data to discover that the temperature of the dry soil goes higher than water and cools to a lower temperature than that of water. The concept of uneven heating is introduced. Students connect their findings to the anchor phenomenon to explain how the air can be warm, the sand hot, and the water cool.	SESSION 1 Steps 1-10 SESSION 2 Steps 11-15 SESSION 3 Steps 16-23 SESSION 4 Steps 24-27 (Step 27 optional) SESSION 5 Steps 28-33 (Step 33 optional) SIDE TRIP 1	Practices • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations • Obtaining, evaluating, and communicating information Crosscutting Concepts • Cause and effect • Scale, proportion, and quantity • Systems and system models • Energy and matter	PS1.A: Structure and properties of matter ESS2.A: Earth materials and systems • The Sun is the major source of energy that heats Earth. • The different materials on Earth's surface heat up differently. • Air has mass. • The atmosphere radiates Earth's surface. • The atmosphere traps heat.	Science Resource Book "Uneven Heating" "Heating the Air: Radiation and Conduction" "Wind and Convection"	Embedded Assessment Science notebook entry NGSS Performance Expectations addressed in this investigation

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.

EXOSPHERE Beyond the thermosphere, Earth's atmosphere fades into space. The **exosphere** is where gas particles escape into space.

These are extreme temperatures in the universe. But there are a few places that have a temperature between those extremes of hot and cold. Earth is one of the places where the temperature is just right. On a typical day, the temperatures on Earth span a range of only about 100°C: from 45°C in the hottest place on Earth and -55°C at one of the poles.

It is not only because we are at the right distance from the Sun that Earth's temperatures are moderate. Earth's atmosphere keeps the temperature within a narrow range so that it is just right for life on Earth.

At about 700 km, Earth's atmosphere fades into space.

Questions for Reflection

1. What is air?
2. How is Earth's atmosphere like the ocean? How is it unlike the ocean?
3. What is the average temperature of the troposphere? Why is that important?

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.

INVESTIGATION 1
PART 1 Air in the Atmosphere

Teacher Background

Phenomenon Storyline

LEARNING OBJECTIVE:

- Students plan and carry out investigations and make cause-and-effect observations to describe a model using scale, proportion, and quantity for the behavior of interacting air particles in the atmosphere.

The anchor phenomenon for the first investigation is that air, sand, and water in the same location can have different temperatures. The scenario is: You are at a beach on a sunny day. The air feels warm. You take your shoes off, and the sand is so hot you can barely walk on it. You run into the water and it is cool.

How can you explain the difference in the temperatures of the air, the land, and the water?

This investigation provides initial experiences for students to construct explanations about interactions between the Earth systems of the atmosphere, the geosphere, and the hydrosphere. In order to understand how the materials are different temperatures, students investigate the materials, starting with air. The next part will investigate the differences in temperature. Here are some things students will find out to connect to the storyline.

- Air is matter; it takes up space and has mass.
- Air can be different temperatures at different times of the day and in different locations.

FOCUS QUESTION

What Are the Properties of Air and Earth's Atmosphere?

Most of the matter in Earth's atmosphere is the mixture of gases we call air—99% of it is nitrogen and oxygen, and most of the remaining 1% is gas as well. Gas is composed of individual particles. The particles are in constant motion, moving past and colliding with one another. In this process they tend to move in all directions, increasing the volume of space they occupy.

Because particles have mass, gravity draws them toward Earth's surface. That keeps the mass of gas from simply continuing to expand outward until it disperses uniformly in space. The kinetic energy in the moving particles pushing on one another produces a force that prevents the gas particles from being pulled to Earth's surface to create a dense layer of gas particles. At equilibrium, the force of gravity pulling the gas particles to Earth is opposed by the force of gas

Earth's Atmosphere

From space, Earth's atmosphere looks like a thin, blue cloud. Some people like to think of the atmosphere as an ocean of air covering Earth. The depth of this "ocean" is about 700 kilometers (km). The atmosphere is most dense right at the bottom, where it rests on Earth's surface. It gets thinner and thinner (less dense) as you move away from Earth's surface. There is no real boundary between the atmosphere and space. The air just gets thinner and thinner until it can no longer be detected.

Imagine a column of air that starts on Earth's surface and extends up 700 km to the top of the atmosphere. Scientists have discovered several layers in this column of air. Each layer has measurable properties. Here is how it stacks up.

The crew of Apollo 17 took this photo of Earth in December 1972, while on their way to the Moon. The small red box at the top of Earth's image shows about how much area is in the atmosphere photo.

EXOSPHERE 700 km
Hubble Space Telescope
International Space Station
400 km

THERMOSPHERE 300 km
Space Shuttle (retiring)
200 km

MESOSPHERE 100 km
Meteor

STRATOSPHERE 50 km
Ozone Layer

TROPOSPHERE 12 km
0 km
Clouds
Weather

TROPOSPHERE The layer we live in is the troposphere. It starts at Earth's surface and extends upward for 12 km. Its thickness depends on the season and where you are on Earth. Over the warm equator, the troposphere is a little thicker than it is over the polar regions, where the air is colder. It also thickens during the summer and thins during the winter.

This ground-floor layer has most of the organisms, dust, water vapor, and clouds found in the entire atmosphere. It has most of the air as well. And, most important, weather occurs in the troposphere. The troposphere is where differences in air temperature, humidity, air pressure, and wind occur.

Space-shuttle astronauts took this photo while orbiting Earth. You can see a side view of Earth's atmosphere. The black bumps peering into the troposphere are tall cumulus clouds.

How FOSS Pathways aligns with today's standards

In this Sampler, pages 9-21 and 23-49 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

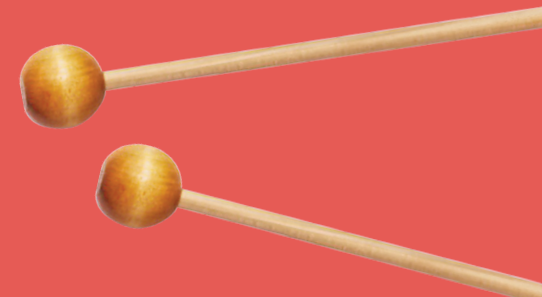
Cross-curricular activities that give students a choice and voice to differentiate instruction

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



Alignment to NGSS Performance Expectations

Grade 5 NGSS Performance Expectations	FOSS Earth and Sun	
	Investigation(s)	Benchmark Assessment
5-PS1-1: Develop a model to describe that matter is made of particles too small to be seen.	Investigation 1	<ul style="list-style-type: none"> Investigations 1 -2 I-Check Survey/Posttest
5-PS2-1: Support an argument that the gravitational force exerted by Earth on objects is directed down.	Investigation 4	<ul style="list-style-type: none"> Investigation 1-2 I-Check Survey/Posttest
5-ESS1-1: Support an argument that differences in the apparent brightness of the Sun compared to other stars is due to their relative distances from Earth.	Investigation 4	<ul style="list-style-type: none"> Investigation 3 I-Check Survey/Posttest
5-ESS1-2: Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.	Investigation 3 Investigation 4	<ul style="list-style-type: none"> Investigation 3 I-Check Survey/Posttest
5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	Investigation 1 Investigation 2	<ul style="list-style-type: none"> Investigation 1-2 I-Check Survey/Posttest
5-ESS2-2: Describe and graph the amounts and percentage of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.	Investigation 2	<ul style="list-style-type: none"> Survey/Posttest
5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect Earth's resources and environment.	Investigation 2	<ul style="list-style-type: none"> Survey/Posttest



Earth and Sun Investigations

Investigation 1: Earth's Atmosphere

- Part 1: Air in the Atmosphere
- Part 2: Heating Earth Materials

Investigation 2: Earth's Water

- Part 1: Water Cycle
- Part 2: Climate Change

Investigation 3: Earth's Sun

- Part 1: Sun Tracking
- Part 2: Day and Night

Investigation 4: Looking out from Earth

- Part 1: Orbits and Gravity
- Part 2: The Stars
- Part 3: Sky Modeler

Earth and Sun

▶ Start here to begin your review of the Grade 5 Earth and Sun Investigations Guide

Introduction

Earth is the third planet from the Sun. It travels around the Sun in a nearly circular orbit at a distance of about 150 million kilometers. Earth is water rich, with 71% of the planet's surface covered with water. It is surrounded by a shallow atmosphere of nitrogen (78%) and oxygen (21%), and small amounts of a lot of other gases. Students investigate the patterns observed in the sky over a day, a month, a year, and more, and their effect on Earth.

Four anchor phenomena drive the investigations.

- Anchor phenomenon 1—Hot sand and cool water
- Anchor phenomenon 2—Water movement
- Anchor phenomenon 3—In the shade then sunlight
- Anchor phenomenon 4—One or many stars

The **Earth and Sun Module** provides students with experiences to explore the properties of the atmosphere, the energy transfer from the Sun to Earth, and the dynamics of weather and water cycling in Earth's atmosphere. The constant renewal of water on Earth's land surfaces by the activities in the atmosphere is one of the defining characteristics of Earth, the water planet. Other experiences help students to develop and use models to understand Earth's place in the solar system, and the interactions of Earth, the Sun, and the Moon to reveal predictable patterns—daily length and direction of shadows, day and night, and the seasonal appearance of stars in the night sky. Students gain experiences that will contribute to the understanding of crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; systems and system models; and energy and matter.

CONTENTS

- Introduction
- Module Matrix
- Conceptual Flow of Module
- FOSS Pathways Teaching Schedule
- FOSS Investigation Organization
- The Elements of the FOSS Instructional Design
- Diversity, Equity, and Inclusion
- Establishing a Classroom Culture

The NGSS Performance Expectations bundled in this module include:

Earth Sciences

- 5-ESS1-1
- 5-ESS1-2
- 5-ESS2-1
- 5-ESS2-2
- 5-ESS3-1

Physical Sciences

- 5-PS1-1
- 5-PS2-1

NOTE

The three modules for grade 5 in FOSS Pathways are:

- Mixtures and Solutions
- Earth and Sun
- Living Systems

Module Matrix

At a Glance

Phenomenon and Storyline	Driving Question and Focus Questions	Content and Disciplinary Core Ideas	Practices and Crosscutting Concepts	NGSS PEs
<p>INV. 1 Earth's Atmosphere</p> <p>Phenomenon 1—Hot sand and cool water: You are at a beach on a sunny day. The air feels warm. You take your shoes off, and the sand is so hot you can barely walk on it. You run into the water and it is cool.</p> <p>Storyline: Students investigate the phenomenon that air surrounds us—Earth's atmosphere. They explore air by working with syringes and tubes to discover that air takes up space and is compressible. They are introduced to the atmosphere as a mixture of gases with properties that change with altitude above Earth's surface.</p> <p>Students investigate the phenomenon of energy transfer on Earth. They investigate uneven heating by recording and graphing temperature changes when two earth materials absorb solar energy. They gather information about energy transfer by radiation and conduction and discuss mechanisms of energy transfer to and from the air. Students consider how the atmosphere, hydrosphere, and geosphere interact.</p>	<p><i>How can you explain the difference in the temperatures of the air, the land, and the water?</i></p> <p>FOCUS QUESTIONS:</p> <p>What are the properties of air and Earth's atmosphere?</p> <p>What is the effect of sunlight on earth materials?</p>	<p>PS1.A: Structure and properties of matter ESS2.A: Earth materials and systems</p> <ul style="list-style-type: none"> • Air is a mixture of gases held by gravity near Earth's surface. • Air has mass and takes up space; it is made of tiny particles too small to see. • Weather happens in the troposphere, the layer of the atmosphere closest to Earth's surface. • The Sun is the major source of energy that heats Earth. • The different energy-transferring properties of earth materials (soil and water) can lead to uneven heating of Earth's surface—interactions of the geosphere, hydrosphere, and atmosphere. • The atmosphere is heated by conduction between Earth's surfaces and air particles and by absorption of energy radiated directly from the Sun and reradiated from Earth's surfaces. 	<p>Science and Engineering Practices</p> <p>Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Using mathematics and computational thinking Constructing explanations Engaging in argument from evidence Obtaining, evaluating, and communicating information</p> <p>Crosscutting Concepts</p> <p>Cause and effect Scale, proportion, and quantity Systems and system models Energy and matter</p>	<p>5-PS1-1: Develop a model to describe that matter is made of particles too small to be seen.</p> <p>5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.</p>
<p>INV. 2 Earth's Water</p> <p>Phenomenon 2—Water movement: Students in their classroom are comparing two photographs—one of a local reservoir taken a few years ago during a drought, and a recent one taken after a month of heavy rain. They look out their classroom window to see the rain pouring down and the water flowing over the ground where it was dry just a few hours ago.</p> <p>Storyline: Students turn to the phenomenon of water on Earth. They consider why Earth is called the water planet. They investigate systems to observe condensation on cold surfaces and determine the components of the water cycle. Students explore the conditions that promote evaporation. They simulate the travels of a drop of water through the water cycle to explore the complexities of the process. Students are introduced to global climate change.</p>	<p><i>Where does water come from, where does it go, and how does it move from place to place?</i></p> <p>FOCUS QUESTIONS:</p> <p>How does water move through the hydrosphere, atmosphere, biosphere, and geosphere?</p> <p>What kinds of data about the hydrosphere help communities plan for climate change?</p>	<p>ESS2.A: Earth materials and systems ESS2.C: The roles of water in Earth's surface processes ESS3.C: Human impacts on Earth systems</p> <ul style="list-style-type: none"> • Most of Earth's water (97%) is salt water in the ocean; Earth's fresh water is found in many locations including water vapor in the atmosphere, lakes and rivers, soil, ground ice, ground water, and glaciers. • Evaporation and condensation redistribute water over Earth's surface. • The Sun's energy drives weather and climate. • People can protect Earth's resources and environments by doing things that conserve energy. These actions may slow Earth's climate change that is affecting water distribution on Earth. • NASA's Gravity Recovery and Climate Experiment (GRACE) is one of several missions using orbiting satellites to improve our understanding of water under the changing climate. 	<p>Science and Engineering Practices</p> <p>Asking questions Developing and using models Analyzing and interpreting data Using mathematics and computational thinking Constructing explanations Obtaining, evaluating, and communicating information</p> <p>Crosscutting Concepts</p> <p>Cause and effect Scale, proportion, and quantity Systems and system models Stability and change</p>	<p>5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.</p> <p>5-ESS2-2: Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.</p> <p>5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.</p>

Module Matrix

At a Glance CONTINUED

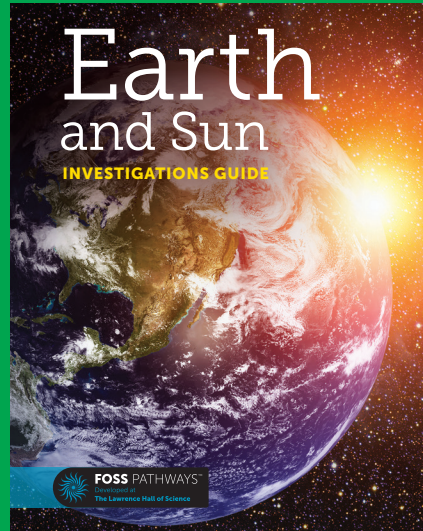
Phenomenon and Storyline	Driving Question and Focus Questions	Content and Disciplinary Core Ideas	Practices and Crosscutting Concepts	NGSS PEs
<p>INV. 3 Earth's Sun</p> <p>Phenomenon 3—In the shade then sunlight: A family is planning on having lunch at the park on a clear, sunny day. When they arrive at 11 am, they sit down at a picnic table in the shade of a nearby tree. After 2 hours their table is not in the shade any more.</p> <p>Storyline: Students monitor the position of the Sun as it moves across the sky. After using a compass to orient a Sun tracker, students make hourly records of the position of the shadow cast by a golf tee. Students imagine an observer on Earth (their head) and position themselves around a lamp to observe day and night. They discover that rotation of Earth produces day and night. Students put the observed daily movement of the Sun phenomenon together with the phenomenon of day and night and use another model to resolve explanations for both phenomena.</p>	<p><i>What causes the picnic table to be in the shade for part of the day and in the sunlight the other part?</i></p> <p>FOCUS QUESTIONS:</p> <p>How and why does a shadow change during the day?</p> <p>What causes day and night?</p>	<p>ESS1.B: Earth and the solar system</p> <ul style="list-style-type: none"> Shadows are the dark areas that result when light is blocked. Shadows change during the day because the position of the Sun changes in the sky. The length and direction of a shadow depends on the Sun's position in the sky. These daily shadow patterns are observable and predictable. Day is the half of Earth's surface being illuminated by sunlight; night is the half of Earth's surface in its own shadow. The cyclical change between day and night is the result of Earth's rotating on its own axis in association with the stationary Sun, Earth's star. 	<p>Science and Engineering Practices</p> <p>Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Using mathematics and computational thinking Constructing explanations Obtaining, evaluating, and communicating information</p> <p>Crosscutting Concepts</p> <p>Patterns Cause and effect Systems and system models</p>	<p>5-ESS1-2: Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.</p>
<p>INV. 4 Looking Out from Earth</p> <p>Phenomenon 4—One or many stars: Two friends who live in different parts of the world are talking on the phone. One says they can see only one large bright star in the sky. The other says they can see hundreds of small stars, but they aren't very bright.</p> <p>Storyline: Students are introduced to constellations as patterns of stars. They simulate Earth's rotation to observe the appearance of stars rising in the east and setting in the west. Students observe a demonstration of why different stars are visible in different seasons. Students use a digital simulation that shows how star brightness, distance, and alignment converge to produce a constellation. Students predict and check which constellation is in the center of the observation field from Earth each month (using a subset of the 88 official constellations identified). Students use the information gained in the investigation to explain the anchor phenomenon.</p>	<p><i>How can you explain the difference in the appearance of the stars that each friend is observing?</i></p> <p>FOCUS QUESTION:</p> <p>How can you explain why we see some natural objects only in the night sky, some only in the day sky, and some at both times?</p> <p>Why do stars appear to move across the night sky?</p> <p>Why do constellations appear to change location in the sky between seasons?</p>	<p>PS2.B: Types of interactions ESS1.A: The universe and its stars ESS1.B: Earth and the solar system</p> <ul style="list-style-type: none"> Gravity is a pulling force between two masses; it is the force that pulls things toward the center of the Earth. The pulling force of gravity keeps the Moon orbiting Earth and the Earth and other planets orbiting the Sun by changing their direction of travel. Stars are at different distances from Earth. The Sun is the closest star to Earth so it appears brighter and larger than other stars. Stars (constellations) appear to move together across the night sky because of Earth's rotation. Because of the brightness of the Sun during the day, we can only see stars outside our solar system when we are on the dark half of Earth (at night). Different constellations are observed in the night sky during different seasons because Earth revolves around the Sun. 	<p>Science and Engineering Practices</p> <p>Asking questions Developing and using models Analyzing and interpreting data Constructing explanations Engaging in argument from evidence Obtaining, evaluating, and communicating information</p> <p>Crosscutting Concepts</p> <p>Patterns Cause and effect Scale, proportion, and quantity Systems and system models</p>	<p>5-PS2-1: Support an argument that the gravitational force exerted by Earth on objects is directed down.</p> <p>5-ESS1-1: Support an argument that the apparent brightness of the Sun and stars is due to their relative distances from Earth.</p> <p>5-ESS1-2: Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.</p>

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:

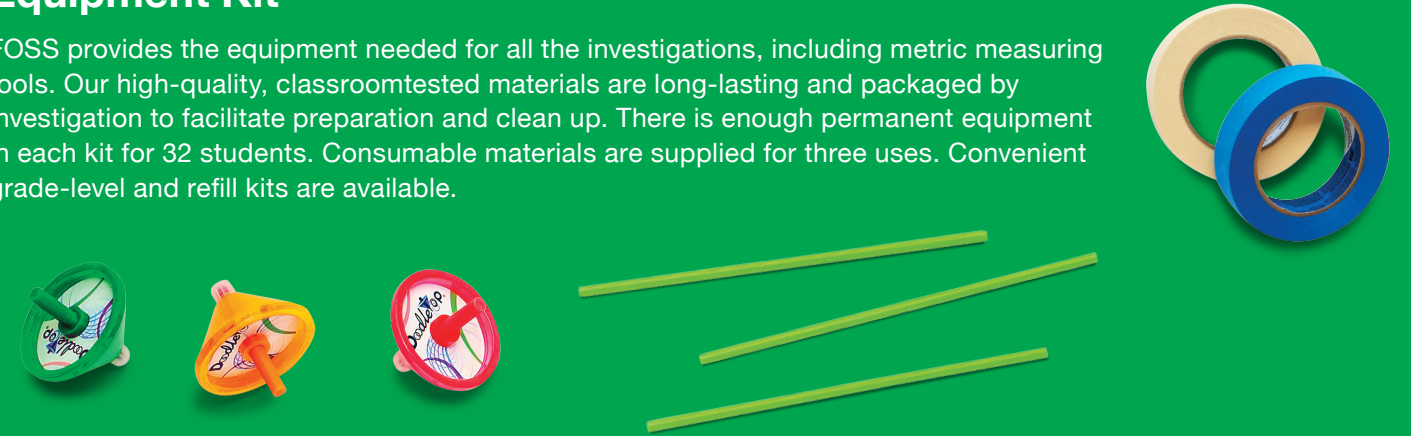
- Use text to obtain, evaluate, and communicate information
 - Use evidence to support their ideas during sense-making discussions and focus question responses
 - Integrate information from multiple sources
 - Interpret graphs, diagrams, and photographs to build understanding
- Available in print and as an interactive eBook in English and Spanish.



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

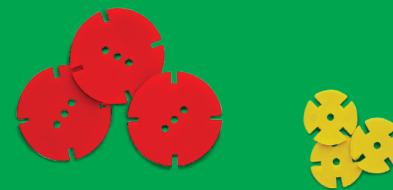
Equipment Kit

FOSS provides the equipment needed for all the investigations, including metric measuring tools. Our high-quality, classroom-tested materials are long-lasting and packaged by investigation to facilitate preparation and clean up. There is enough permanent equipment in each kit for 32 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 on ThinkLink

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.

SLIDE 3: EARTH AND SUN 1.1: AIR IN THE ATMOSPHERE, STEP 1

Introduce Anchor Phenomenon

You are at a beach on a sunny day. The air feels warm. You take your shoes off, and the sand is so hot you can barely walk on it. You run into the water and it is cool.

- How can you explain the difference in the temperatures of the air, the land, and the water?

FOSS PATHWAYS Click here to view Anchor Phenomenon Resource video.

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.

FOSS Sky Modeler Simulation Credits ?

Space View Predicted Constellation: 12 AM Earth View: Facing South

Tilt view Rotate view Show constellation lines Show daylight

Trial Check Time of Day: 12 AM

Key: Match No match Delete trial

Predicted Constellation	Month	12 AM Constellation	Constellation match?
	January		

Predict a 12 AM constellation and its month

Constellation Choose ... Month January

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.

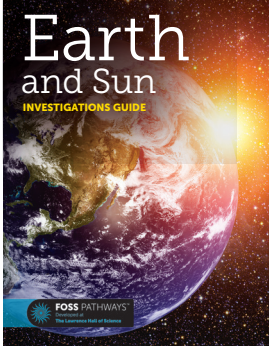
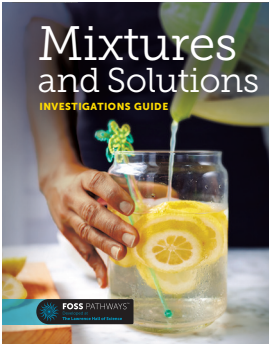
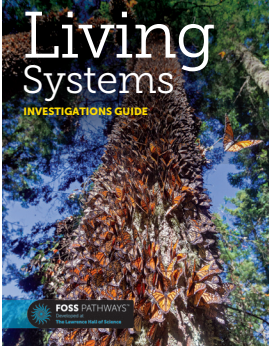


FOSSmap Online Assessment

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 5

FOSS Module	Module Overview/Bundled Performance Expectations	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts
 <p>Earth Science</p>	<p>Why do shadows change throughout the day? Why does the sky appear different to people located in different regions of the Earth? Students make observations and reveal patterns of Earth's position in the universe and the motion of the earth, moon, and stars to explain the brightness of stars and patterns of daily, monthly, and yearly changes in the sky. Students develop models of interactions between the atmosphere, hydrosphere, and geosphere and apply the ideas to construct an explanation of why sand is hot and the water cool at a beach on a sunny day.</p> <p>NGSS PEs: Earth Sciences: 5-ESS1-1 5-ESS1-2 5-ESS2-1 5-ESS2-2 5-ESS3-1</p> <p>Physical Sciences: 5-PS1-1 5-PS2-1</p>	<p>ESS1.A: The universe and its stars ESS1.B: Earth and the solar system ESS2.A: Earth materials and systems ESS2.C: The roles of water in Earth's surface processes ESS3.C: Human impacts on Earth systems PS1.A: Structure and properties of matter PS2.B: Types of interactions</p>	<ul style="list-style-type: none"> Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Using mathematics and computational thinking Constructing explanations and designing solutions Engaging in argument from evidence Obtaining, evaluating, and communicating information 	<ul style="list-style-type: none"> Patterns Cause and effect Scale, proportion, and quantity Systems and system models Energy and matter Stability and change
 <p>Physical Science</p>	<p>Students investigate changes in a pond in a park and are surprised by the change in appearance to the water. They design and construct investigations to make sense of the particles in mixtures and solutions, and they measure and graph materials to provide evidence for the conservation of matter. Students develop models to describe that matter is made of particles too small to be seen. Finally, they conduct investigations to determine whether the mixing of two or more substances results in new substances.</p> <p>NGSS PEs: Physical Sciences: 5-PS1-1 5-PS1-2 5-PS1-3 5-PS1-4 ETAS: 3-5 ETS1-2</p> <p>Earth and Space Sciences: 5-ESS3-1</p>	<p>PS1.A: Structure and properties of matter PS1.B: Chemical reactions ETS1.B: Designing solutions to engineering problems ESS3.C: Human impacts on Earth systems</p>	<ul style="list-style-type: none"> Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Using mathematics and computational thinking Constructing explanations and designing solutions Engaging in argument from evidence Obtaining, evaluating, and communicating information 	<ul style="list-style-type: none"> Patterns Cause and effect Scale, proportion, and quantity Systems and system models Energy and matter Structure and function
 <p>Life Science</p>	<p>Students learn about Dr. Salina Bryan, who has been studying a population of brine shrimp that live in Mono Lake, a large salt lake. Dr. Bryan has noticed that the size of the brine shrimp population and the amount of water in the lake has been decreasing in the last few years. Students design and conduct investigations and analyze data to figure out causes of the decrease in the number of brine shrimp, and the effect on the ecosystem. They explore the flow of matter and energy in ecosystems and develop models to describe how elements of the Earth's major systems support life.</p> <p>NGSS PEs: Life Sciences: 5-LS1-1 5-LS2-1 Physical Sciences: 5-PS3-1 Earth Sciences: 5-ESS2-1 5-ESS3-1</p>	<p>LS1.C: Organization for matter and energy flow in organisms LS2.A: Interdependent relationships in ecosystems LS2.B: Cycles of matter and energy transfer in ecosystems PS3.D: Energy in chemical processes and everyday life ESS2.A: Earth materials and systems ESS3.C: Human impacts on Earth systems</p>	<ul style="list-style-type: none"> Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Using mathematics and computational thinking Constructing explanations Engaging in argument from evidence Obtaining, evaluating, and communicating information 	<ul style="list-style-type: none"> Patterns Cause and effect Systems and system models Energy and matter

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 Earth and Sun 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



Developed at:

**The Lawrence
Hall of Science**
UNIVERSITY OF CALIFORNIA, BERKELEY

Published & distributed by:

Delta Education

