

# FOSS Grade-Level Planning Guide—Grade 5



## INTRODUCTION

The Next Generation Science Standards bring a new vision to K-12 science instruction. The **FOSS Next Generation™ Program** is designed to support you in realizing this vision through a three-dimensional approach to teaching and learning.

This Planning Guide introduces the FOSS modules at grade 5 and the instructional resources in print and on FOSSweb. This guide describes the relationships between the components of the program and how to use them to provide continuous improvement of learning. This guide:

- will get you started using your *Investigations Guides*, *FOSS Science Resources* books, and FOSSweb to implement the program;
- identifies specific *Teacher Resources* on FOSSweb to support instruction over time; and
- describes an implementation progression that quickly gets you using FOSS in your classroom and builds your instructional expertise with each subsequent module and over the years.

FOSS eases you into three-dimensional teaching and allows you to realize your potential as a facilitator of science learning. FOSS Next Generation supports your NGSS goals whether you are experienced with earlier editions or are new to the FOSS Program. Enjoy the journey.

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## ► NOTE

The latest printings of the FOSS Next Generation *Investigation Guides* and *Teacher Resources* are available on FOSSweb.



# FOSS Grade-Level Planning Guide—Grade 5

## FOSS MODULES—GRADE 5

	Module Phenomenon and Driving Question	Module Overview /Bundled Performance Expectations
FOSS Module	<p><b>Earth and Sun Module</b></p> <p><b>Anchor phenomenon:</b> <i>Patterns observed in the sky over a day, a month, a year, and more, and their effects on Earth</i></p> <p><b>Module driving questions:</b></p> <ul style="list-style-type: none"> <li>How do Earth's geosphere, hydrosphere, atmosphere, and biosphere interact to create a sustainable environment for all life?</li> </ul>  <p>5 investigations 11 weeks duration</p>	<p>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. Students investigate the properties of the atmosphere, energy transfer from the Sun to Earth, and the dynamics of weather and water cycling in Earth's atmosphere. 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.</p> <p><b>Earth Sciences:</b> 5-ESS1-1, 5-ESS1-2, 5-ESS2-1, 5-ESS2-2, 5-ESS3-1  <b>Physical Sciences:</b> 5-PS1-1, 5-PS2-1  <b>ETAS:</b> 3-5 ETS1-2, 3-5 ETS1-3</p>
FOSS Module	<p><b>Mixtures and Solutions Module</b></p> <p><b>Anchor phenomenon:</b> <i>Matter and its interactions in our everyday life, such as mixtures, solutions, and chemical reactions.</i></p> <p><b>Module driving question:</b></p> <ul style="list-style-type: none"> <li>What is matter and what happens when samples of matter interact?</li> </ul>  <p>5 investigations 10 weeks duration</p>	<p>Students engage with matter and its interactions in our everyday life—mixtures, solutions, solubility, concentration, and chemical reactions. They come to know that matter is made of particles too small to be seen and develop the understanding that matter is conserved when it changes state—from solid to liquid to gas—when it dissolves in another substance, and when it is part of a chemical reaction. Students have experiences with mixtures, solutions of different concentrations, and reactions forming new substances. Knowing about properties and systems of substances, how things go together and are taken apart, enables us to develop models that explain phenomena too small to see directly.</p> <p><b>Physical Sciences:</b> 5-PS1-1, 5-PS1-2, 5-PS1-3, 5-PS1-4  <b>ETAS:</b> 3-5 ETS1-1, 3-5 ETS1-2, 3-5 ETS1-3</p>
FOSS Module	<p><b>Living Systems Module</b></p> <p><b>Anchor phenomenon:</b> <i>Ecosystems and organisms and their interacting parts</i></p> <p><b>Module driving question:</b></p> <ul style="list-style-type: none"> <li>How can we describe Earth's biosphere as a system of interacting parts?</li> </ul>  <p>4 investigations 10 weeks duration</p>	<p>Students start by looking at Earth as the interaction of four Earth systems or subsystems—the geosphere, the atmosphere, the hydrosphere, and the biosphere. They focus on the biosphere and investigate systems on different scales—nutrient and transport systems within an organism that moves matter and provides energy to the individual organism, and feeding relationships in ecosystems that move matter among plants, animals, decomposers, and the environment. They come to understand that plants get the materials they need for growth primarily from water and air, and that energy in animals' food was once energy from the Sun. Students explore how human activities in agriculture, industry, and everyday life can have major effects on these systems</p> <p><b>Life Sciences:</b> 5-LS1-1, 5-LS2-1, 4-LS1-2 *  <b>Physical Sciences:</b> 5-PS3-1  <b>Earth Sciences:</b> 5-ESS2-1, 5-ESS3-1</p>

\* This PE is addressed in grade 4 and extended in grade 5.

**For more details on each instructional segment, refer to pages 20–22 of this document.**

	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts
	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  ETS1.A: Defining and delimiting engineering problems ETS1.B: Developing possible solutions ETS1.C: Optimizing the design solutions	<ul style="list-style-type: none"> <li>• Asking questions and defining problems</li> <li>• Developing and using models</li> <li>• Planning and carrying out investigations</li> <li>• Analyzing and interpreting data</li> <li>• Using mathematics and computational thinking</li> <li>• Constructing explanations and designing solutions</li> <li>• Engaging in argument from evidence</li> <li>• Obtaining, evaluating, and communicating information</li> </ul>	<ul style="list-style-type: none"> <li>• Patterns</li> <li>• Cause and effect</li> <li>• Scale, proportion, and quantity</li> <li>• Systems and system models</li> <li>• Energy and matter</li> </ul>
	PS1.A: Structure and properties of matter PS1.B: Chemical reactions  ETS1.A: Defining and delimiting engineering problems ETS1.B: Developing possible solutions ETS1.C: Optimizing the design solution	<ul style="list-style-type: none"> <li>• Asking questions and defining problems</li> <li>• Developing and using models</li> <li>• Planning and carrying out investigations</li> <li>• Analyzing and interpreting data</li> <li>• Using mathematics and computational thinking</li> <li>• Constructing explanations and designing solutions</li> <li>• Engaging in argument from evidence</li> <li>• Obtaining, evaluating, and communicating information</li> </ul>	<ul style="list-style-type: none"> <li>• Patterns</li> <li>• Cause and effect</li> <li>• Scale, proportion, and quantity</li> <li>• Systems and system models</li> <li>• Energy and matter</li> </ul>
	LS1.C: Organization for matter and energy flow in organisms LS1.D: Information processing 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	<ul style="list-style-type: none"> <li>• Asking questions and defining problems</li> <li>• Developing and using models</li> <li>• Planning and carrying out investigations</li> <li>• Analyzing and interpreting data</li> <li>• Using mathematics and computational thinking</li> <li>• Constructing explanations and designing solutions</li> <li>• Engaging in argument from evidence</li> <li>• Obtaining, evaluating, and communicating information</li> </ul>	<ul style="list-style-type: none"> <li>• Patterns</li> <li>• Scale, proportion, and quantity</li> <li>• Systems and system models</li> <li>• Energy and matter</li> <li>• Structure and function</li> <li>• Stability and change</li> </ul>



## FOSS INSTRUCTIONAL DESIGN

To effectively use the FOSS Program, learn and embrace the FOSS instructional design—the pulse of the program that conveys the spirit and intelligence of science between you and your students.

FOSS is designed around active investigation that provides engagement with science concepts and science and engineering practices. Surrounding and supporting those first-hand investigations are a wide range of experiences that help build student understanding of core science concepts and deepen scientific habits of mind.

There are three modules at grade 5 (**Earth and Sun, Mixtures and Solutions, Living Systems**). Each module has 4–5 investigations. Each FOSS investigation follows the same design to provide multiple exposures to science concepts.

The design includes these pedagogies. This is not a linear process but an iterative one.

- **Active investigation** in collaborative groups: firsthand experiences with phenomena in the natural and designed worlds
- **Communicating** answers to focus and guiding questions and monitoring scientific phenomena under investigation in science notebooks
- **Reading informational text** in *FOSS Science Resources* books

- **Using online digital activities** to acquire information or to elaborate and extend the investigations.
- **Engaging in outdoor experiences** to collect data from the local environment or to apply knowledge by solving problems.
- **Using formative assessment** to monitor progress and inform student learning.

### Phenomena Drive FOSS Investigations

Engagement with real-world **phenomena** is at the heart of FOSS. Every module has an anchor phenomenon and a **driving question**. Each investigation has a **guiding question**. In every part of every investigation, the investigative phenomenon is referenced implicitly in the **focus question that guides instruction of each part** and frames the intellectual work. The focus question is a prominent part of each lesson and is called out for the teacher and student. The investigation Background for the Teacher section is organized by focus

#### The Elements of the FOSS Instructional Design



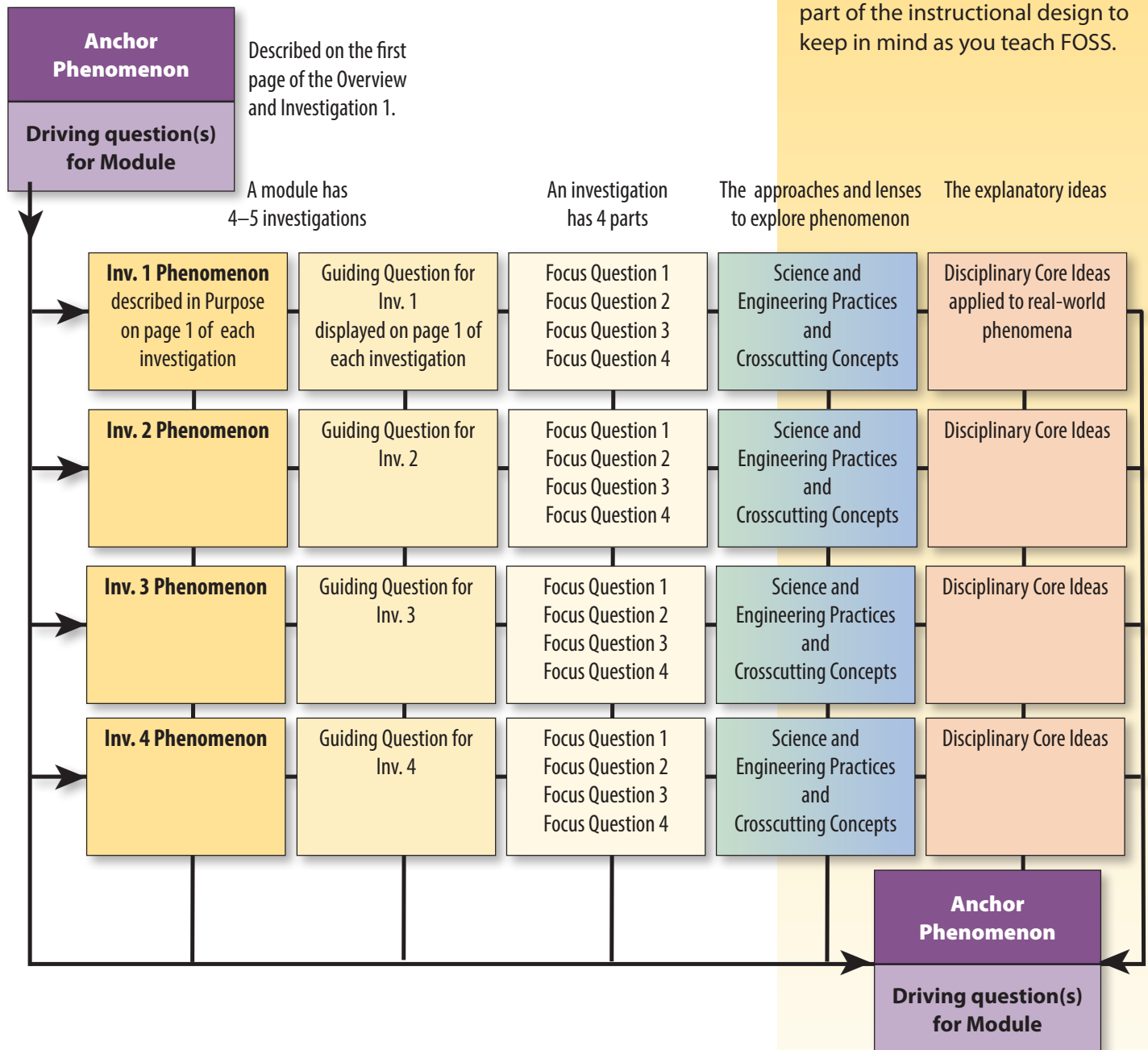
The FOSS active investigation has four parts.

- Context setting: sharing prior knowledge, questioning, and planning
- Activity: doing and observing
- Data management: recording, organizing, and processing observations
- Analysis: discussing discoveries and writing explanations—sense making

question—the teacher has the opportunity to read and reflect on the phenomenon in each part in preparing for the lesson. Students record the focus question in their science notebooks, and after exploring and making sense of the phenomenon thoroughly, explain their thinking in words and drawings. At the end of each investigation, the students integrate their experiences through discussion of the guiding question for the entire investigation.

## NOTE

The schematic below is another part of the instructional design to keep in mind as you teach FOSS.



# FOSS Grade-Level Planning Guide—Grade 5

## ▶ GETTING STARTED WITH FOSS COMPONENTS

Both *Investigations Guide* and *Teacher Resources* are available in print and on FOSSweb.

Additionally, on FOSSweb you can visit Implementation Tools to view FOSS Getting Started videos, specifically *Getting Started with FOSS: Meet your Teacher Toolkit*.

The *Teacher Toolkit* consists of these components:

- *Investigations Guide*
- *Teacher Resources*
- *FOSS Science Resources* (student book)

## INVESTIGATIONS GUIDE

Adopting a new curriculum yields the best results when you plan to develop expertise over time, rather than to take on all components in the first module or first year. Getting to know the structure and organization of the Teacher Toolkit should be your first step with FOSS.

The Teacher Toolkit is the most important part of the FOSS Program. There are three parts of the *Teacher Toolkit*—*Investigations Guide*, *Teacher Resources*, and the student *FOSS Science Resources* book. Choose one FOSS module to walk through, and open up the *Investigations Guide*.

**Welcome to FOSS Next Generation.** In the very front, before the Overview tab, is Getting Started with FOSS Next Generation 3–5. The section has many visuals to orient you to the program components. Begin by reviewing this section.

**Module Overview.** The first tab is the **Overview** chapter—a high-level look at the 10 weeks of instruction in the module. The anchor phenomenon and the driving question for the module are on page 1. An important two- to four-page spread is the Module Matrix. It shows information on each of the 4 to 5 investigations—summary, guiding and focus questions, content, media, and assessment.

EARTH AND SUN

Overview

Module Matrix

FOSS

	Module Summary	Guiding and Focus Questions for Phenomena	Content Related to Disciplinary Core Ideas	Reading/Technology	Assessment
Inv. 1: The Sun	<p>Students observe the phenomenon of outdoor shadows. They trace their shadows in the morning and afternoon. They use this information to 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. Back in the classroom, students use flashlights to reproduce the shadow movements to model how the Sun's position in the sky changes during the day. 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>How can we predict events based on shadows?</i> <i>What do shadows tell us about daily patterns involving the Earth/sun system?</i></p> <p><i>How and why does your shadow change during the day?</i></p> <p><b>What is the relationship between the position of the Sun and the length and direction of shadows?</b></p> <p><b>What causes day and night?</b></p>	<ul style="list-style-type: none"> <li>Shadows are the dark areas that result when light is blocked.</li> <li>Shadows change during the day because the position of the Sun changes in the sky.</li> <li>The length and direction of a shadow depends on the Sun's position in the sky.</li> <li>Day is the half of Earth's surface being illuminated by sunlight; night is the half of Earth's surface in its own shadow.</li> <li>The cyclical change between day and night is the result of Earth's rotating around the stationary Sun, Earth's star.</li> </ul>	<p><b>Science Resources Book</b> "Changing Shadows" "Sunrise and Sunset"</p> <p><b>Online Activities</b> "Shadow Tracker" "Tutorial: Sun Tracking" "Seasons"</p>	<p><b>Embedded Assessment</b> Science notebook entries Response sheet</p> <p><b>Benchmark Assessment</b> Survey Investigation 1 I-Check</p> <p><b>NGSS Performance Expectations</b> 5-ESS1-2</p>
Inv. 2: Planetary Systems	<p>Students investigate the phenomena of objects giving off light and others reflecting light in the sky. They take a field trip to the schoolyard to look for the Moon. The class starts a Moon calendar, on which they record the Moon's appearance every day for a month and analyze their observations to discover the sequence of changes. Students grapple with the size and distance relationships among the Moon, Earth, and the Sun, and build a model of the Earth/Moon/Sun system.</p> <p>Based on previous knowledge, information on solar system cards, and information provided by the teacher, students organize a model of the solar system. Gravity is introduced as the force that pulls on planets, changing their direction of travel to produce circular orbits. 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.</p>	<p><i>What objects do we observe in our solar system and how do they move in relation to each other?</i> <i>What do we see outside our system?</i></p> <p><i>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?</i></p> <p><i>How would you describe the size of and distance between Earth, the Moon, and the Sun?</i></p> <p><i>How does the shape of the Moon change over 4 weeks?</i></p> <p><i>How do the parts of the solar system interact?</i></p> <p><i>Why do stars appear to move across the night sky?</i></p>	<ul style="list-style-type: none"> <li>The solar system includes the Sun, a star, and the objects that orbit it, including Earth, the Moon, seven other planets, their satellites, and smaller objects.</li> <li>The Moon is much smaller than Earth and orbits at a distance equal to about 30 Earth diameters.</li> <li>The Sun is 12,000 Earth diameters away from Earth and is more than 100 times larger than Earth.</li> <li>Gravity is a pulling force between two masses; it is the force that pulls things toward the center of Earth. The pulling force of gravity keeps the planets and other objects in orbit by continuously changing their direction of travel.</li> <li>A great deal of light travels through space to Earth from the Sun and from distant stars.</li> <li>Stars are at different distances from Earth. The Sun is the closest star to Earth, so it appears brighter and larger.</li> <li>The side of Earth facing the Sun is always in daylight; the side facing away from the Sun is always in darkness. Because of the brightness of the Sun, we can only see stars outside our solar system when we are on the dark half of Earth (at night).</li> </ul>	<p><b>Science Resources Book</b> "The Night Sky" "Looking through Telescopes" "Comparing the Size of Earth and the Moon" "Apollo 11 Space Mission" "How Did Earth's Moon Form?" "Exploring the Solar System" "Planets of the Solar System" "Why Doesn't Earth Fly Off into Space?" "Stargazing" "Star Scientists" "Our Galaxy"</p> <p><b>Videos</b> <i>All about the Moon</i> <i>The Planets and the Solar System</i> <i>All about Stars</i></p> <p><b>Online Activities</b> "Lunar Calendar" "Star Maps" "Stellar Motions"</p>	<p><b>Embedded Assessment</b> Science notebook entries Performance assessment Response sheet</p> <p><b>Benchmark Assessment</b> Investigation 2 I-Check</p> <p><b>NGSS Performance Expectations</b> 5-PS2-1 5-ESS1-1 5-ESS1-2</p>

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Full Option Science System

Earth and Sun Module—FOSS Next Generation

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Then, review these sections in the Overview chapter.

- FOSS Components
- FOSS Instructional Design
- Differentiated Instruction for Access and Equity
- FOSS Investigation Organization
- Establishing a Classroom Culture
- Safety and Scheduling the Module

**Framework.** Next, glance at the **Framework and NGSS** chapter, which provides a complete overview of NGSS connections, learning progressions, and background to support the FOSS conceptual framework.

**Materials.** This chapter helps you get your student equipment ready for first-time use and shares helpful tips for getting your classroom ready for FOSS. Your FOSS module includes one or more large boxes, called drawers, and two or more smaller boxes for the *Teacher Toolkit*, student books, and possibly other equipment. Look for what the school should provide for each investigation; for life science, be sure to read about how best to invite other living organisms into the classroom.

**Technology.** This chapter provides an introduction to each digital resource in the module and gets you up and running on **FOSSweb**. FOSSweb is essential to the program—it is the portal to teacher and student resources for your modules. You might want to visit it now, or proceed to Investigation 1 and return to FOSSweb later.

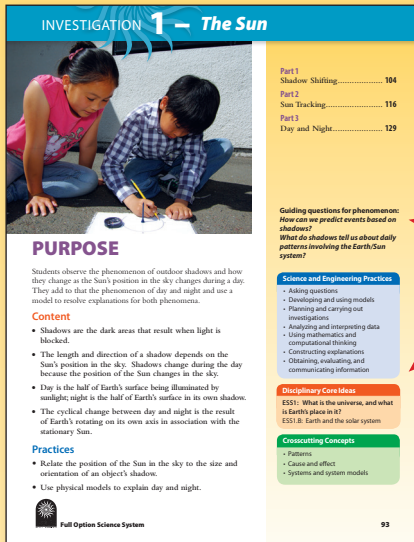
When visiting FOSSweb, the first step is to register, and then to activate your modules using the code found inside the front cover of your *Investigations Guide*. This may already be done for you at the district level by your FOSSweb administrator. Then you can do these things.

- Access the eInvestigations Guide.
- Access the student eBook online in two formats.
- Access **Resources by Investigation**, which has all the notebook, teacher and assessment masters, online activities, assessment coding guides, and streaming videos needed for each part.
- View the **Teacher Preparation Videos** for each investigation.
- Download **Interactive Whiteboard (IWB) slides** for each part of each investigation—a tool to facilitate instruction.
- Take note of the link to **FOSSmap**, the online assessment system, but save this for later.
- Set up class pages for student access to digital resources.





# FOSS Grade-Level Planning Guide—Grade 5



**FOSS Investigations.** You're ready to look at the main part of the *Investigations Guide*, the instructional content. Each module is divided into **investigations**, and each investigation is subdivided into **parts**. Choose one investigation to walk through.

Start by reading the Purpose on the first page, the **guiding question for the phenomenon**, and the **three-dimensions of NGSS** woven into the experiences.

Next study the Investigation At-a-Glance charts to see the focused summary of each part with the investigation summary, time (number of 45–50 minute sessions), focus question for phenomenon and practices, content related to DCIs, integration of reading/writing/media, and assessment (embedded and benchmark). This Investigation At-a-Glance is a useful tool, your roadmap to return to repeatedly as you proceed through the investigation.

# INVESTIGATION 1 — The Sun

## At a Glance

	Investigation Summary	Time	Focus Question for Phenomenon, Practices	Content Related to DCIs	Writing/Reading	Assessment
PART 1	<b>Shadow Shifting</b> Students trace their shadows in the morning and afternoon, and compare the tracings. They use this information to determine the position of the Sun as it appears to move throughout the day.	<b>Assessment</b> 1 Session * <b>Active Inv.</b> 2 Sessions	<b>How and why does your shadow change during the day?</b>  <b>Practices</b> Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations	<ul style="list-style-type: none"> <li>Shadows are the dark areas that result when light is blocked.</li> <li>Shadows change during the day because the position of the Sun changes in the sky.</li> </ul>	<b>Science Notebook Entry</b> Answer the focus question <i>Shadow Challenges</i>	<b>Benchmark Assessment</b> Survey  <b>Embedded Assessment</b> Science notebook entry
PART 2	<b>Sun Tracking</b> Pairs of students construct Sun trackers. After using a compass to orient the Sun tracker north-south, students make hourly records of the position of the tip of the shadow cast by a golf tee. Back in the classroom, students use flashlights to reproduce the movement of the Sun throughout the day.	<b>Active Inv.</b> 2–3 Sessions <b>Reading</b> 1 Session	<b>What is the relationship between the position of the Sun and the length and direction of shadows?</b>  <b>Practices</b> 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	<ul style="list-style-type: none"> <li>Shadows change during the day because the position of the Sun changes in the sky.</li> <li>The length and direction of a shadow depends on the Sun's position in the sky. These daily shadow patterns are observable and predictable.</li> </ul>	<b>Science Notebook Entry</b> <i>Sun Tracker Recording</i> <b>Science Resources Book</b> "Changing Shadows" <b>Online Activities</b> "Tutorial: Sun Tracking" "Shadow Tracker"	<b>Embedded Assessment</b> Response sheet
PART 3	<b>Day and Night</b> Students imagine one of their eyes as an observer on Earth and position themselves around a lamp to observe day and night. They discover that rotation of Earth results in day and night and, in the process, figure out which direction Earth rotates on its axis.	<b>Active Inv.</b> 1 Session <b>Reading</b> 1 Session <b>Assessment</b> 2 Sessions	<b>What causes day and night?</b>  <b>Practices</b> Asking questions Developing and using models Analyzing and interpreting data Using mathematics and computational thinking Constructing explanations Obtaining, evaluating, and communicating information	<ul style="list-style-type: none"> <li>Day is the half of Earth's surface being illuminated by sunlight; night is the half of Earth's surface in its own shadow.</li> <li>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.</li> </ul>	<b>Science Notebook Entry</b> <i>Day/Night Questions</i> <b>Science Resources Book</b> "Sunrise and Sunset" <b>Online Activity</b> "Seasons"	<b>Embedded Assessment</b> Science notebook entry <b>Benchmark Assessment</b> <i>Investigation 1 I-Check</i> <b>NGSS Performance Expectations addressed in this investigation</b> 5-ESS1-2

\* A class session is 45–50 minutes.

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Earth and Sun Module—FOSS Next Generation

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\* A class session is 45–50 minutes.

Full Option Science System

Earth and Sun Module—FOSS Next Generation



Look for each of these sections in each investigation.

- Background for the Teacher
- Teaching and Learning about . . . (with NGSS foundation boxes)
- New word icon with listing of academic science vocabulary
- Conceptual Flow
- Materials for Part
- Getting Ready for Part
- Guiding the Investigation for Part
- Embedded Assessment and What to Look For
- Reading in *FOSS Science Resources*
- Wrap-Up/Warm-Up (at the end of each part)
- Interdisciplinary Extension Investigation (end of last part)

## NOTE

You'll see icons next to various steps. Refer to the Overview section, "FOSS Investigation Organization" to learn more about each icon.

### INVESTIGATION 3 — Earth's Atmosphere

**1**

**SCIENCE AND ENGINEERING PRACTICES**  
Asking questions  
Developing and using models  
Constructing explanations

**DISCIPLINARY CORE IDEAS**  
PS1.A: Structure of matter

**CROSSCUTTING CONCEPTS**  
Cause and effect  
Systems and system models

**EL NOTE**  
For students who need scaffolding, provide sentence frames such as  
When I push the plunger down, \_\_\_\_\_.  
When I crimped the tube, \_\_\_\_\_.  
When two syringes are connected \_\_\_\_\_.

**7. Assess progress: performance assessment**  
Observe students as they explore air in syringes. Note how well they follow science practices.

**What to Look For**

- Students ask questions that can be investigated. (Asking questions.)
- Students build reasonable explanations for observations. (Constructing explanations; cause and effect.)
- Students consider thinking about air from the perspective of a particle model, especially when air is compressed. (Developing and using models; PS1.A: Structure of matter.)
- Students consider the implications of the syringe as a closed system. (Systems and system models.)

**8. Share observations**  
After 15–20 minutes call on several groups to share an observation. Here are some likely observations.

- When you push the plunger down, the air in the syringe gets pushed out of the tube.
- With the tube crimped, the plunger can push the trapped air into a smaller space.
- When two syringes are connected, one plunger can make the other plunger go in and out. Air can move from one syringe to the other.
- Air can pop one plunger clear out of its barrel.

Ask,  
You can't push both plungers to the bottom of their barrels when two syringes are connected. Why is that? [Air takes up space. As long as there is air in the syringes, the plungers can't be in the air's space.]

### Part 1: The Air around Us

**9. Have a sense-making discussion**

Ask,

- When you clamp the tube closed and push the plunger down, what happens to the air? [It squeezes into a smaller space.]
- Is there more air, less air, or the same amount of air in the syringe when the plunger is pushed down? How do you know? [Same amount.]
- What happens when you let go of the plunger after pushing it down? Why do you think this happens? [The plunger pushes back up.]
- What happens to push the plunger back out when you stop pushing on the plunger? [The trapped air pushes back on the plunger.]
- What do you think happens to the air when it is forced into a smaller space? [The volume of air gets smaller.]

Let students share their ideas about these last two questions.

**10. Introduce compress and pressure**  
Tell students,  
When you put force (push) on the plunger, the air is pushed into a smaller space. Air that has been forced into a smaller space is **compressed**. The same amount of air is still in the syringe when it is compressed.  
Compressed air is under **pressure**. The compressed air pushes back with a force equal to the force compressing it. If the force pushing on the plunger is released, the pressure in the compressed air will force the plunger out. Compressed air pushes back, and the push is called pressure.  
Add the new words to the word wall.

**11. Clean up**  
Have Getters return all the materials to the materials station. After class, you will need to separate the syringes from the tubes. This may require using a metal fork as a lever to pry the tubes loose from the syringe tip. Position the fork as indicated in the illustration, with two tines on opposite sides of the syringe tip. Push down on the fork handle to lift the tube off the syringe tip.

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Full Option Science System

Earth and Sun Module—FOSS Next Generation

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1. Key three-dimensional highlights

2. Embedded assessment "What to Look For"

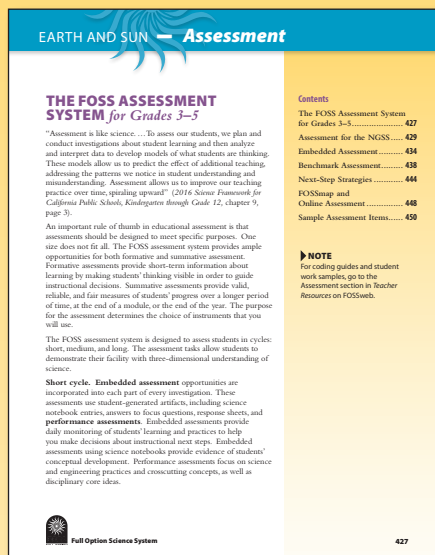
3. Sense-making discussions

4. Helpful drawings and diagrams

5. Strategies to introduce new words in context (see English Learner EL NOTE on previous page)

6. Teaching notes to facilitate instruction

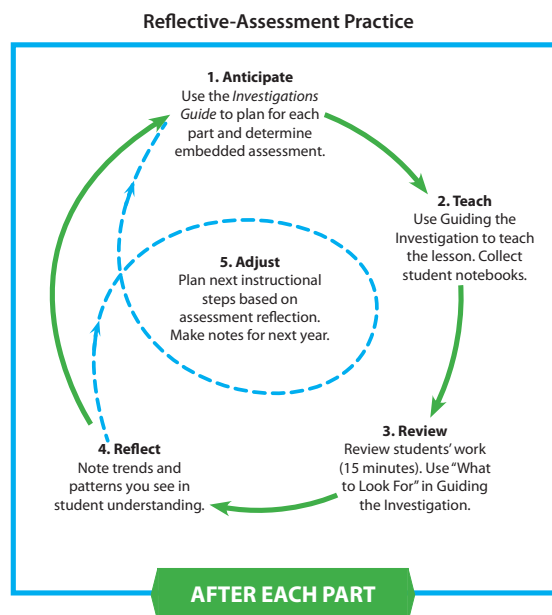
# FOSS Grade-Level Planning Guide—Grade 5



► **NOTE**  
Find the latest assessment masters, assessment charts, and assessment coding guides on FOSSweb.

**Assessment.** The final tab in the *Investigations Guide* is the **Assessment** chapter. Glance through it now, but plan to come back to it as you complete the first part of Investigation 1. This chapter gives you an in-depth look at the research-based components of the FOSS assessment system, guidance on assessing for three-dimensional learning, and generalized next-step strategies to use in your classroom.

The FOSS assessment system is designed to assess students at different times throughout a module. Embedded assessments are suggested for each part. They focus on specific content and practices that are taught in that lesson. The reflective-assessment practice (shown to the right) is an easy and effective way to gather evidence about student learning for planning the next lesson. This is one of the first parts of the system that you will want to incorporate into your teaching. The diagram here will serve as a reminder to study that section of the Assessment chapter.



Benchmark assessments include the *Survey*, *I-Checks* and *Posttest*. The *Survey* is given before instruction begins. It provides information about students' prior knowledge. **I-Checks** are actually hybrid tools: they can provide summative information about students' achievement, but more importantly, they can be used formatively as well to provide diagnostic information at the end of each investigation. Students can take benchmark assessments online. Most items are automatically coded and the system provides informative narrative reports, including alignment to NGSS.

Optional interim assessments are designed to assess specific performance expectations and are not curriculum specific. These assessments can be used to practice for high-stake tests, or be used as end-of-year assessments to evaluate the school science program implementation.

Assessment masters, if you prefer to give paper-and-pencil tests, can be found on FOSSweb, along with the Assessment Coding Guides and *Assessment Record* charts for each module. The more proficient you become as a FOSS instructor, the more value you will find in implementing and studying the FOSS assessment system.

## SCIENCE RESOURCES BOOK

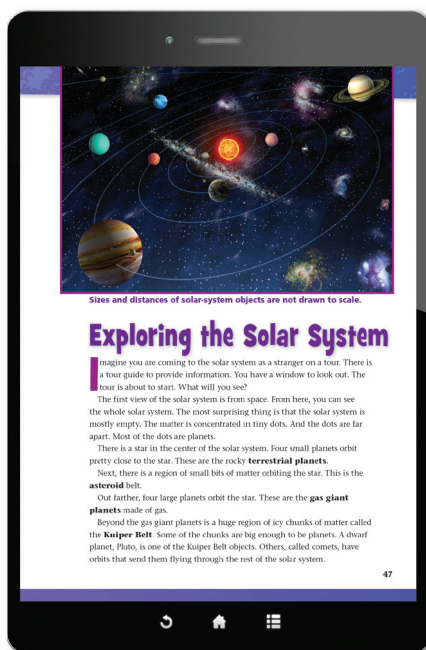
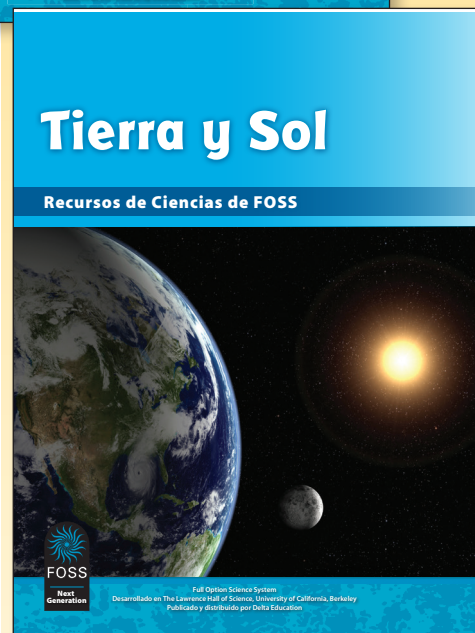
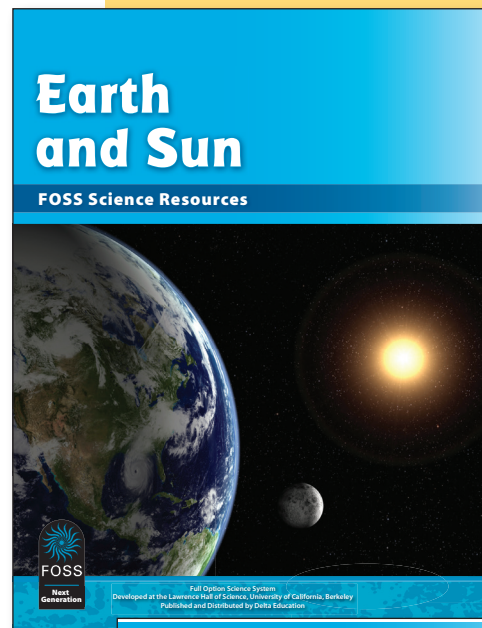
The *Teacher Toolkit* includes one copy of the *FOSS Science Resources* students book. This book is available as individual module books (three titles per grade level) or a combined, grade-level book with all three titles bound together. Check to see which format of the hard copy book your school/district has purchased.

In addition, the teacher has access to two digital formats of the *FOSS Science Resources* book on FOSSweb—a PDF-based eBook and an interactive eBook. The interactive eBook can be viewed in an HTML format or through an application on a tablet. Check FOSSweb for instructions on downloading the application to view *FOSS Science Resources*.

Individual student access to eBooks is called Premium Content and is purchased separately. Check with your school/district to see if your students have Premium Content access. You enter the code through your Teacher Page on FOSSweb.

The interactive eBook format of *FOSS Science Resources* is a platform-neutral interactive student ebook with integrated audio, audio-synced text, and links to videos and online activities. The videos in the ebook are sometimes used in instruction to introduce a phenomenon to the class or to facilitate a wrap-up discussion.

**Spanish student materials.** The *FOSS Science Resources* books are available in Spanish as printed module-specific books, PDF-based eBooks, and interactive eBooks. There are audio books in both English and Spanish. Other student-facing materials (notebook masters, teacher masters, assessment masters, FOSS equipment cards, streaming videos, posters, focus questions and vocabulary lists) are provided in Spanish on FOSSweb. The teacher can use the Spanish Interactive Whiteboard charts to facilitate a FOSS classroom in Spanish.



## ► IF YOU ARE NEW TO FOSS

The use of the *Teacher Resources* (TR) chapters is more productive after you have some experience with the *Investigations Guide* (IG) in the classroom. We have provided here a suggested order to become familiar with the *Teacher Resources* chapters.

The latest versions of the *Teacher Resources* chapters are available on FOSSweb.

## TEACHER RESOURCES

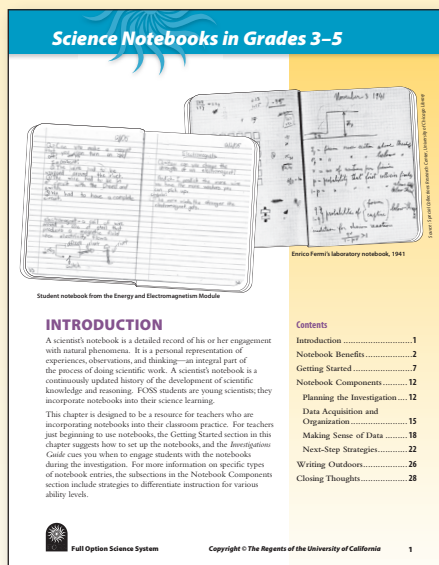
These chapters can be downloaded from Teacher Resources on FOSSweb.

- FOSS Program Goals K–8
- Planning Guide—Grade 5 (the chapter you are reading)
- Science Notebooks in Grades 3–5
- Science-Centered Language Development in Grades 3–5
- FOSS and Common Core ELA—Grade 5
- FOSS and Common Core Math—Grade 5
- Taking FOSS Outdoors
- Access and Equity
- Science and Engineering Practices—Grade 5
- Crosscutting Concepts—Grade 5
- Sense-Making Discussions for Three-Dimensional Learning—Grade 5

Below are some highlights from a few of these chapters and a suggested order in which you might become familiar with them as you develop your FOSS instructional expertise. Use these resources as you feel ready to do so.

**Science Notebooks in Grades 3–5.** Research and effective practice have led FOSS to place emphasis on the student science notebook. Keeping a notebook helps students organize their observations and data, process their data, and maintain a record of their learning for future reference. The process of writing about their science experiences and communicating their thinking is a powerful learning device for students. The science-notebook entries stand as credible and useful expressions of learning. The artifacts in the notebooks form one of the core exhibitions of the FOSS Assessment System. Look to this chapter for details about how to use notebooks with FOSS. And in the Getting Ready for the first investigation in each module, there is a reminder about planning for use of science notebooks.

You will find the duplication masters for grades 3–5 presented in notebook format. They are sized two copies to a standard sheet for placement (glue or tape) into a bound composition book. Full-sized masters for grades 3–5 that can be filled in electronically and are suitable for display are available on FOSSweb.





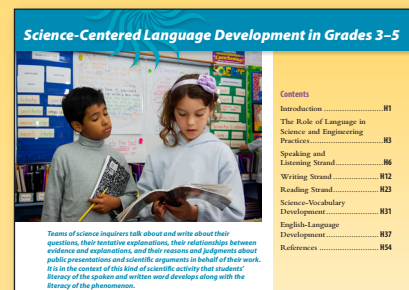
**Science-Centered Language Development in Grades 3–5.** This chapter focuses on the intersection of science and language and the implications for effective science teaching and language development. It provides a collection of literacy strategies that are integrated purposefully into the FOSS investigations in the language domains—speaking and listen, writing, and reading, as well as suggestions for additional strategies that both enhance student learning in science and exercise English language literacy skills.

**FOSS and Common Core ELA—Grade 5.** Specific methods to make connections to the Common Core State Standards for English Language Arts are included in the flow of Guiding the Investigation. These recommended methods are linked to the CCSS ELA through ELA Connection notes. In addition, the FOSS and the Common Core ELA chapter in *Teacher Resources* summarizes all of the connections to each standard at grade 5.

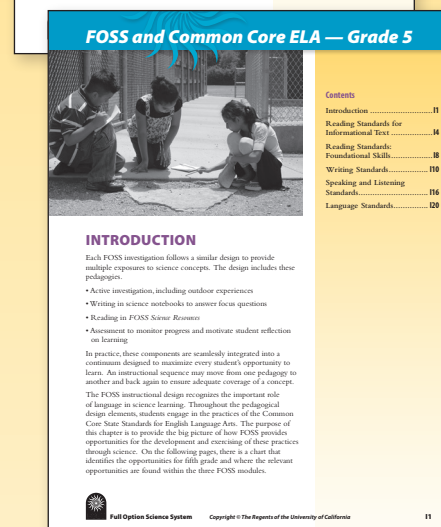
There is also a CCSS Math chapter summarizing the FOSS connections to the standards at the grade level.

**Taking FOSS Outdoors.** When you see the outdoor icon in the flow of an investigation, you know that it is time to go outdoors for science. The march into the schoolyard has three objectives: 1) the outdoor activities continue and extend the learning that starts in the classroom; 2) venturing outside provides opportunities to discover applications and everyday examples of the phenomenon being investigated; and 3) it connects students with nature and develops environmental literacy. This chapter provides specific guidance for working with students outdoors in science.

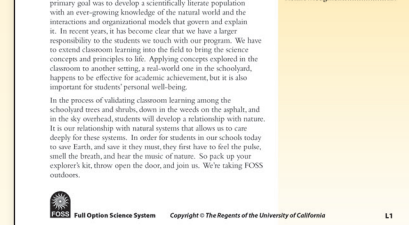
**Access and Equity.** Each classroom dynamic differs from year to year. As the teacher, you assess the needs of your particular students and decide on appropriate methods and supports. This chapter describes universal approaches for access and equity embedded in FOSS, and provides additional strategies to support the specific needs of a particular student(s) in one or more of these populations—ethnically diverse learners, standard English learners, English learners (students whose primary language is other than English who are developing proficiency in academic English), students living in poverty, foster youth, girls and young women, advanced learners and gifted learners, students with disabilities, and students experiencing difficulties with literacy in science and engineering. Use this chapter as a reference when needed.



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# FOSS Grade-Level Planning Guide—Grade 5

**Science and Engineering Practices—Grade 5.** One goal of the FOSS Program is scientific literacy for all students. This means more than just knowledge of core ideas. Scientific literacy includes engaging in the activities and intellectual behaviors of scientists and engineers. Written into each investigation are specific steps that aim to build student competence with each practice. Over the course of the year, the expectation is for all students to have multiple experiences with the practices. Student capabilities with each practice should advance as the year progresses. This chapter provides general guidance on how to intentionally teach practices using FOSS grade-level modules.

**Crosscutting Concepts—Grade 5.** This chapter describes crosscutting concepts and student capabilities when using them. These capabilities suggest how to introduce a concept, and strategies and questions that can be used in sense-making discussions. The chapter includes grade-level examples as well as a complete listing of all the opportunities to exercise each concept at the grade level.

**Sense-Making Discussions for Three-Dimensional Learning.** One of the biggest challenges is to intentionally teach science using all three dimensions as described in NGSS—disciplinary core ideas, science and engineering practices, and crosscutting concepts. This chapter describes a professional learning process to enhance your abilities to facilitate sense-making discussions of science phenomena for grade 5 students, and will be most useful after you have taught a FOSS module.

## TEACHING NOTE

*Refer to the Sense-Making Discussions for Three-Dimensional Learning chapter in Teacher Resources on FOSSweb for more information about how to facilitate this with students.*

Earth and Sun Module	Mixtures and Solutions Module	Living Systems Module
Inv 1, Part 3, Step 18 DCI ESS1.B: Earth and the solar system SEP: Constructing explanations CC: Cause and effect, Systems and system models	Inv 1, Part 1, Step 14 DCI PS1.A: Structure and properties of matter, ETS1.B: Developing possible solutions SEP: Planning and carrying out investigations CC: Cause and effect	Inv 1, Part 2, Step 26 DCI LS2.A: Interdependent relationships in ecosystems SEP: Developing and using models; Constructing explanations CC: Energy and matter, Stability and change
Inv 2, Part 5, Step 13 DCI ESS1.A: The universe and its stars, ESS1.B: Earth and the solar system SEP: Developing and using models, Constructing explanations CC: Patterns, Cause and effect, Systems and system models	Inv 3, Part 4, Step 8 DCI PS1.A: Structure and properties of matter SEP: Analyzing and interpreting data CC: Cause and effect	Inv 3, Part 2, Step 18 DCI LS1.C: Organization for matter and energy flow in organisms SEP: Developing and using models, Constructing explanations CC: Systems and system models
Inv 4, Part 3, Step 27 DCI ESS2.A: Earth materials and systems SEP: Constructing explanations, Engaging in argument from evidence; Obtaining, evaluating, and communicating information CC: Cause and effect	Inv 4, Part 3, Step 16 DCI PS1.A: Structure and properties of matter SEP: Constructing explanations CC: Patterns	Inv 3, Part 3, Step 12 DCI LS2.B: Cycles of matter and energy transfer in ecosystems SEP: Constructing explanations CC: Patterns, Systems and system models

This table shows specific examples in each module referenced in the Sense-Making Discussions chapter. The references are to the copyright 2018 printing.

## IMPLEMENTATION PROGRESSION

With FOSS, expect to build expertise during the first year and beyond. The program is complex yet easy to get into; so start with a few components and build on as you grow with the program. On the next two pages is one model approach to implementing the various components as your expertise with the curriculum grows over time. The implementation progression will be different for teachers based on experience and needs, and should be modified accordingly during your implementation.

We have described three stages, each one reaching deeper into the complexity of the FOSS resource to meet NGSS. Each stage references chapters in the *Investigations Guide* (IG) and/or *Teacher Resources* (TR), both of which are available in print and digitally on FOSSweb. In some cases, the references are to general approaches.

By reading and following the *Investigations Guide* for each part of the investigations, you will be well on your way to meeting the goals of stage 1. We suggest that you take time with the first module, engage with your students and listen to their discussions, reflect on your teaching and their learning, and be patient and flexible. Don't try to be an expert at everything at one time, but do push yourself to expand and improve your teaching strategies.

### **Goals for Stage 1:**

- Get excited about teaching science and enjoy your students' engagement with the practices of science. Make time for science.
- Establish a collaborative classroom culture of productive thinking and respectful communication of science ideas where everyone participates and builds on the ideas of others.
- Prepare for each teaching session carefully using the *Investigations Guide* and carry it with you as you teach. Trust it.
- Become an effective manager of materials and enable students to help in that process. Teach both in the classroom and outdoors.
- With colleagues, reflect on your own practice and student learning. Begin to set goals for stage 2 to meet the needs of all students and to make more efficient use of time by integrating other disciplines. Consider a science-centered classroom.

The first stage is focused on getting to know the resource and how to use the instructional materials. Later stages are focused on deepening understanding of three-dimensional teaching, pedagogical practices, and effectively using assessment to differentiate instruction.

# FOSS Grade-Level Planning Guide—Grade 5

IG = Investigations Guide

TR = Teacher Resources

FOSS Program Component	Year 1 (or Stage 1)
<b>General classroom planning</b>	<ul style="list-style-type: none"> <li>IG: Overview chapter, Establishing a Classroom Culture</li> </ul>
<b>Instructional design</b>	<ul style="list-style-type: none"> <li>IG: Overview chapter, Instructional Design</li> <li>TR: Planning Guide, Instructional Design</li> <li>IG: Investigation background, Teaching Children about Conceptual Flow, Wrap-Up</li> </ul>
<b>Scheduling and safety</b>	<ul style="list-style-type: none"> <li>IG: Overview chapter, Scheduling the Module Safety in the Classroom and Outdoors</li> </ul>
<b>Materials</b>	<ul style="list-style-type: none"> <li>IG: Materials Chapter</li> <li>IG: Investigation: Getting Ready for Investigation</li> <li>FOSSweb—Teacher preparation videos for each part of each investigation</li> </ul>
<b>Using FOSSweb</b>	<ul style="list-style-type: none"> <li>IG: Technology chapter</li> <li>Set up your teacher and class pages</li> <li>FOSSweb, Teaching the Module—Resources by Investigation</li> </ul>
<b>Establishing science notebooks</b>	<ul style="list-style-type: none"> <li>TR: Science Notebooks in Grades 3–5 Setting up Notebooks</li> <li>IG: Look for notebook icon in sidebar</li> </ul>
<b>Science-Centered Language Development (SCLD)</b>	<ul style="list-style-type: none"> <li>TR: Science-Centered Language Development Follow IG Guiding and refer to TR chapter for several techniques to try</li> </ul>
<b>Three-dimensional teaching and learning</b>	<ul style="list-style-type: none"> <li>IG: Framework chapter</li> <li>IG: Investigation, Teacher Background</li> <li>IG: Investigation, Teaching and Learning about . . . and Conceptual Flow</li> <li>IG: Investigation, Guiding the Investigation, use with fidelity (look at Science and Engineering Practices in performance assessments)</li> </ul>
<b>Sense-making discussions</b>	<ul style="list-style-type: none"> <li>IG: Look for step heads: Have a sense-making discussion</li> </ul>
<b>Assessment system</b> <b>Formative assessments</b> <b>Benchmark assessment</b> <b>FOSSmap for online taking and reports</b>	<ul style="list-style-type: none"> <li>IG: Assessment chapter</li> <li>IG: Review assessment step in Getting Ready; look for assessment icons in Guiding the Investigation</li> <li>Try out <i>Survey</i>, <i>I-Checks</i>, and <i>Posttest</i></li> <li>Review student work using Embedded Assessment</li> </ul>
<b>ELA/English learners support and integration</b>	<ul style="list-style-type: none"> <li>IG: Be aware of ELA connections as described in Guiding the Investigation. Follow the EL Notes in sidebars.</li> <li>TR: Refer to Science-Centered Language Development (SCLD) chapter for additional strategies</li> </ul>
<b>Reaching all students</b>	<ul style="list-style-type: none"> <li>TR: Use Access and Equity chapter as reference for strategies</li> </ul>
<b>Math integration</b>	<ul style="list-style-type: none"> <li>IG: Be aware of math connections as described in IG. Look for math icon.</li> </ul>
<b>Develop outdoor and environmental connections</b>	<ul style="list-style-type: none"> <li>IG: Look for outdoor steps in Guiding the Investigation (coded in green)</li> </ul>



# Implementation Progression

Plan for continuous improvement with each new module you teach during one year and from year to year. The duration of a Stage is based on your prior experience and your goals for growth.

Year 2 (or Stage 2)	Year 3 (or Stage 3) and Beyond
<ul style="list-style-type: none"> <li>Work with students on classroom arrangement for active investigations and sense-making discussions</li> </ul>	<ul style="list-style-type: none"> <li>Share ideas and get feedback from colleagues and parents. Use Extensions to meet student needs.</li> </ul>
<ul style="list-style-type: none"> <li>IG: Investigation background, Teaching Children about, Conceptual Flow, Wrap-Up</li> <li>TR: Sense-Making Discussions Using Three-Dimensional Learning (DCI and SEP)</li> </ul>	<ul style="list-style-type: none"> <li>TR: Crosscutting Concepts chapter, make connections between modules</li> <li>TR: Science and Engineering Practices chapter—intentionally connect practices in different modules</li> </ul>
<ul style="list-style-type: none"> <li>Make more time for science. Schedule science earlier in the day.</li> </ul>	<ul style="list-style-type: none"> <li>Make even more time for science in the school day by using science as the context for ELA</li> </ul>
<ul style="list-style-type: none"> <li>Have students take more responsibility for managing materials for the class.</li> </ul>	<ul style="list-style-type: none"> <li>Have certain classes maintain living organisms used by other classes at the school.</li> </ul>
<ul style="list-style-type: none"> <li>Use online activities, virtual investigation, tutorials, science and engineering database to meet student needs.</li> </ul>	<ul style="list-style-type: none"> <li>Have students use Regional Resources to research topics as extensions to classroom investigations and explore field trip possibilities.</li> </ul>
<ul style="list-style-type: none"> <li>TR: Science Notebooks in Grades 3–5 Focus on student-driven data collection, analysis, and reflection</li> </ul>	<ul style="list-style-type: none"> <li>TR: Science Notebooks in Grades 3–5, Next-Step Strategies</li> </ul>
<ul style="list-style-type: none"> <li>Intersection of ELA— using science as a context to develop ELA skills</li> </ul>	<ul style="list-style-type: none"> <li>Intersection of ELA— purposefully using science as a context to develop ELA skills. Collaborate with colleagues.</li> </ul>
<ul style="list-style-type: none"> <li>IG: Investigation and Assessment chapters Use Performance Assessments to evaluate and improve three-dimensional instruction.</li> <li>TR: Sense-Making Discussions Using Three-Dimensional Learning (DCI and SEP)</li> </ul>	<ul style="list-style-type: none"> <li>TR: Assessment Coding Guides Use Next-Step Strategies to Improve understanding of DCI, SEP and CC</li> <li>TR: Sense-Making Discussions, create new ones using templates. Focus on crosscutting concepts.</li> </ul>
<ul style="list-style-type: none"> <li>TR: Sense-Making Discussions for Three-Dimensional Learning</li> </ul>	<ul style="list-style-type: none"> <li>Focus on sense-making discussions using three dimensions</li> </ul>
<ul style="list-style-type: none"> <li>Use <i>Survey</i> data to plan instruction</li> <li>Make greater use of reflective-assessment practice</li> <li>Use Next-Step Strategies for formative and summative assessment</li> <li>Use <i>Survey</i>, <i>I-Checks</i>, and <i>Posttest</i></li> </ul>	<ul style="list-style-type: none"> <li>Implement data-driven changes to instruction based on previous-year's instruction</li> <li>Differentiation for students</li> <li>Use FOSSmap and reports to inform instruction. Refer to this information the next time you teach the module.</li> </ul>
<ul style="list-style-type: none"> <li>TR: FOSS and Common Core ELA—Grade 5, for all opportunities</li> <li>TR: Explore ways to integrate English language proficiency standards to support science learning in FOSS investigations</li> </ul>	<ul style="list-style-type: none"> <li>TR: Science-Centered Language Development in Grade 3–5, use new strategies.</li> <li>TR: Plan collaboratively with school/district specialists to address English language proficiency standards using FOSS as the context</li> </ul>
<ul style="list-style-type: none"> <li>TR: Access and Equity chapter, purposefully implement selected strategies</li> </ul>	<ul style="list-style-type: none"> <li>TR: Access and Equity chapter, reflect on implementation of selected strategies</li> </ul>
<ul style="list-style-type: none"> <li>TR: FOSS and Common Core Math—Grade 5 for all opportunities</li> </ul>	<ul style="list-style-type: none"> <li>TR: Work more with integration of math and use engineering as focus</li> </ul>
<ul style="list-style-type: none"> <li>TR: Taking FOSS Outdoors</li> </ul>	<ul style="list-style-type: none"> <li>Take field trips and partner with local agencies and outdoor agencies to extend classroom experiences</li> </ul>

## ► NOTE

This information and schedule is found on page 29 of the Overview of each module.

## ► NOTE

There is a suggested daily teaching schedule like this one for the other two modules as the grade level.

There is no mandatory sequence for FOSS modules, so check with your district for a recommendation. If you are looking for a suggested sequence, we recommend Earth, Physical, and Life Sciences in that order through the year.

## PLANNING INSTRUCTION

**Scheduling.** Each module is 8–10 weeks long. Below is a suggested teaching schedule for the **Earth and Sun Module**. Each module has a similar schedule. The investigations are numbered and should be taught in order, as the concepts build upon each other from investigation to investigation.

**Active-investigation (A)** sessions include hands-on work with materials, active thinking about experiences, small-group discussion, writing in science notebooks, and learning new vocabulary in context.

**Reading (R)** sessions involve reading *FOSS Science Resources* articles. Reading can be completed during language-arts time to make connections to Common Core State Standards for ELA (CCSS ELA).

During **Wrap-Up/Warm-Up (W)** sessions, students share notebook entries and engage in connections to CCSS ELA. These sessions can also be completed during language-arts time.

I-Checks are short summative assessments at the end of each investigation. Students have a short notebook review session the day before and a self-assessment of selected items the following day.

Week	Day 1	Day 2	Day 3	Day 4	Day 5
	Survey				
1	START Inv. 1 Part 1 A	A/W	START Inv. 1 Part 2 A	A	A
2	R/W	START Inv. 1 Part 3 A/R	Review	I-Check 1	Self-assess
3	START Inv. 2 Part 1	A/R	R/W	START Inv. 2 Part 2 A/R	R/W
4	START Inv. 2 Part 4 A	A/R	R/W	START Inv. 2 Part 5 A	A/R
5	R/Review	I-Check 2	Self-assess	START Inv. 3 Part 1 A	R/W
6	START Inv. 3 Part 2 A/R/W	START Inv. 3 Part 3 A	R/Review	I-Check 3	Self-assess
7	START Inv. 2 Part 3 A	optional R/R/W	START Inv. 4 Part 1 A	A	R/W
8	START Inv. 4 Part 2 A	A	R/W	START Inv. 4 Part 3 A	R/W
9	START Inv. 4 Part 4 A	A	A/R	Review	I-Check 4
10	START Inv. 5 Part 1 A	A/R/W	START Inv. 5 Part 2 A	A/W	START Inv. 5 Part 3 A
11	A/R/R	START Inv. 5 Part 4 W/A/R	R	Review	Posttest

**Safety in the Classroom and Outdoors.** Following the procedures described in each investigation will make for a very safe experience in the classroom. You should also review your district safety guidelines and make sure that everything you do is consistent with those guidelines. Two posters are included in the kit: *FOSS Science Safety* for classroom use and *FOSS Outdoor Safety* for outdoor activities.

Look for the safety icon in the Getting Ready and Guiding the Investigation sections that will alert you to safety considerations throughout the module.

Safety Data Sheets (SDS) for materials used in the FOSS Program can be found on FOSSweb. If you have questions regarding any SDS, call Delta Education at 1-800-258-1302 (Mon.–Fri., 8 a.m.–6 p.m. EST).

**Working in Collaborative Groups.** For most activities in upper-elementary grades, collaborative groups of four in which students take turns assuming specific responsibilities work best. Groups can be identified completely randomly (first four names drawn from a hat constitute group 1), or you can assemble groups to ensure diversity and inclusion. Thoughtfully constituted groups tend to work better. See the Module Overview for more on setting up and using collaborative groups.

**Norms for Sense-Making Discussions.** Setting up norms for discussion and holding yourself and your students accountable is the first step toward creating a culture of productive talk in the classroom that supports engagement in the science and engineering practices. Students need to feel free to express their ideas, and to provide and receive criticism from others as they work toward understanding of the disciplinary core ideas of science and methods of engineering. See the Module Overview for more on setting up and using norms.

**Managing materials.** The Getting Ready section for each part of an investigation helps you prepare. It provides information on scheduling the activities and introduces the tools and techniques used in the activity. Be prepared—read the Getting Ready section thoroughly and review the teacher preparation video on FOSSweb. And review the information in the Materials chapter from time to time.

**FOSSweb.** Make sure that you are registered on FOSSweb and be sure that your three grade-level modules are on your teacher page. Review the four main areas for the first module.

- Teaching the Module
- Materials and Kit Information
- Teacher Resources
- Digital-Only Resources



## FOSS MODULES—GRADE 5

### FOSS GRADE FIVE MODULE: EARTH AND SUN

**Anchor Phenomenon:** *Patterns observed in the sky over a day, a month, a year, and more, and their effect on Earth*

**Driving Questions for the Module**

*How do Earth's geosphere, hydrosphere, atmosphere, and biosphere interact to create a sustainable environment for life*

**Guiding Questions for Investigations**

*How can we predict events based on shadows?*

*What do shadows tell us about daily patterns involving the Earth/Sun system?*

*What objects do we observe in our solar system and how do they move in relation to each other?*

*What do we see outside our system?*

*What is Earth's atmosphere and what does it have to do with weather?*

*How does Earth's atmosphere heat up?*

*How is water distributed over Earth's surface and atmosphere, how does it move, and what is the effect on Earth?*

Students who demonstrate understanding can:

- 5-ESS1-1. Support an argument that the apparent brightness of the Sun and stars is due to their relative distances from Earth.
- 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. [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.]
- 5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.]
- 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.
- 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect Earth's resources and environment
- 5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen. [Clarification Statement: Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.]
- 5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down. [Clarification Statement: Down is a local description that points toward the center of the spherical Earth.]
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.



## FOSS GRADE FIVE MODULE: MIXTURES AND SOLUTIONS

**Anchor Phenomenon:** *Matter and its interactions in our everyday life, such as mixtures, solutions, and chemical reactions.*

### Driving Question for the Module

*What is matter and what happens when samples of matter interact?*

### Guiding Questions for Investigations

*What happens when two or more samples of materials are combined?*

*What is the best way to explain a phenomenon for which you have incomplete information?*

*How can we use models to explain the difference between the phenomena of melting and dissolving?*

*How can solutions made with the same substances be distinguished one from another?*

*How can the property of solubility be used to identify a substance?*

*What observations serve as evidence that a chemical reaction has occurred?*

Students who demonstrate understanding can:

- 5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen. [Clarification Statement: Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]
- 5-PS1-2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.]
- 5-PS1-3. Make observations and measurements to identify materials based on their properties. [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass and weight.]
- 5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

## FOSS GRADE FIVE MODULE: LIVING SYSTEMS

**Anchor Phenomenon:** *Ecosystems and organisms and their interacting parts*

### Driving Question for the Module

*How can we describe Earth's biosphere as a system of interacting parts?*

### Guiding Questions for Investigations

*How does matter and energy move through ecosystems of the biosphere?*

*What is food, where does it come from, and how do organisms use it?*

*How do plants and animals get nutrients to all of their cells?*

*How do animal sensory systems function in the biosphere?*

Students who demonstrate understanding can:

- 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water. [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]
- 4-LS1-2\*. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. [Clarification Statement: Emphasis is on systems of information transfer.] [Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.]
- 5-LS2-1. Use a model to describe the movement of matter among plants, animals, decomposers, and the environment. [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]
- 5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the Sun. [Clarification Statement: Examples of models could include diagrams, and flow charts.]
- 5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]
- 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

\* This performance expectation is addressed in Grade 4 and extended in Grade 5.

# FOSS CONTACTS

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[techsupport.science@schoolspecialty.com](mailto:techsupport.science@schoolspecialty.com)

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### ***Professional Development***

<https://www.fossweb.com/professional-development>

# FOSS Grade-Level Planning Guide—Grade 5

## RECOMMENDED FOSS NEXT GENERATION K–8 SCOPE AND SEQUENCE

Grade	Integrated Middle Grades				
6–8	 Heredity and Adaptation*	 Electromagnetic Force*	 Gravity and Kinetic Energy*	 Waves*	 Planetary Science
	 Chemical Interactions		 Earth History		 Populations and Ecosystems
	 Weather and Water		 Diversity of Life		 Human Systems Interactions*

\*Half-length courses



Physical Science content



Earth Science content



Life Science content



Engineering content

Grade	Physical Science	Earth Science	Life Science
5	Mixtures and Solutions	Earth and Sun	Living Systems
4	Energy	Soils, Rocks, and Landforms	Environments
3	Motion and Matter	Water and Climate	Structures of Life
2	Solids and Liquids	Pebbles, Sand, and Silt	Insects and Plants
1	Sound and Light	Air and Weather	Plants and Animals
K	Materials and Motion	Trees and Weather	Animals Two by Two