FOSS

*Developed at:*

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

# Designed to meet every standard, including yours.

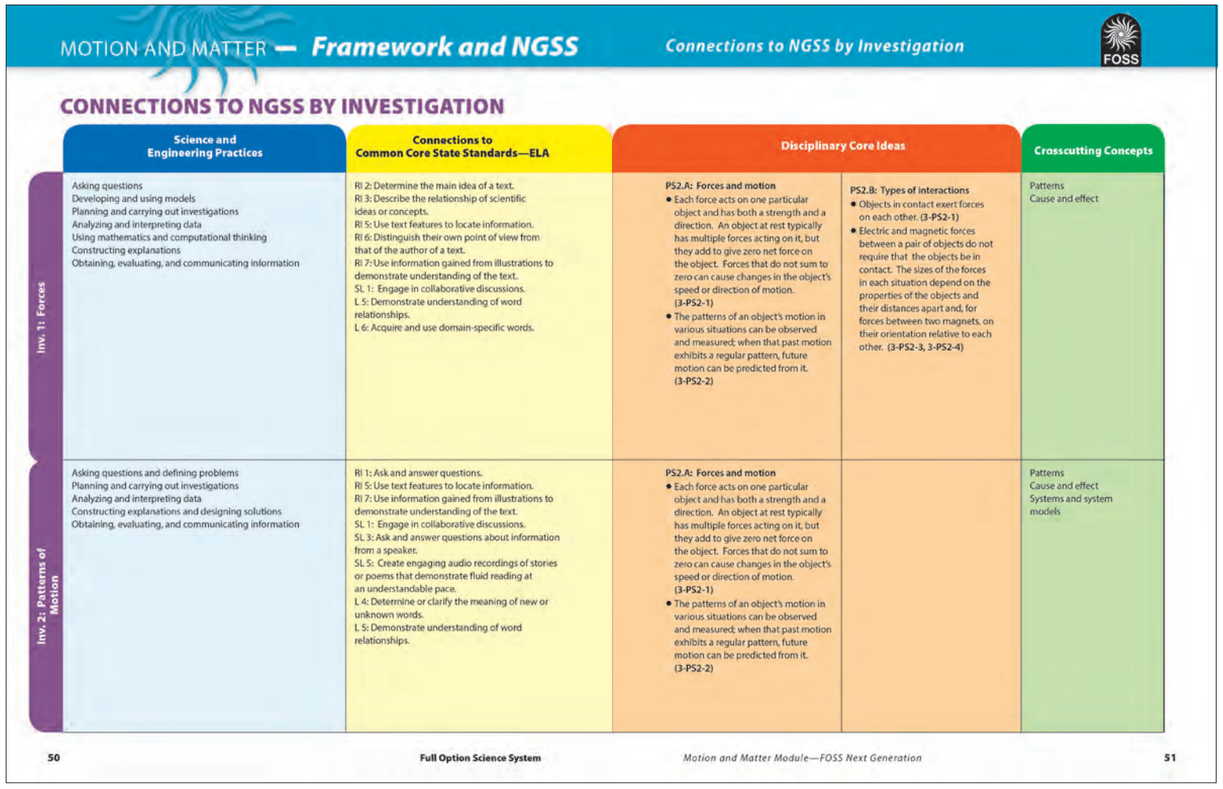
# FOSS doesn't just meet the standards, it embodies them.

Today, standards like the *Framework* and NGSS call for students to not just memorize the material, but to think analytically and solve problems. For three decades, the scholars at UC Berkeley's Lawrence Hall of Science have built FOSS® around these goals. FOSS provides engaging firsthand experiences that focus on three-dimensional learning, builds on them in a developmental progression, and cultivates the ability to deliver on NGSS performance expectations.

**Science and engineering practices** have always been a critical part of FOSS investigations.

Rigorous **ELA connections** build literacy skills through science.

Every FOSS investigation integrates both **disciplinary core ideas** and **crosscutting concepts** for true three-dimensional learning.



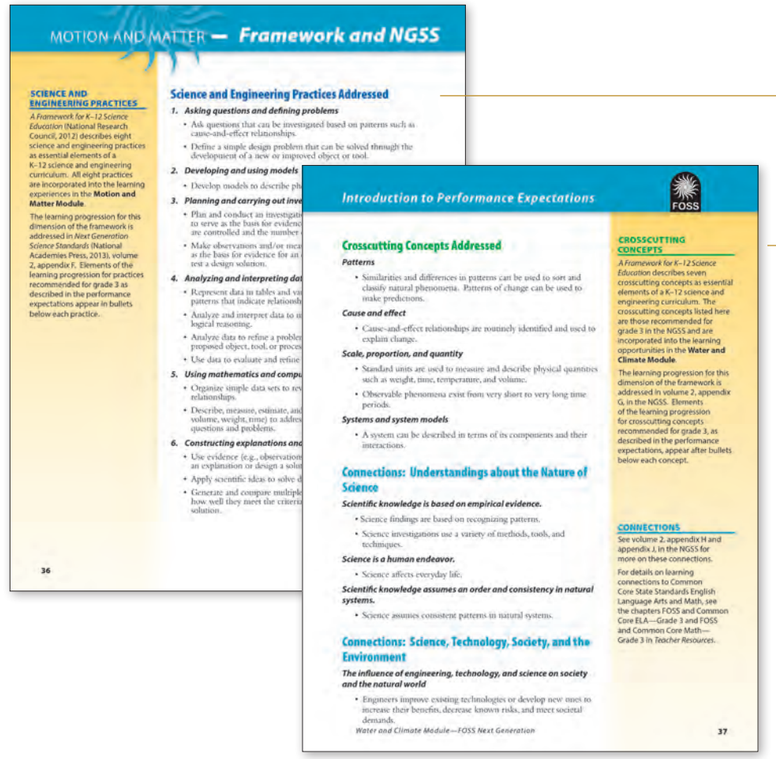
MOTION AND MATTER — *Framework and NGSS* — *Connections to NGSS by Investigation*

FOSS

## CONNECTIONS TO NGSS BY INVESTIGATION

| | Science and Engineering Practices | Connections to Common Core State Standards—ELA | Disciplinary Core Ideas | | Crosscutting Concepts |
|---|---|---|---|---|---|
| Inv. 1: Forces | Asking questions<br>Developing and using models<br>Planning and carrying out investigations<br>Analyzing and interpreting data<br>Using mathematics and computational thinking<br>Constructing explanations<br>Obtaining, evaluating, and communicating information | RI 2: Determine the main idea of a text.<br>RI 3: Describe the relationship of scientific ideas or concepts.<br>RI 5: Use text features to locate information.<br>RI 6: Distinguish their own point of view from that of the author of a text.<br>RI 7: Use information gained from illustrations to demonstrate understanding of the text.<br>SL 1: Engage in collaborative discussions.<br>L 5: Demonstrate understanding of word relationships.<br>L 6: Acquire and use domain-specific words. | **PS2.A: Forces and motion**<br>• Each force acts on one particular object and has both a strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. **(3-PS2-1)**<br>• The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. **(3-PS2-2)** | **PS2.B: Types of interactions**<br>• Objects in contact exert forces on each other. **(3-PS2-1)**<br>• Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. **(3-PS2-3, 3-PS2-4)** | Patterns<br>Cause and effect |
| Inv. 2: Patterns of Motion | Asking questions and defining problems<br>Planning and carrying out investigations<br>Analyzing and interpreting data<br>Constructing explanations and designing solutions<br>Obtaining, evaluating, and communicating information | RI 1: Ask and answer questions.<br>RI 5: Use text features to locate information.<br>RI 7: Use information gained from illustrations to demonstrate understanding of the text.<br>SL 1: Engage in collaborative discussions.<br>SL 3: Ask and answer questions about information from a speaker.<br>SL 5: Create engaging audio recordings of stories or poems that demonstrate fluid reading at an understandable pace.<br>L 4: Determine or clarify the meaning of new or unknown words.<br>L 5: Demonstrate understanding of word relationships. | **PS2.A: Forces and motion**<br>• Each force acts on one particular object and has both a strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. **(3-PS2-1)**<br>• The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. **(3-PS2-2)** | | Patterns<br>Cause and effect<br>Systems and system models |





MOTION AND MATTER — *Framework and NGSS*

**SCIENCE AND ENGINEERING PRACTICES**

*A Framework for K–12 Science Education* (National Research Council, 2012) describes eight science and engineering practices as essential elements of a K–12 science and engineering curriculum. All eight practices are incorporated into the learning experiences in the **Motion and Matter Module**.

The learning progression for this dimension of the framework is addressed in *Next Generation Science Standards* (National Academies Press, 2013), volume 2, appendix F. Elements of the learning progression for practices recommended for grade 3 as described in the performance expectations appear in bullets below each practice.

**Science and Engineering Practices Addressed**

1. ***Asking questions and defining problems***
   - Ask questions that can be investigated based on patterns such as cause-and-effect relationships.
   - Define a simple design problem that can be solved through the development of a new or improved object or tool.
2. ***Developing and using models***
   - Develop models to describe ph…
3. ***Planning and carrying out inve…***
   - Plan and conduct an investigati… to serve as the basis for evidenc… are controlled and the number …
   - Make observations and/or mea… as the basis for evidence for an … test a design solution.
4. ***Analyzing and interpreting dat…***
   - Represent data in tables and vi… patterns that indicate relationsh…
   - Analyze and interpret data to i… logical reasoning.
   - Analyze data to refine a proble… proposed object, tool, or proces…
   - Use data to evaluate and refine …
5. ***Using mathematics and compu…***
   - Organize simple data sets to re… relationships.
   - Describe, measure, estimate, an… volume, weight, time) to addres… questions and problems.
6. ***Constructing explanations and…***
   - Use evidence (e.g., observation… an explanation or design a solut…
   - Apply scientific ideas to solve d…
   - Generate and compare multiple … how well they meet the criteria … solution.

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*Introduction to Performance Expectations* — FOSS

**Crosscutting Concepts Addressed**

***Patterns***
- Similarities and differences in patterns can be used to sort and classify natural phenomena. Patterns of change can be used to make predictions.

***Cause and effect***
- Cause-and-effect relationships are routinely identified and used to explain change.

***Scale, proportion, and quantity***
- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
- Observable phenomena exist from very short to very long time periods.

***Systems and system models***
- A system can be described in terms of its components and their interactions.

**Connections: Understandings about the Nature of Science**

***Scientific knowledge is based on empirical evidence.***
- Science findings are based on recognizing patterns.
- Science investigations use a variety of methods, tools, and techniques.

***Science is a human endeavor.***
- Science affects everyday life.

***Scientific knowledge assumes an order and consistency in natural systems.***
- Science assumes consistent patterns in natural systems.

**Connections: Science, Technology, Society, and the Environment**

***The influence of engineering, technology, and science on society and the natural world***
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.

*Water and Climate Module—FOSS Next Generation* 37

**CROSSCUTTING CONCEPTS**

*A Framework for K–12 Science Education* describes seven crosscutting concepts as essential elements of a K–12 science and engineering curriculum. The crosscutting concepts listed here are those recommended for grade 3 in the NGSS and are incorporated into the learning opportunities in the **Water and Climate Module**.

The learning progression for this dimension of the framework is addressed in volume 2, appendix G, in the NGSS. Elements of the learning progression for crosscutting concepts recommended for grade 3, as described in the performance expectations, appear after bullets below each concept.

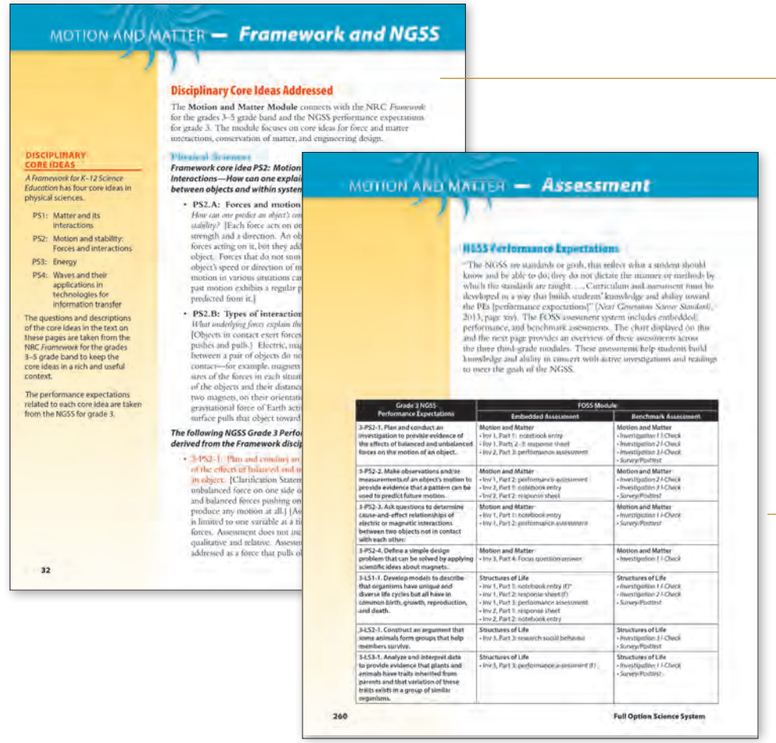
**CONNECTIONS**

See volume 2, appendix H and appendix J, in the NGSS for more on these connections.

For details on learning connections to Common Core State Standards English Language Arts and Math, see the chapters FOSS and Common Core ELA—Grade 3 and FOSS and Common Core Math—Grade 3 in *Teacher Resources*.

Each course highlights the featured **practices** that support long-term college and career readiness.

The **crosscutting concepts** addressed in each investigation help students make connections at a deeper level between science disciplines.



MOTION AND MATTER — *Framework and NGSS*

**DISCIPLINARY CORE IDEAS**

*A Framework for K–12 Science Education* has four core ideas in physical sciences.

- PS1: Matter and its interactions
- PS2: Motion and stability: Forces and interactions
- PS3: Energy
- PS4: Waves and their applications in technologies for information transfer

The questions and descriptions of the core ideas in the text on these pages are taken from the NRC *Framework* for the grades 3–5 grade band to keep the core ideas in a rich and useful context.

The performance expectations related to each core idea are taken from the NGSS for grade 3.

**Disciplinary Core Ideas Addressed**

The **Motion and Motter Module** connects with the NRC *Framework* for the grades 3–5 grade band and the NGSS performance expectations for grade 3. The module focuses on core ideas for force and matter interactions, conservation of matter, and engineering design.

**Physical Sciences**

***Framework core idea PS2: Motion…***
***Interactions—How can one explai…***
***between objects and within syste…***

- **PS2.A: Forces and motion**
  *How can one predict an object's …stability?* [Each force acts on o… strength and a direction. An ob… forces acting on it, but they ad… object. Forces that do not sum … object's speed or direction of m… motion in various situations ca… past motion exhibits a regular p… predicted from it.]
- **PS2.B: Types of interaction…**
  *What underlying forces explain th…* [Objects in contact exert forces … pushes and pulls.) Electric, mag… between a pair of objects do no… contact—for example, magnets … sizes of the forces in each situa… of the objects and their distanc… two magnets, on their orientati… gravitational force of Earth acti… surface pulls that object toward…

***The following NGSS Grade 3 Perfo…***
***derived from the Framework discip…***

- 3-PS2-1. Plan and conduct an … of the effects of balanced and u… on objects. [Clarification Statem… unbalanced force on one side o… and balanced forces pushing on… produce any motion at all.] [Ass… is limited to one variable at a ti… forces. Assessment does not inc… qualitative and relative. Assess… addressed as a force that pulls o…

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MOTION AND MATTER — *Assessment*

**NGSS Performance Expectations**

"The NGSS are standards or goals, that reflect what a student should know and be able to do; they do not dictate the manner or methods by which the standards are taught. . . . Curriculum and assessment must be developed in a way that builds students' knowledge and ability toward the PEs [performance expectations]" (*Next Generation Science Standards*, 2013, page xiv). The FOSS assessment system includes embedded, performance, and benchmark assessments. The chart displayed on this and the next page provides an overview of these assessments across the three third-grade modules. These assessments help students build knowledge and ability in concert with active investigations and readings to meet the goals of the NGSS.

| Grade 3 NGSS Performance Expectations | FOSS Module | |
|---|---|---|
| | Embedded Assessment | Benchmark Assessment |
| 3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. | Motion and Matter<br>• Inv 1, Part 1: notebook entry<br>• Inv 1, Parts 2–3: response sheet<br>• Inv 2, Part 3: performance assessment | Motion and Matter<br>• Investigation 1 Check<br>• Investigation 2 Check<br>• Investigation 3 Check<br>• Survey/Posttest |
| 3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. | Motion and Matter<br>• Inv 1, Part 2: performance assessment<br>• Inv 2, Part 1: notebook entry<br>• Inv 2, Part 2: response sheet | Motion and Matter<br>• Investigation 2 Check<br>• Investigation 3 Check<br>• Survey/Posttest |
| 3-PS2-3. Ask questions to determine cause-and-effect relationships of electric or magnetic interactions between two objects not in contact with each other. | Motion and Matter<br>• Inv 1, Part 1: notebook entry<br>• Inv 1, Part 2: performance assessment | Motion and Matter<br>• Investigation 1 Check<br>• Survey/Posttest |
| 3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas about magnets. | Motion and Matter<br>• Inv 3, Part 4: Focus question/answer | Motion and Matter<br>• Investigation 1 Check |
| 3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. | Structures of Life<br>• Inv 1, Part 1: notebook entry (F)*<br>• Inv 1, Part 2: response sheet (F)<br>• Inv 1, Part 3: performance assessment<br>• Inv 2, Part 1: response sheet<br>• Inv 2, Part 2: notebook entry | Structures of Life<br>• Investigation 1 Check<br>• Investigation 2 Check<br>• Survey/Posttest |
| 3-LS2-1. Construct an argument that some animals form groups that help members survive. | Structures of Life<br>• Inv 3, Part 3: research social behavior | Structures of Life<br>• Investigation 3 Check<br>• Survey/Posttest |
| 3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. | Structures of Life<br>• Inv 3, Part 3: performance assessment (F) | Structures of Life<br>• Investigation 1 Check<br>• Survey/Posttest |

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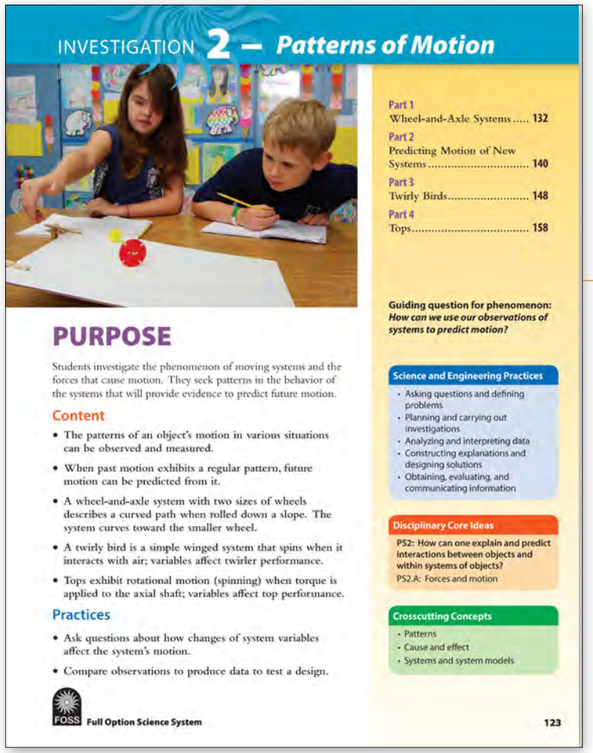
Each course addresses multiple **core ideas** that relate to the grade-level performance expectations.

**Embedded, performance, and benchmark assessments,** during and after active investigations and readings, monitor progress toward NGSS performance expectations.

# FOSS honors NGSS and the Framework.

- FOSS is designed around learning as a developmental progression. FOSS provides experiences that allow students to continually build and develop more complex science and engineering ideas.
- FOSS focuses on core ideas. FOSS chooses depth over superficial coverage, addressing core ideas at multiple grade levels in ever more complex ways.
- FOSS integrates scientific knowledge with the practices of science and engineering. FOSS investigations provide students with engaging firsthand experiences and sense-making activities.



INVESTIGATION 2 — *Patterns of Motion*

Part 1 Wheel-and-Axle Systems ..... 132
Part 2 Predicting Motion of New Systems ..... 140
Part 3 Twirly Birds ..... 148
Part 4 Tops ..... 158

**Guiding question for phenomenon:** ***How can we use our observations of systems to predict motion?***

## PURPOSE

Students investigate the phenomenon of moving systems and the forces that cause motion. They seek patterns in the behavior of the systems that will provide evidence to predict future motion.

### Content

- The patterns of an object's motion in various situations can be observed and measured.
- When past motion exhibits a regular pattern, future motion can be predicted from it.
- A wheel-and-axle system with two sizes of wheels describes a curved path when rolled down a slope. The system curves toward the smaller wheel.
- A twirly bird is a simple winged system that spins when it interacts with air; variables affect twirler performance.
- Tops exhibit rotational motion (spinning) when torque is applied to the axial shaft; variables affect top performance.

### Practices

- Ask questions about how changes of system variables affect the system's motion.
- Compare observations to produce data to test a design.

**Science and Engineering Practices**
- Asking questions and defining problems
- Planning and carrying out investigations
- Analyzing and interpreting data
- Constructing explanations and designing solutions
- Obtaining, evaluating, and communicating information

**Disciplinary Core Ideas**
**PS2: How can one explain and predict interactions between objects and within systems of objects?**
PS2.A: Forces and motion

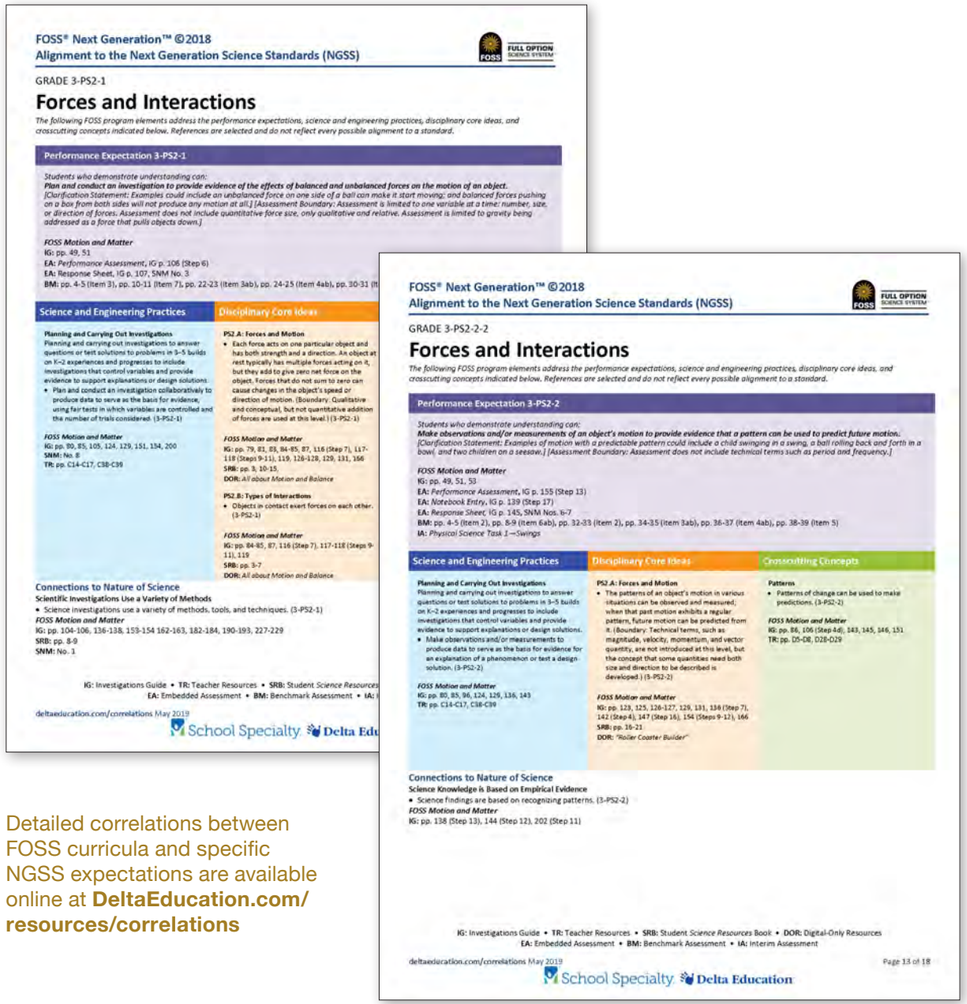
**Crosscutting Concepts**
- Patterns
- Cause and effect
- Systems and system models

FOSS Full Option Science System 123

**Color-coded point-of-use references** are provided every step of the way, from the very beginning of the investigation through the final assessment. They let you see how every FOSS investigation integrates science and engineering practices (blue), disciplinary core ideas (orange), and crosscutting concepts (green) to help students meet NGSS performance expectations.

# FOSS supports NGSS performance expectations.

Performance expectations describe what students should know and be able to do. FOSS carefully crafts a progression of experiences that builds the knowledge and skills students need, enabling them to successfully deliver on NGSS performance expectations.



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Alignment to the Next Generation Science Standards (NGSS)

GRADE 3-PS2-1

**Forces and Interactions**

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

**Performance Expectation 3-PS2-1**

*Students who demonstrate understanding can:*
***Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.*** *[Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]*

***FOSS Motion and Matter***
**IG:** pp. 49, 51
**EA:** *Performance Assessment*, IG p. 106 (Step 6)
**EA:** Response Sheet, IG p. 107, SNM No. 3
**BM:** pp. 4-5 (Item 3), pp. 10-11 (Item 7), pp. 22-23 (Item 3ab), pp. 24-25 (Item 4ab), pp. 30-31 (I

| Science and Engineering Practices | Disciplinary Core Ideas |
|---|---|
| **Planning and Carrying Out Investigations**<br>Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.<br>• Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-PS2-1) | **PS2.A: Forces and Motion**<br>• Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1) |
| ***FOSS Motion and Matter***<br>**IG:** pp. 80, 85, 105, 124, 129, 151, 154, 200<br>**SNM:** No. 8<br>**TR:** pp. C14-C17, C38-C39 | ***FOSS Motion and Matter***<br>**IG:** pp. 79, 83, 85, 94–95, 87, 116 (Step 7), 117-118 (Steps 9-11), 119, 128-128, 129, 131, 166<br>**SRB:** pp. 3, 10-15,<br>**DOR:** *All about Motion and Balance*<br>**PS2.B: Types of Interactions**<br>• Objects in contact exert forces on each other. (3-PS2-1)<br>***FOSS Motion and Matter***<br>**IG:** pp. 84-85, 87, 116 (Step 7), 117-118 (Steps 9-11), 119<br>**SRB:** pp. 3-7<br>**DOR:** *All about Motion and Balance* |

**Connections to Nature of Science**
**Scientific Investigations Use a Variety of Methods**
• Science investigations use a variety of methods, tools, and techniques. (3-PS2-1)
***FOSS Motion and Matter***
**IG:** pp. 104-106, 136-138, 153-154 162-163, 182-184, 190-193, 227-229
**SRB:** pp. 8-9
**SNM:** No. 1

IG: Investigations Guide • TR: Teacher Resources • SRB: Student *Science Resources* Book • DOR: Digital-Only Resources
EA: Embedded Assessment • BM: Benchmark Assessment • IA: I

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Alignment to the Next Generation Science Standards (NGSS)

GRADE 3-PS2-2-2

**Forces and Interactions**

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

**Performance Expectation 3-PS2-2**

*Students who demonstrate understanding can:*
***Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.*** *[Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a seesaw.] [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]*

***FOSS Motion and Matter***
**IG:** pp. 49, 51, 53
**EA:** *Performance Assessment*, IG p. 155 (Step 13)
**EA:** *Notebook Entry*, IG p. 139 (Step 17)
**EA:** *Response Sheet*, IG p. 145, SNM Nos. 6-7
**BM:** pp. 4-5 (Item 2), pp. 8-9 (Item 6ab), pp. 32-33 (Item 2), pp. 34-35 (Item 3ab), pp. 36-37 (Item 4ab), pp. 38-39 (Item 5)
**IA:** *Physical Science Task 1—Swings*

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
|---|---|---|
| **Planning and Carrying Out Investigations**<br>Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.<br>• Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3-PS2-2)<br>***FOSS Motion and Matter***<br>**IG:** pp. 80, 85, 96, 124, 129, 136, 143<br>**TR:** pp. C14-C17, C38-C39 | **PS2.A: Forces and Motion**<br>• The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2)<br>***FOSS Motion and Matter***<br>**IG:** pp. 123, 125, 126-127, 129, 131, 138 (Step 7), 142 (Step 4), 147 (Step 16), 154 (Steps 9-12), 166<br>**SRB:** pp. 16-21<br>**DOR:** *"Roller Coaster Builder"* | **Patterns**<br>• Patterns of change can be used to make predictions. (3-PS2-2)<br>***FOSS Motion and Matter***<br>**IG:** pp. 86, 106 (Step 4d), 143, 145, 146, 151<br>**TR:** pp. D5-D8, D28-D29 |

**Connections to Nature of Science**
**Science Knowledge is Based on Empirical Evidence**
• Science findings are based on recognizing patterns. (3-PS2-2)
***FOSS Motion and Matter***
**IG:** pp. 138 (Step 13), 144 (Step 12), 202 (Step 11)

IG: Investigations Guide • TR: Teacher Resources • SRB: Student *Science Resources* Book • DOR: Digital-Only Resources
EA: Embedded Assessment • BM: Benchmark Assessment • IA: Interim Assessment

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Detailed correlations between FOSS curricula and specific NGSS expectations are available online at **DeltaEducation.com/resources/correlations**

# FOSS promotes three-dimensional active learning.

The FOSS program has always placed student learning of science *practices* on equal footing with science *concepts* and *principles*, with robust interdisciplinary connections. NGSS describes these as science and engineering practices, disciplinary core ideas, and crosscutting concepts. In each FOSS Next Generation investigation, students put together these three dimensions to develop increasingly complex knowledge and understanding.

## Science and Engineering Practices

Scientists and engineers employ science and engineering practices as their cognitive tools to answer questions and design solutions. Using these same tools, FOSS students gather evidence to explain real-world phenomena.

## Disciplinary Core Ideas

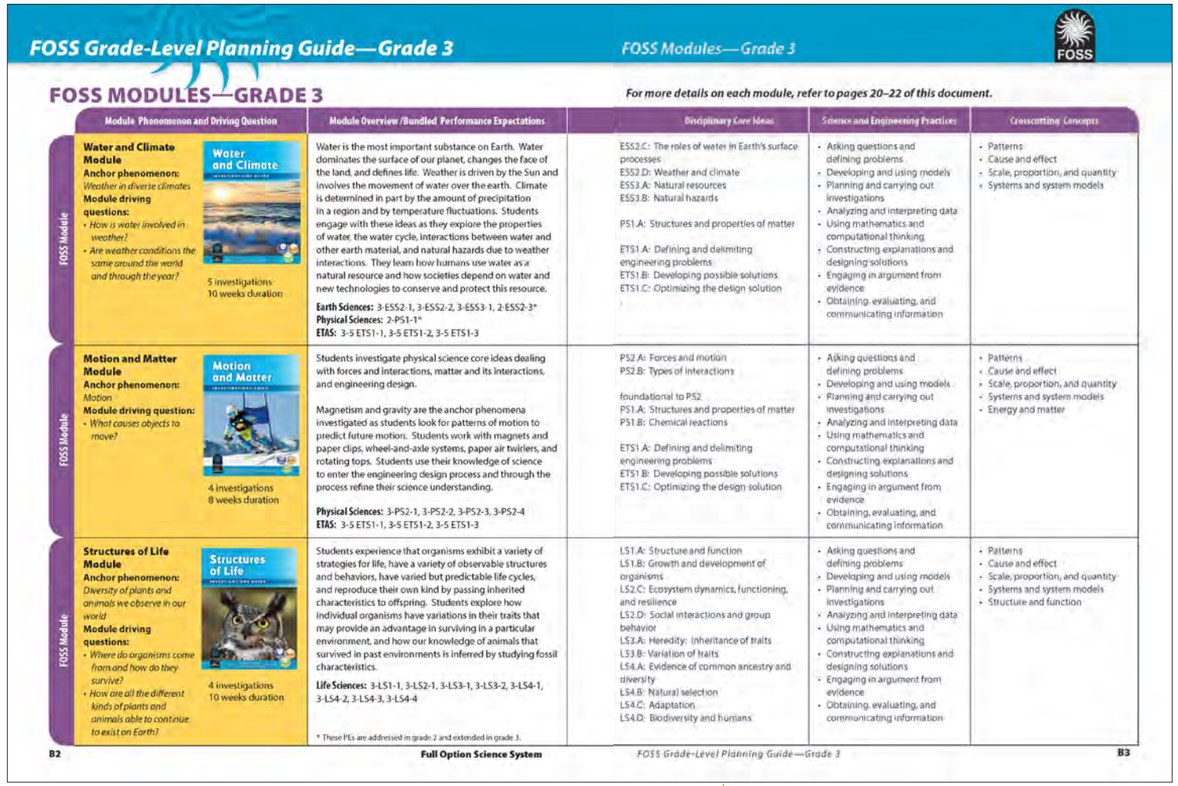
Grade-level appropriate disciplinary core ideas are the concepts and established ideas of science. FOSS students develop these building blocks throughout investigations to make sense of phenomena.

## Crosscutting Concepts

FOSS students apply these concepts to the situations they encounter in order to connect the varied principles and disciplines of science, helping them develop comprehensive understanding.

# FOSS provides three-dimensional support for teaching.

Thinking about science in three dimensions isn't just new to students—it's a whole new world for teachers, too. FOSS eases you into three-dimensional teaching and empowers you to realize your potential as a science learning facilitator, with built-in teaching support.



FOSS Grade-Level Planning Guide—Grade 3

FOSS Modules—Grade 3

FOSS MODULES—GRADE 3

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

| | Module Phenomenon and Driving Question | Module Overview /Bundled Performance Expectations | Disciplinary Core Ideas | Science and Engineering Practices | Crosscutting Concepts |
|---|---|---|---|---|---|
| FOSS Module | **Water and Climate Module**<br>**Anchor phenomenon:** *Weather in diverse climates*<br>**Module driving questions:**<br>• *How is water involved in weather?*<br>• *Are weather conditions the same around the world and through the year?*<br>Water and Climate<br>5 investigations<br>10 weeks duration | Water is the most important substance on Earth. Water dominates the surface of our planet, changes the face of the land, and defines life. Weather is driven by the Sun and involves the movement of water over the earth. Climate is determined in part by the amount of precipitation in a region and by temperature fluctuations. Students engage with these ideas as they explore the properties of water, the water cycle, interactions between water and other earth material, and natural hazards due to weather interactions. They learn how humans use water as a natural resource and how societies depend on water and new technologies to conserve and protect this resource.<br>**Earth Sciences:** 3-ESS2-1, 3-ESS2-2, 3-ESS3-1, 2-ESS2-3*<br>**Physical Sciences:** 2-PS1-1*<br>**ETAS:** 3-5 ETS1-1, 3-5 ETS1-2, 3-5 ETS1-3 | ESS2.C: The roles of water in Earth's surface processes<br>ESS2.D: Weather and climate<br>ESS3.A: Natural resources<br>ESS3.B: Natural hazards<br><br>PS1.A: Structures and properties of matter<br><br>ETS1.A: Defining and delimiting engineering problems<br>ETS1.B: Developing possible solutions<br>ETS1.C: Optimizing the design solution | • Asking questions and defining problems<br>• Developing and using models<br>• Planning and carrying out investigations<br>• Analyzing and interpreting data<br>• Using mathematics and computational thinking<br>• Constructing explanations and designing solutions<br>• Engaging in argument from evidence<br>• Obtaining, evaluating, and communicating information | • Patterns<br>• Cause and effect<br>• Scale, proportion, and quantity<br>• Systems and system models |
| FOSS Module | **Motion and Matter Module**<br>**Anchor phenomenon:** *Motion*<br>**Module driving question:**<br>• *What causes objects to move?*<br>Motion and Matter<br>4 investigations<br>8 weeks duration | Students investigate physical science core ideas dealing with forces and interactions, matter and its interactions, and engineering design.<br><br>Magnetism and gravity are the anchor phenomena investigated as students look for patterns of motion to predict future motion. Students work with magnets and paper clips, wheel-and-axle systems, paper air twirlers, and rotating tops. Students use their knowledge of science to enter the engineering design process and through the process refine their science understanding.<br>**Physical Sciences:** 3-PS2-1, 3-PS2-2, 3-PS2-3, 3-PS2-4<br>**ETAS:** 3-5 ETS1-1, 3-5 ETS1-2, 3-5 ETS1-3 | PS2.A: Forces and motion<br>PS2.B: Types of interactions<br><br>foundational to PS2<br>PS1.A: Structures and properties of matter<br>PS1.B: Chemical reactions<br><br>ETS1.A: Defining and delimiting engineering problems<br>ETS1.B: Developing possible solutions<br>ETS1.C: Optimizing the design solution | • Asking questions and defining problems<br>• Developing and using models<br>• Planning and carrying out investigations<br>• Analyzing and interpreting data<br>• Using mathematics and computational thinking<br>• Constructing explanations and designing solutions<br>• Engaging in argument from evidence<br>• Obtaining, evaluating, and communicating information | • Patterns<br>• Cause and effect<br>• Scale, proportion, and quantity<br>• Systems and system models<br>• Energy and matter |
| FOSS Module | **Structures of Life Module**<br>**Anchor phenomenon:** *Diversity of plants and animals we observe in our world*<br>**Module driving questions:**<br>• *Where do organisms come from and how do they survive?*<br>• *How are all the different kinds of plants and animals able to continue to exist on Earth?*<br>Structures of Life<br>4 investigations<br>10 weeks duration | Students experience that organisms exhibit a variety of strategies for life, have a variety of observable structures and behaviors, have varied but predictable life cycles, and reproduce their own kind by passing inherited characteristics to offspring. Students explore how individual organisms have variations in their traits that may provide an advantage in surviving in a particular environment, and how our knowledge of animals that survived in past environments is inferred by studying fossil characteristics.<br>**Life Sciences:** 3-LS1-1, 3-LS2-1, 3-LS3-1, 3-LS3-2, 3-LS4-1, 3-LS4-2, 3-LS4-3, 3-LS4-4<br><br>* These PEs are addressed in grade 2 and extended in grade 3. | LS1.A: Structure and function<br>LS1.B: Growth and development of organisms<br>LS2.C: Ecosystem dynamics, functioning, and resilience<br>LS2.D: Social interactions and group behavior<br>LS3.A: Heredity: Inheritance of traits<br>LS3.B: Variation of traits<br>LS4.A: Evidence of common ancestry and diversity<br>LS4.B: Natural selection<br>LS4.C: Adaptation<br>LS4.D: Biodiversity and humans | • Asking questions and defining problems<br>• Developing and using models<br>• Planning and carrying out investigations<br>• Analyzing and interpreting data<br>• Using mathematics and computational thinking<br>• Constructing explanations and designing solutions<br>• Engaging in argument from evidence<br>• Obtaining, evaluating, and communicating information | • Patterns<br>• Cause and effect<br>• Scale, proportion, and quantity<br>• Systems and system models<br>• Structure and function |



**Your Grade-Level Planning Guide** provides helpful tools for ensuring complete coverage of performance expectations.

# FOSS: A vision fulfilled. Science teaching transformed.

Every student deserves the benefits of science education—not just exposure to scientific phenomena, but the opportunity to understand and explain them. From its foundation, FOSS was built to afford that opportunity to all, regardless of background culture, language, or ability.

The scholars at the Lawrence Hall of Science designed FOSS around the principle of collaborative, active investigation. FOSS effectively engages all students by inviting them to interact with observable phenomena, a teaching philosophy subsequently codified with the arrival of NGSS. FOSS makes science accessible and equitable for every student in every classroom. This active learning philosophy has turned two million students and 100,000 teachers into hands-on active investigators of scientific phenomena. FOSS is recognized today by experts and organizations across the country for its proven quality, rigor, support, and effectiveness.

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