# FOSS® Next Generation™

## NGSS Alignment Overview

### Middle School

Three-dimensional active science for the Next Generation


June 2017

*The Next Generation of*

# NGSS Alignment

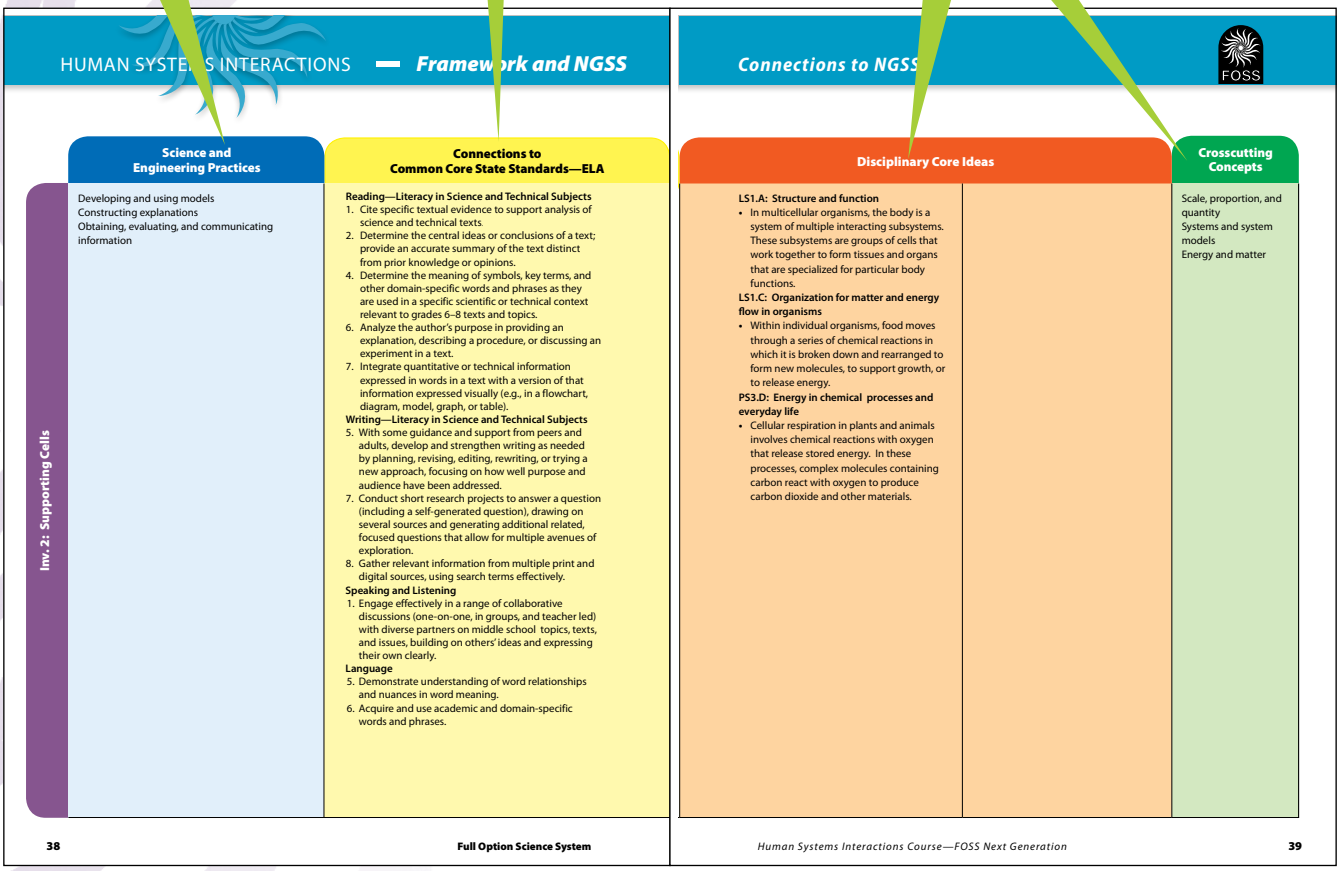
## **FOSS Next Generation** fulfills the vision of the *Framework* and the NGSS in three key ways:

1. **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.
2. **FOSS focuses on core ideas**—FOSS chooses depth over superficial coverage and addresses core ideas at multiple grade levels in evermore complex ways.
3. **FOSS integrates scientific knowledge with the practices of science and engineering**—FOSS investigations provide students with engaging firsthand experiences and sense-making activities.

**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.**



HUMAN SYSTEMS INTERACTIONS — *Framework and NGSS*

*Connections to NGSS*

| Inv. 2: Supporting Cells | Science and Engineering Practices | Connections to Common Core State Standards—ELA | Disciplinary Core Ideas | | Crosscutting Concepts |
|---|---|---|---|---|---|
| | Developing and using models<br>Constructing explanations<br>Obtaining, evaluating, and communicating information | **Reading—Literacy in Science and Technical Subjects**<br>1. Cite specific textual evidence to support analysis of science and technical texts.<br>2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.<br>4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.<br>6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.<br>7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).<br>**Writing—Literacy in Science and Technical Subjects**<br>5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.<br>7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.<br>8. Gather relevant information from multiple print and digital sources, using search terms effectively.<br>**Speaking and Listening**<br>1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on middle school topics, texts, and issues, building on others' ideas and expressing their own clearly.<br>**Language**<br>5. Demonstrate understanding of word relationships and nuances in word meaning.<br>6. Acquire and use academic and domain-specific words and phrases. | **LS1.A: Structure and function**<br>• In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.<br>**LS1.C: Organization for matter and energy flow in organisms**<br>• Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.<br>**PS3.D: Energy in chemical processes and everyday life**<br>• Cellular respiration in plants and animals involves chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. | | Scale, proportion, and quantity<br>Systems and system models<br>Energy and matter |

38 Full Option Science System

*Human Systems Interactions Course—FOSS Next Generation* 39

Contact a Sales Representative at 800.338.5270

# FOSS Instructional Design

FOSS is designed around active investigations that provide engagement with science concepts and science and engineering practices. Surrounding and supporting those firsthand investigations are experiences that help build student understanding of core science concepts and deepen scientific habits of mind.

---

## SCIENCE NOTEBOOKS

Students organize data and thinking to create a personalized record of learning.

## FORMATIVE ASSESSMENT

Ongoing assessment monitors student progress and drives future instruction.

## SCIENCE-CENTERED LANGUAGE DEVELOPMENT

Using the connections between science and language arts, students read, write, and discuss their experiences.


## REAL-WORLD APPLICATIONS

Engineering and problem solving challenges make connections to everyday life.

## READING INFORMATIONAL TEXT

Students analyze informational text to extend and enrich their experiences.

## INTEGRATED TECHNOLOGY

Online activities review and provide application opportunities for each investigation.

# FOSS Next Generation

## Physical Science Performance Expectations

| | | Chemical Interactions | Waves | Electro-magnetic Force | Gravity and Kinetic Energy | Variables and Design |
|---|---|---|---|---|---|---|
| **MS-PS1-1** | Develop models to describe the atomic composition of simple molecules and extended structures. | ✔ | | | | |
| **MS-PS1-2** | Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. | ✔ | | | | |
| **MS-PS1-3** | Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. | ✔ | | | | |
| **MS-PS1-4** | Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. | ✔ | | | | |
| **MS-PS1-5** | Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. | ✔ | | | | |
| **MS-PS1-6** | Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.* | ✔ | | | | |
| **MS-PS2-1** | Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.* | | | | ✔ | |
| **MS-PS2-2** | Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. | | | ✔ | ✔ | |
| **MS-PS2-3** | Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. | | | ✔ | | |
| **MS-PS2-4** | Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. | | | | ✔ | |
| **MS-PS2-5** | Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. | | | ✔ | ✔ | |
| **MS-PS3-1** | Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. | | | | ✔ | |
| **MS-PS3-2** | Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. | | | ✔ | ✔ | |
| **MS-PS3-3** | Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.* | ✔ | | | | |
| **MS-PS3-4** | Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. | ✔ | | | | |
| **MS-PS3-5** | Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object. | ✔ | | ✔ | ✔ | ✔ |
| **MS-PS4-1** | Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. | | ✔ | | | |
| **MS-PS4-2** | Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. | | ✔ | | | |
| **MS-PS4-3** | Integrate qualitative scientific and technical information to support the claim that digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. | | ✔ | | | |
| | *Additional performance expectations addressed:* | | **HS-ESS2-3** | **MS-ESS3-3**<br>**MS-ESS3-4** | **MS-ESS1-2** | |

*Courses in grey have not yet been published.*
*Anticipated performance expectation coverage is shown.*

# FOSS Next Generation

## Physical Science Performance Expectations *continued*

| | | Chemical Interactions | Waves | Electro-magnetic Force | Gravity and Kinetic Energy | Variables and Design |
|---|---|---|---|---|---|---|
| **MS-ETS-1** | Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. | ✔ | ✔ | ✔ | ✔ | ✔ |
| **MS-ETS-2** | Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. | ✔ | ✔ | ✔ | ✔ | ✔ |
| **MS-ETS-3** | Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. | ✔ | ✔ | ✔ | ✔ | ✔ |
| **MS-ETS-4** | Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. | ✔ | ✔ | ✔ | ✔ | ✔ |

## Physical Science Core Ideas

| | | Chemical Interactions | Waves | Electro-magnetic Force | Gravity and Kinetic Energy | Variables and Design |
|---|---|---|---|---|---|---|
| **PS1.A** | Structures of Matter and Nuclear Processes | ✔ | | | | |
| **PS1.B** | Chemical Reactions | ✔ | | | | |
| **PS2.A** | Forces and Motion | | | ✔ | ✔ | |
| **PS2.B** | Types of Interactions | | | ✔ | ✔ | |
| **PS3.A** | Definitions of Energy | ✔ | | ✔ | ✔ | |
| **PS3.B** | Conservation of Energy and Energy Transfer | ✔ | | ✔ | ✔ | |
| **PS3.C** | Relationship between Energy and Forces | | | ✔ | ✔ | |
| **PS3.D** | Energy in Chemical Processes and Everyday Life | | | | | |
| **PS4.A** | Wave Properties | | ✔ | | | |
| **PS4.B** | Electromagnetic Radiation | | ✔ | | | |
| **PS4.C** | Information Technologies in Instrumentation | | ✔ | | | |
| **ETS1.A** | Defining and Delimiting Engineering Problems | ✔ | ✔ | ✔ | ✔ | |
| **ETS1.B** | Developing Possible Solutions | ✔ | ✔ | ✔ | ✔ | |
| **ETS1.C** | Optimizing the Design Solution | ✔ | ✔ | ✔ | ✔ | |

*Courses in grey have not yet been published.*
*Anticipated performance expectation coverage is shown.*

# FOSS Next Generation

## **Earth Science** Performance Expectations

| | | Weather and Water | Earth History | Planetary Science |
|---|---|---|---|---|
| **MS-ESS1-1** | Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. | ✔ | | ✔ |
| **MS-ESS1-2** | Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. | | | ✔ |
| **MS-ESS1-3** | Analyze and interpret data to determine scale properties of objects in the solar system. | | | ✔ |
| **MS-ESS1-4** | Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. | | ✔ | ✔ |
| **MS-ESS2-1** | Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. | | ✔ | |
| **MS-ESS2-2** | Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. | | ✔ | ✔ |
| **MS-ESS2-3** | Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. | | ✔ | |
| **MS-ESS2-4** | Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. | ✔ | | ✔ |
| **MS-ESS2-5** | Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. | ✔ | | |
| **MS-ESS2-6** | Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. | ✔ | | |
| **MS-ESS3-1** | Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. | | ✔ | ✔ |
| **MS-ESS3-2** | Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. | ✔ | ✔ | |
| **MS-ESS3-3** | Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. | ✔ | ✔ | ✔ |
| **MS-ESS3-4** | Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. | ✔ | ✔ | ✔ |
| **MS-ESS3-5** | Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. | ✔ | ✔ | |
| | *Additional performance expectations addressed:* | **PS1-4, PS3-3, PS3-4, PS3-5** | **LS4-1** | **PS2-4, PS4-1, PS4-2, ETS1-1** |

# FOSS Next Generation

## Earth Science Core Ideas

| | | Weather and Water | Earth History | Planetary Science |
|---|---|---|---|---|
| **ESS1.A** | The Universe and Its Stars | | | ✔ |
| **ESS1.B** | Earth and the Solar System | ✔ | | ✔ |
| **ESS1.C** | The History of Planet Earth | | ✔ | ✔ |
| **ESS2.A** | Earth's Materials and Systems | | ✔ | ✔ |
| **ESS2.B** | Plate Tectonics and Large-Scale System Interactions | | ✔ | |
| **ESS2.C** | The Roles of Water in Earth's Surface Processes | ✔ | ✔ | ✔ |
| **ESS2.D** | Weather and Climate | ✔ | | |
| **ESS3.A** | Natural Resources | | ✔ | ✔ |
| **ESS3.B** | Natural Hazards | ✔ | ✔ | |
| **ESS3.C** | Human Impacts on Earth Systems | ✔ | ✔ | ✔ |
| **ESS3.D** | Global Climate Change | ✔ | ✔ | |
| | *Additional core ideas addressed:* | **PS1.A, PS3.A, PS3.B, ETS1.A, ETS1.B, ETS1.C** | **LS4.A** | **PS2.B, PS4.A, PS4.B, ETS1.A** |

# FOSS Next Generation

## Life Science Performance Expectations

| | | Diversity of Life | Populations and Ecosystems | Heredity and Adaptation | Human Systems Interactions |
|---|---|---|---|---|---|
| **MS-LS1-1** | Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. | ✔ | | | ✔ |
| **MS-LS1-2** | Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. | ✔ | | | |
| **MS-LS1-3** | Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. | ✔ | | | ✔ |
| **MS-LS1-4** | Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. | ✔ | | | |
| **MS-LS1-5** | Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. | ✔ | | | |
| **MS-LS1-6** | Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. | ✔ | ✔ | | |
| **MS-LS1-7** | Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. | ✔ | ✔ | | ✔ |
| **MS-LS1-8** | Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. | | | | ✔ |
| **MS-LS2-1** | Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. | | ✔ | | |
| **MS-LS2-2** | Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. | | ✔ | | |
| **MS-LS2-3** | Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. | | ✔ | | |
| **MS-LS2-4** | Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. | | ✔ | | |
| **MS-LS2-5** | Evaluate competing design solutions for maintaining biodiversity and ecosystem services.* | | ✔ | | |
| **MS-LS3-1** | Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. | | | ✔ | |
| **MS-LS3-2** | Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. | ✔ | | ✔ | |
| **MS-LS4-1** | Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. | | | ✔ | |
| **MS-LS4-2** | Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. | | | ✔ | |

*Courses in grey have not yet been published.*
*Anticipated performance expectation coverage is shown.*

# FOSS Next Generation

## Life Science Performance Expectations *continued*

| | | Diversity of Life | Populations and Ecosystems | Heredity and Adaptation | Human Systems Interactions |
|---|---|---|---|---|---|
| **MS-LS4-3** | Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. | | | ✔ | |
| **MS-LS4-4** | Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. | | | ✔ | |
| **MS-LS4-5** | Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. | | | ✔ | |
| **MS-LS4-6** | Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. | | | ✔ | |
| | *Additional performance expectations addressed* | | **ESS3.3, ESS3.4, ETS1.1, ETS1.2** | | |

## Life Science Core Ideas

| | | Diversity of Life | Populations and Ecosystems | Heredity and Adaptation | Human Systems Interactions |
|---|---|---|---|---|---|
| **LS1.A** | Structure and Function | ✔ | | | ✔ |
| **LS1.B** | Growth and Development of Organisms | ✔ | ✔ | | |
| **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 | | ✔ | | |
| **LS2.C** | Ecosystems Dynamics, Functioning, and Resilience | ✔ | ✔ | | |
| **LS3.A** | Inheritance of Traits | | | ✔ | |
| **LS3.B** | Variation of Traits | | | ✔ | |
| **LS4.A** | Evidence of Common Ancestry and Diversity | | | ✔ | |
| **LS4.B** | Natural Selection | | | ✔ | |
| **LS4.C** | Adaptation | | | ✔ | |
| **LS4.D** | Biodiversity and Humans | | ✔ | | |
| | *Additional core ideas addressed:* | | **PS3.D, ESS3.C, ETS1.B** | | **PS3.D** |

*Courses in grey have not yet been published.*
*Anticipated performance expectation coverage is shown.*

# FOSS Next Generation

| Science and Engineering Practices | Chemical Interactions | Waves | Electromagnetic Force | Gravity and Kinetic Energy | Variables and Design | Weather and Water | Earth History | Planetary Science | Diversity of Life | Populations and Ecosystems | Heredity and Adaptation | Human Systems Interactions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Asking Questions and Defining Problems | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Developing and Using Models | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Planning and Carrying Out Investigations | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Analyzing and Interpreting Data | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Using Mathematics and Computational Thinking | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Constructing Explanations and Designing Solutions | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Engaging in Argument From Evidence | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Obtaining, Evaluating, and Communicating Information | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |

## Crosscutting Concepts

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Patterns | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Cause and Effect | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Scale, Proportion, and Quantity | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Systems and System Models | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Energy and Matter | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | | ✔ |
| Structure and Function | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ |
| Stability and Change | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | |

*Courses in grey have not yet been published. Visit **deltaeducation.com/fossng** for the latest version of this document.*

# Join the **Next Generation!**

# FOSS Next Generation
## Recommended K–8 Scope and Sequence

| Grade | Physical Science | Earth Science | Life Science |
|---|---|---|---|
| 6–8 | Waves*<br>Gravity and Kinetic Energy* | Planetary Science | Human Systems Interactions*<br>Heredity and Adaptation* |
| | Chemical Interactions | Earth History | Populations and Ecosystems |
| | Electromagnetic Force*<br>Variables and Design* | Weather and Water | Diversity of Life |
| 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 |

**Half-length course*

PUBLISHED AND DISTRIBUTED BY
Delta Education
...because children learn by doing.®

DEVELOPED AT
THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

FOSS research supported in part by NSF

School Specialty.

Contact a Sales Representative at 800.338.5270