

# FULL OPTION SCIENCE SYSTEM FOR MIDDLE SCHOOL (FOSS/MS)

*FOSS/MS* is a 9-course middle school science curriculum for grades 6, 7, and 8. The courses are grouped into three strands: Life Science, Physical Science and Technology, and Earth and Space Science. Each strand includes three courses. The Middle School program complements the *FOSS K–6* program, also developed by the Lawrence Hall of Science, University of California at Berkeley. The program is published and distributed by Delta Education.

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 Web Sites: <http://www.deltaeducation.com/teachers/middle/foss.html>  
[www.lhsfoss.org](http://www.lhsfoss.org)  
[www.fossworks.com](http://www.fossworks.com)

**CONTENT** Descriptions of the *FOSS for Middle School (FOSS/MS)* courses are listed in the table below.

STRAND	UNIT TITLE	UNIT DESCRIPTION
Life Science	<i>Human Brain and Senses</i> Grades 7–8	Students investigate how the brain and senses acquire, interpret and respond to information (stimuli) from the environment. An emphasis on vision and touch leads to investigations of the structure and function of the sensory organs, receptors, and the brain itself. Imaging techniques (MRI and EEG) are used to reveal brain anatomy and activity. Students also explore learning, memory, and sensory dysfunction. Concepts: structure/function, perception, stimulus/response, learning, neurotransmission.
	<i>Diversity of Life</i> Grades 6–7	Students observe and maintain protists, plants, and animals in the classroom and study their characteristic features. The study progresses from macroscopic to microscopic observation to discover the fundamental unit of life, the cell. Students then investigate organism subsystems and behaviors, and consider their diversity of adaptive structures and strategies. Concepts: cell, tissue, organism, structure, function, behavior, adaptation, system, interaction.
	<i>Populations and Ecosystems</i> Grades 7–8	Students raise populations of organisms to discover population dynamics and interactions over a range of conditions. They learn that food is the source of energy used by all life forms in all ecosystems to conduct life processes. Reproduction, including limiting factors, heredity, and natural selection are explored as ways to understand both the similarity and the variation within and between species. Concepts: species, population, community, ecosystem, food chain, food web, limiting factor, biotic environment, abiotic environment, genetics, trait, adaptation, natural selection.
Physical Science and Technology	<i>Electronics</i> Grades 7–8	Students will learn fundamental electrical circuitry and basic electronic principles. They make simple and complex circuits, quantify electrical interactions and properties (current, voltage, resistance) using a digital multimeter, and discover how different components affect circuits (resistors, diodes, LEDs, capacitors, transistors). They make and read schematics, and construct solid-state devices. Concepts: circuit, Ohm's law, component, meter, digital, energy potential, current, resistance.

	<i>Force and Motion</i> <b>In Development</b>	Students investigate linear motion, including position, and several aspects of change of position—distance, speed, and acceleration. They investigate fundamental forces (gravity and electromagnetism) in familiar environments, such as pushes, pulls, impacts, and falls. Interaction and outcomes are represented graphically to help students think mathematically about their observations. Investigations of opposing forces and additive forces help students develop the idea that a net force on an object produces motion. An object in motion has momentum, and momentum is conserved. Students acquire the most fundamental and most important understanding about the interplay between force and motion: Force = mass X acceleration. Concepts: force, position, distance, motion, acceleration, speed, change, gravity, mass, linear, technology.
	<i>Chemical Interactions</i> <b>In Development</b>	Students learn the atomic theory of matter and use this notion to think theoretically about familiar materials and chemical interactions, such as the behavior of oil and water, rusting, dissolving of common materials, plastics, and melting ice with salt. The history of the development of the periodic table of the elements will guide an inquiry into the properties of the elements found on Earth. Concepts: atom, molecule, reaction, oxidation, element, solution, and concentration.
<b>Earth and Space Science</b>	<i>Planetary Science</i> Grades 7–8	Students study the Earth as a celestial object before progressing to lunar science and lunar exploration, and then on to the solar system. Activities explore the origin of the Moon, celestial motions, Moon phases, lunar geology, cratering processes, imaging technologies, scaling and space exploration. Concepts: solar system, planet, satellite, crater, atmosphere, scale, orbit, revolution, day and night, interaction, change.
	<i>Earth History</i> Grades 7–8	Students investigate rocks and fossils to discover clues that reveal Earth’s history. They explore sedimentary rocks and fossils from the Grand Canyon, consider the processes that created them, and compare evidence discovered in the rocks to present-day geologic processes and contemporary life forms. The students use these data to make inferences about past organisms, environments, and events that occurred on Earth over its history. Concepts: erosion, deposition, sedimentation, lithification, index fossil, rock formation, landform, prehistoric environment, evidence.
	<i>Weather and Water</i> Grades 6–7	Students investigate the properties of Earth’s atmosphere and the processes that produce weather, including energy transfer, atmospheric pressure, and water cycle. They study principles that govern temperature, wind, humidity, precipitation, and severe weather. Students collect and analyze local and global weather data using instruments and reports from various media. They investigate fresh water as a vital resource. Additional concepts: heat, radiation, conduction, convection, density, pressure, condensation, water cycle, drainage basin, and climate. Concepts: heat, radiation, conduction, convection, density, pressure, condensation, water cycle, drainage, and climate.

**FORMAT Teacher Guide:** Each FOSS/MS course comprises about 10 investigations, often divided into several smaller parts, or “sub-investigations.” Each investigation begins with an at-a-glance chart, which outlines the objectives, assessment opportunities, and materials preparation for each sub-investigation. The teacher guides provide extensive scientific and historical background, and directly address the question, “Why do we have to learn this?” Instructional procedures and guidelines for facilitating student learning are discussed in detail. The teacher guides also provide a variety of assessments with scoring guides, master copies of student record sheets, and links to the relevant National Science Education Standards.

**Lab Notebook:** The lab notebook contains recording sheets and data organizers for the investigations. One lab notebook is included in the kit to be

used as a set of duplicated masters. Schools can purchase additional copies to be used as consumable books.

**Resources Book:** The Resources books contain images, data, and readings for students. Sixteen Resources Books are included in the kit.

**Materials Kit:** Each FOSS/MS course materials kit contains all of the equipment needed to implement the course with five classes of 32 students. The kit also contains class resource materials, such as posters, maps, books, and videos. All kits include a set of transparencies. Consumable materials can be replenished by ordering line items.

**Multimedia CD-ROM:** The CD-ROM includes data sets, video clips, high-resolution images, and simulations that all link to the instructional objectives. It can be used as a whole-class demonstration tool or as an individual or small-group instructional tool. Five CDs are included in the kit.

**INSTRUCTIONAL DESIGN** FOSS/MS uses a number of strategies to enhance learning.

- *Concrete Experiences:* First hand experience with scientific phenomena and hands-on materials is essential for the middle school science student. In the FOSS/MS courses, students conduct investigations and experiments, observe natural phenomena, make models, and create simulations.
- *Representational Materials:* Images, maps, and photographs bring “objects” into the classroom that would otherwise be beyond reach (e.g., photographs of moon craters).
- *Symbolic Materials (Reading, Writing, and Mathematics):* FOSS/MS is an integrated program and provides a diverse array of readings, and many opportunities to exercise mathematics skills. Although reading materials are included in the *Resources Book*, students are encouraged to seek additional reading materials from other sources, usually referenced in the *References* section of the Teacher Guide.

FOSS investigations are written to accommodate different methods for recording and organizing data (e.g., lab notebooks, student binders, student journal, etc.). Similarly, units and investigations vary in the type of formats and combinations of methods suggested for organizing information.

- *Schoolyard Field Trips:* As much as possible, FOSS courses incorporate opportunities to explore and understand the local environment right outside school walls.
- *Group Work:* Throughout the courses, students have opportunities to work individually, in pairs, and in teams.

**ASSESSMENT** In the FOSS/MS program, students are assessed in three areas: *content knowledge*, *conducting investigations*, and *building explanations*. These three areas are called the FOSS “Assessment Variables.” *Content knowledge* refers to the “facts and concepts” that students learn throughout the course. *Conducting investigations* focuses on skills, such as experimental design and data organization. *Building explanations* refers to students’ abilities to analyze evidence and process for meaning.

The FOSS/MS program provides teachers with multiple, varied tools for assessing students’ progress and achievement. Formative assessments, for example, are embedded throughout the course and are designed to gauge student thinking and inform instruction. Formative assessments include

quick writes, informal notes, teacher observations, student journal entries, and self-assessments. Summative assessments, designed to evaluate student achievement, are also included in the *FOSS/MS* program. These assessments almost always occur at the end of an investigation or series of investigations, and are graded. Each module includes several mid-summative exams and one final summative exam, all of which include multiple choice, short answer, and narrative questions.

**RESOURCES  
AND SUPPORT**

Delta Education publishes and distributes the *FOSS* program. Delta hosts one-day Informational Institutes during the year in conjunction with the NSTA Area and National Conventions. Institutes are designed for all educators—lead teachers, administrators, curriculum coordinators, university methods instructors, science committee members, and school board members. The Institutes are designed to spend time with the program materials, doing activities and engaging in discussions about instruction and implementation of the Program. The Institutes are led by *FOSS* development staff. There is no charge, but participants must register in advance to attend. For more information, visit Delta's Web site <[www.deltaeducation.com](http://www.deltaeducation.com)>.