OVERVIEW
MATTER AND ENERGY

CONTENT GOALS

The **Matter and Energy Module** consists of four sequential investigations to introduce the multiple forms that matter and energy can take and to give students experience with the transfer of energy from one form to another. Light absorption and reflection is the focus of an entire investigation. Students also conduct and observe chemical reactions and are introduced to atoms and elements.

FOSS EXPECTS STUDENTS TO

- Learn that light from the Sun is the source of most of the energy on Earth.
- Observe energy sources doing work and learn how energy (light, heat, motion, chemical, electric) can be converted from one form to another.
- Learn that stored energy take many forms; machines and organisms can convert energy into motion and heat.
- Describe how energy can be carried from one place to another by waves, electric current, and moving objects.
- Learn that light energy travels in straight lines from a source.
- Find out how light can reflect from the surface of a mirror.
- Learn that an object is seen only when light from that object enters an eye.
- Learn that white light is a mixture of all colors of light, that matter can absorb and reflect light, and that a shadow is the dark area behind objects that block light.
- Learn that the apparent color of an object is the result of the light it reflects; observe that the apparent color of an object is affected by the color of light striking it.
- Explore properties of the three forms of matter (solid, liquid, and gas), including change of state.
- Use metric tools to measure mass, volume, and temperature, and make multiple numerical observations to improve accuracy.
- Observe and analyze a chemical reaction.
- Collect and analyze data to develop logical conclusions.
- Predict the outcome of an event and compare the results with the prediction.

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FOSS AND CALIFORNIA STANDARDS

The **Matter and Energy Module** supports the following Physical Sciences and Investigation and Experimentation Content Standards for grade 3.*

PHYSICAL SCIENCES

PS1 ***Energy and matter have multiple forms and can be changed from one form to another. As a basis for understanding this concept:***

- PS1a Students know energy comes from the Sun to Earth in the form of light.
- PS1b Students know sources of stored energy take many forms, such as food, fuel, and batteries.
- PS1c Students know machines and living things convert stored energy to motion and heat.
- PS1d Students know energy can be carried from one place to another by waves, such as water waves and sound waves, by electric current, and by moving objects.
- PS1e Students know matter has three forms: solid, liquid, and gas.
- PS1f Students know evaporation and melting are changes that occur when the objects are heated.
- PS1g Students know that when two or more substances are combined, a new substance may be formed with properties that are different from those of the original materials.
- PS1h Students know all matter is made of small particles called atoms, too small to see with the naked eye.
- PS1i Students know people once thought that earth, wind, fire, and water were the basic elements that made up all matter. Science experiments show that there are more than 100 different types of atoms, which are presented on the periodic table of the elements.

**Science Content Standards for California Public Schools: Kindergarten through Grade Twelve* (Sacramento: California Department of Education, 2000).

†*Science Framework for California Public Schools: Kindergarten through Grade Twelve (*Sacramento: California Department of Education, 2003), pages 45 and 49.

"The discussion of energy and matter in grade three is at a simple level, but it sets a foundation for further study in later grade levels. Students learn that energy may be stored in various ways and that both living organisms and machines convert stored energy into heat and motion... Atoms will be introduced as the smallest component of the elements that compose all matter... Light, like heat, is a form of energy...[Students] should know that light travels in a straight line away from its source and that the color of an object is affected by the color of light that strikes it."†

PS2 ***Light has a source and travels in a direction. As a basis for understanding this concept:***

PS2a Students know sunlight can be blocked to create shadows.

PS2b Students know light is reflected from mirrors and other surfaces.

PS2c Students know the color of light striking an object affects the way the object is seen.

PS2d Students know an object is seen when light traveling from the object enters the eye.

INVESTIGATION AND EXPERIMENTATION

I&E5 ***Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:***

I&E5a Repeat observations to improve accuracy and know that the results of similar scientific investigations seldom turn out exactly the same because of differences in the things being investigated, methods being used, or uncertainty in the observation.

I&E5b Differentiate evidence from opinion and know that scientists do not rely on claims or conclusions unless they are backed by observations that can be confirmed.

I&E5c Use numerical data in describing and comparing objects, events, and measurements.

I&E5d Predict the outcome of a simple investigation and compare the result with the prediction.

I&E5e Collect data in an investigation and analyze those data to develop a logical conclusion.

**Science Content Standards for California Public Schools: Kindergarten through Grade Twelve* (Sacramento: California Department of Education, 2000).

†Science Framework for California Public Schools: Kindergarten through Grade Twelve (Sacramento: California Department of Education, 2003), page 55.

"Students can begin to make predictions based on observations, prior knowledge, and logic. Predictions should not be confused with random guesses. Students should know that their predictions must be verified by experiments and the analysis of data gathered from careful measurements."†

MATTER AND ENERGY MODULE MATRIX

SYNOPSIS	CA SCIENCE CONTENT STANDARDS	
1. ENERGY Students investigate different forms of energy (light, heat, sound, and motion) and determine ways that energy is converted to make things happen. They explore ways that energy forms are carried from one place to another. Students explore energy working with materials (batteries, bulbs, candle, solar cells, spring toys, rolling balls), through readings, and through video.	PS1a	Students know energy comes from the Sun to Earth in the form of light.
	PS1b	Students know sources of stored energy take many forms, such as food, fuel, and batteries.
	PS1c	Students know machines and living things convert stored energy to motion and heat.
	PS1d	Students know energy can be carried from one place to another by waves, such as water waves and sound waves, by electric current, and by moving objects.
2. LIGHT Students use mirrors to reflect light and learn that light travels in straight lines. They are introduced to blocked light (shadows), light absorption, and to white light as a mixture of all colors of light. They investigate firsthand and through simulations, video, and readings how the appearance of an object is affected by the color of light striking it.	PS2a	Students know sunlight can be blocked to create shadows.
	PS2b	Students know light is reflected from mirrors and other surfaces.
	PS2c	Students know the color of light striking an object affects the way the object is seen.
	PS2d	Students know an object is seen when light traveling from the object enters the eye.
	I&E5d	Predict the outcome of a simple investigation and compare the result with the prediction.
3. MATTER Students work with different states of matter, measure mass and volume using metric standards and tools, and solve problems using their knowledge of metric measurement. They develop a set of defining characteristics for states of matter. They read about the difference between opinion and evidence.	PS1e	Students know matter has three forms: solid, liquid, and gas.
	I&E5a	Repeat observations to improve accuracy and know that the results of similar scientific investigations seldom turn out exactly the same because of differences in the things being investigated, methods being used, or uncertainty in the observation.
	I&E5b	Differentiate evidence from opinion and know that scientists do not rely on claims or conclusions unless they are backed by observations that can be confirmed.
	I&E5c	Use numerical data in describing and comparing objects, events, and measurements.
	I&E5d	Predict the outcome of a simple investigation and compare the result with the prediction.
	I&E5e	Collect data in an investigation and analyze those data to develop a logical conclusion.
4. CHANGING MATTER Students use a thermometer to measure and record temperatures as they explore melting of common substances. The class conducts an evaporation investigation, and students use the data to draw conclusions. Students combine substances and observe the results of a chemical reaction. They read about atoms and elements.	PS1f	Students know evaporation and melting are changes that occur when the objects are heated.
	PS1g	Students know that when two or more substances are combined, a new substance may be formed with properties that are different from those of the original materials.
	PS1h	Students know all matter is made of small particles called atoms, too small to see with the naked eye.
	PS1i	Students know people once thought that earth, wind, fire, and water were the basic elements that made up all matter. Science experiments show that there are more than 100 different types of atoms, which are presented on the periodic table of the elements.
	I&E5a	Repeat observations to improve accuracy and know that the results of similar scientific investigations seldom turn out exactly the same because of differences in the things being investigated, methods being used, or uncertainty in the observation.
	I&E5c	Use numerical data in describing and comparing objects, events, and measurements.
	I&E5d	Predict the outcome of a simple investigation and compare the result with the prediction.

CONCEPTS	READING AND WRITING	ASSESSMENT
• Energy makes things happen. • Energy takes many forms. • Most of the energy used by organisms, including humans, comes from the Sun in the form of light. • Stored energy can be converted to other forms of energy. • Machines and living things can convert energy into motion and heat. • Energy can be carried from one place to another by waves, electric current, and moving objects.	• *Energy Sources* • *Energy Conversion* • *Energy on the Move* • *Summary: Energy* • Science Notebook: Students write about their observations of energy sources and energy conversions.	**Pretest** **Embedded Assessment** • Science notebook • Response sheet **Benchmark Assessment** • I-Check 1
• Light is a form of energy that travels in straight lines from a light source. • Light can reflect off surfaces that it strikes. • An object is seen only when light from that object enters an eye. • White light is a mixture of all colors. • Light can be absorbed by matter. • The apparent color of an object is the result of the light it reflects. • The apparent color of an object is affected by the color of light striking it. • A shadow is created when objects block light.	• *Reflection* • *Throw a Little Light on Sight* • *Summary: Light* • Science Notebook: Students record the ways they worked with mirrors to solve mirror challenges and what happens to the appearance of objects when different colors of light are used to illuminate the objects.	**Embedded Assessment** • Teacher observation • Science notebook **Benchmark Assessment** • I-Check 2
• The behavior of a sample of matter in an open container indicates its state. • The gram (g) is the standard unit of measure used to quantify mass in the metric system. • Volume is a measure of the three-dimensional space occupied by matter. • The liter (L) is the standard for measuring fluid volume in the metric system. • Opinion is based on belief; scientific evidence is based on observation.	• *States of Matter* • *Opinion and Evidence* • *The Metric System* • *Summary: Matter* • Science Notebook: Students record predictions and measurements using metric tools for mass and volume.	**Embedded Assessment** • Science notebook • Teacher observation • Notebook sheet **Benchmark Assessment** • I-Check 3
• Degree Celsius (ºC) is the unit used when scientists measure temperature. • Melting occurs when solids are heated. • Different substances melt at different temperatures. • Evaporation occurs when liquids are heated. • When two substances are combined, a reaction may occur, producing a new substance with unique properties. • Matter is made of small particles, atoms.	• *Change of State* • *Atoms* • *Reactions* • *Summary: Changing Matter* • Science Notebook: Students explain the results of a chemical reaction.	**Embedded Assessment** • Teacher observation • Notebook sheet **Benchmark Assessment** • I-Check 4 **Posttest**

SAFETY IN THE CLASSROOM

Following the procedures described in each investigation will make for a very safe experience with physical science in the classroom. You should also review your district safety guidelines and make sure that everything that you do is consistent with those guidelines.

Look for the safety-note icon in the Getting Ready section, which will alert you to safety concerns throughout the module.

Materials Safety Data Sheets (MSDS) for materials used in the FOSS program can be found on the Delta Education website (http://www.delta-education.com/msds.shtml). If you have questions regarding any MSDS, call Delta Education toll free at 800-258-1302 (Monday–Friday 8 a.m. to 6 p.m. EST).

General classroom safety rules to share with students include

1. Listen carefully to all instructions. Follow directions. Ask questions if you don't know what to do.
2. Tell your teacher if you have any allergies.
3. Never put any materials in your mouth. Do not taste anything unless your teacher tells you to do so.
4. Never smell any unknown material. If your teacher asks you to smell something, wave your hand over the material to draw the smell toward your nose.
5. Do not touch your face, mouth, ears, nose, or eyes while working with chemicals, plants, or animals.
6. Always protect your eyes. Wear safety goggles when necessary. Tell your teacher if you wear contact lenses.
7. Always wash your hands with soap and warm water after working with chemicals, plants, or animals.
8. Never mix any chemicals unless your teacher tells you to do so.
9. Report all spills, accidents, and injuries to your teacher.
10. Treat animals with respect, caution, and consideration.
11. Clean up your work space after each investigation.
12. Act responsibly during science investigations.

These rules are provided for your class on the FOSS safety poster and are in the *Science Resources* book for each student.

SCHEDULING THE MODULE

For comprehensive teaching of the science standards at grade 3, with multiple exposures, science should be taught on the schedule below. Active-investigation sessions (including wrap-up) and reading sessions might be 40–45 minutes, I-Check and assessment-review sessions 20–25 minutes.

Active-investigation (A) sessions include firsthand observations of energy and matter, active thinking about the experiences, small-group discussion, simulations, writing in science notebooks, learning new vocabulary in context, viewing a video, and completing written embedded assessments to inform instruction.

Wrap-up (W) sessions are teacher-directed vocabulary reinforcement and science content review.

Reading (R) sessions (*Science Resources* book) include individual and interactive reading, answering review questions, and discussing the reading to ensure that students integrate the information.

I-Checks are short summative assessments. Students respond to written prompts. The next day, after you have scored the assessments, students review their written responses to reflect on and improve their understanding.

Week	Day 1	Day 2	Day 3	Day 4	Day 5
	Pretest				
1	START Inv. 1 Part 1 A	A/W	R	START Inv. 1 Part 2 A/W	R
2	A	START Inv. 1 Part 3 A	A	R	I-Check 1
3	Review	START Inv. 2 Part 1 A	A/W	R	START Inv. 2 Part 2 A
4	A/W	R	R	I-Check 2	Review
5	START Inv. 3 Part 1 A	A/W	R	START Inv. 3 Part 2 A	A
6	A/W	R	START Inv. 3 Part 3 A	A/W	R
7	R	I-Check 3	Review	START Inv. 4 Part 1 A	
8	START Inv. 4 Part 2 A	A/W	R	R	START Inv. 4 Part 3 A
9	A/W	R	I-Check 4	Review	**Posttest**

SCOPE AND SEQUENCE FOR FOSS CALIFORNIA 2007 EDITION

GRADE	PHYSICAL SCIENCES	LIFE SCIENCES	EARTH SCIENCES
5	Mixtures and Solutions	Living Systems	Water Planet
4	Magnetism and Electricity	Environments	Solid Earth
3	Matter and Energy	Structures of Life	Sun, Moon, and Stars
2	Balance and Motion	Insects and Plants	Pebbles, Sand, and Silt
1	Solids and Liquids Air and Weather	Plants and Animals	Air and Weather
K	Wood and Paper	Animals Two by Two Trees	Wood and Paper Trees

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Full Option Science System FOSS

Lawrence Hall of Science
University of California
Berkeley, CA 94720
510-642-8941