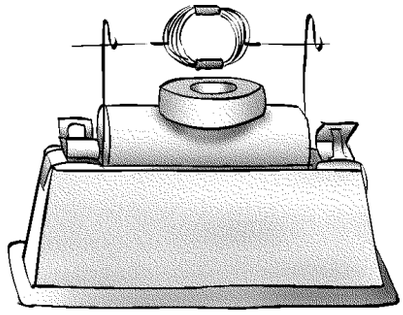
OVERVIEW
MAGNETISM AND ELECTRICITY

CONTENT GOALS



The **Magnetism and Electricity Module** consists of five sequential investigations, each designed to introduce or reinforce concepts in physical science. Students experience magnetism and electricity as related effects and learn useful applications of magnetism and electricity in everyday life.

FOSS EXPECTS STUDENTS TO

- Observe the interaction of permanent magnets with a variety of common materials.
- Discover that magnets have two different poles, called north and south poles; like poles repel and opposite poles attract.
- Build a compass and use it to detect magnetic fields, including Earth's magnetic field.
- Measure the change in force between two magnets as the distance between them changes.
- Create static charge and determine that electrically charged objects attract or repel each other.
- Understand, design, and build simple open, closed, parallel, and series circuits.
- Observe that electric current flowing in a wire produces a magnetic field.
- Learn how to build an electromagnet.
- Experience the relationship between the number of winds of wire around a core and the strength of the magnetism.
- Use their knowledge of electromagnets to make a simple device, a telegraph, and understand how electromagnets are used in other devices such as motors and generators.
- Learn that electric energy can be converted to heat, light, and motion.
- Develop questions and perform scientific investigations to test predictions and draw conclusions.

OVERVIEW CONTENTS

MAGNETISM AND ELECTRICITY MODULE MATRIX

SYNOPSIS	CA SCIENCE CONTENT STANDARDS
1. THE FORCE Students investigate the properties of magnets. They construct a simple compass and use it to detect magnetic effects. They investigate the strength of the force of attraction by graphing data to look for patterns of interaction.	PS1b Students know how to build a simple compass and use it to detect magnetic effects, including Earth's magnetic field. PS1f Students know that magnets have two poles (north and south) and that like poles repel each other while unlike poles attract each other. I&E6c Formulate and justify predictions based on cause-and-effect relationships. I&E6d Conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results. I&E6e Construct and interpret graphs from measurements. I&E6f Follow a set of written instructions for a scientific investigation.
2. MAKING CONNECTIONS Students investigate current electricity and circuits, the pathways through which electricity flows. They observe electric energy being converted to heat, light, and motion. They work with electrically charged objects and observe their behavior.	PS1a Students know how to design and build simple series and parallel circuits by using components such as wires, batteries, and bulbs. PS1e Students know electrically charged objects attract or repel each other. PS1g Students know electrical energy can be converted to heat, light, and motion. I&E6c Formulate and justify predictions based on cause-and-effect relationships.
3. ADVANCED CONNECTIONS Students explore series and parallel circuits and compare the functioning of the components in each circuit. They formulate and justify their predictions, based on their observations of electric energy being converted to light and motion.	PS1a Students know how to design and build simple series and parallel circuits by using components such as wires, batteries, and bulbs. PS1g Students know electrical energy can be converted to heat, light, and motion. I&E6c Formulate and justify predictions based on cause-and-effect relationships.
4. CURRENT ATTRACTIONS Students learn how to use electricity to make an electromagnet. They explore the variables that influence the strength of the magnetism produced by their electromagnets.	PS1c Students know electric currents produce magnetic fields and know how to build a simple electromagnet. I&E6a Differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations. I&E6b Measure and estimate the weight, length, or volume of objects. I&E6c Formulate and justify predictions based on cause-and-effect relationships. I&E6d Conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results. I&E6e Construct and interpret graphs from measurements. I&E6f Follow a set of written instructions for a scientific investigation.
5. CLICK IT Students use all the concepts they have learned to build a simple telegraph system. The last part of the investigation asks students to use their inquiry skills to design, conduct, and report their own investigations.	PS1c Students know electric currents produce magnetic fields and know how to build a simple electromagnet. PS1d Students know the role of electromagnets in the construction of electric motors, electric generators, and simple devices, such as doorbells and earphones. PS1g Students know electrical energy can be converted to heat, light, and motion. I&E6c Formulate and justify predictions based on cause-and-effect relationships. I&E6d Conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results.

CONCEPTS	READING AND WRITING	ASSESSMENT
• Only iron sticks to a magnet. • Magnetism can be induced in iron. • Magnets have two poles. Like poles repel; opposite poles attract. • Magnets display forces of attraction and repulsion that decrease with distance. • A compass is a magnet used to detect magnetic fields, including Earth's.	• *When Magnet Meets Magnet* • *Magnificent Magnetic Models* • *Make a Magnetic Compass* • *Summary: The Force* • Science Notebook: Students describe interactions, record and analyze data, and explain relationships.	**Pretest** **Embedded Assessment** • Science Notebook sheets • Response sheet • Teacher observation **Benchmark Assessment** • I-Check 1
• A circuit is a pathway on which electric current flows. • Lightbulbs convert electric energy into heat and light energy. • Motors convert electric energy into motion energy when placed in a closed circuit. • Conductors complete circuits and allow the flow of electric current; insulators do not.	• *Making Static* • *Edison Sees the Light* • *Summary: Making Connections* • Science Notebook: Students make schematic diagrams, record results, and write explanations.	**Embedded Assessment** • Science Notebook sheets • Response sheet • Teacher observation **Benchmark Assessment** • I-Check 2
• A circuit with only one pathway for current flow is a series circuit. Components "share" the electric energy. • A circuit with two or more pathways for current flow is a parallel circuit.	• *Series and Parallel Circuits* • *Summary: Advanced Connections* • Science Notebook: Students make schematic diagrams and write explanations.	**Embedded Assessment** • Science Notebook sheets • Response sheet **Benchmark Assessment** • I-Check 3
• A core of iron or steel becomes an electromagnet when electricity flows through a coil of insulated wire surrounding the core. • There are many ways to change the strength of an electromagnet, including changing the number of winds of wire around the core.	• *Electricity = Magnetism: Oersted's Discovery* • *How Electromagnetism Stopped a War* • *Summary: Current Attractions* • Science Notebook: Students record data from multiple experiments and graph their results.	**Embedded Assessment** • Teacher observation • Response sheet • Science Notebook sheets **Benchmark Assessment** • I-Check 4
• A telegraph is an electronic communication device that uses an electromagnet. • A code is a symbolic system used for communication. • A telegraph converts electric energy into motion and sound energy.	• *Morse Gets Clicking* • *Electromagnets Everywhere* • *Summary: Click It* • Science Notebook: Students design and draw a long-distance telegraph circuit.	**Embedded Assessment** • Teacher observation • Performance assessment **Posttest**

FOSS AND CALIFORNIA STANDARDS

FOSS supports the following Physical Sciences Content Standards for grade 4.

STD	TEXT OF STANDARD	PRIMARY CITATIONS	SUPPORTING CITATIONS
1	**Electricity and magnetism are related effects that have many useful applications in everyday life. As a basis for understanding this concept:**		
1.a	*Students know* how to design and build simple series and parallel circuits by using components such as wires, batteries, and bulbs.	**Magnetism and Electricity Teacher Guide** Inv. 3: pp. 148-149, 152, 155-160, 63-164 Inv. 2: pp. 110-113, 118-120 Notebook Sheets nos. 15-20 pp. 245-250 **Grade 4 Science Resources Book** *Series and Parallel Circuits* pp. 30-35	**Magnetism and Electricity Teacher Guide** Inv. 2: pp. 131-132 Benchmark Assessment Items 30-31, 33, pp. 429-430 **Grade 4 Science Resources Book** *Summary: Advanced Connections*, pp. 36-38
1.b	*Students know* how to build a simple compass and use it to detect magnetic effects, including Earth's magnetic field.	**Magnetism and Electricity Teacher Guide** Inv. 1: pp. 80-81, 85-86 **Grade 4 Science Resources Book** *Make a Magnetic Compass* pp. 12-15	**Grade 4 Science Resources Book** *Summary: The Force* pp. 17-18 **Magnetism and Electricity Teacher Guide** Inv. 1: p. 84 Benchmark Assessment Item 16, p. 422
1.c	*Students know* electric currents produce magnetic fields and know how to build a simple electromagnet.	**Grade 4 Science Resources Book** *Electromagnets Everywhere* pp. 55-63 *Summary: Click It* pp. 64-65 **Magnetism and Electricity Teacher Guide** Inv. 5: p. 223 Notebook Sheet no. 28, p. 258	**Magnetism and Electricity Teacher Guide** Inv. 5: pp. 213, 215, 219-221 Benchmark Assessment Item 39, p. 433 **Grade 4 Science Resources Book** *Electricity = Magnetism* pp. 41-42
1.d	Students know the role of electromagnets in the construction of electric motors, electric generators, and simple devices, such as doorbells and earphones.	**Grade 4 Science Resources Book** *Electromagnets Everywhere* pp. 55-63 Summary: Click It pp. 64-65 **Magnetism and Electricity Teacher Guide** Inv. 5: p. 223 Notebook Sheet no. 28, p. 258	**Magnetism and Electricity Teacher Guide** Inv. 4: pp. 197-199 **Grade 4 Science Resources Book** *Morse Gets Clicking* pp. 50-54
1.e	Students know electrically charged objects attract or repel each other.	**Magnetism and Electricity Teacher Guide** Inv. 2: pp. 102-106 Notebook Sheet no. 8, p. 238 **Grade 4 Science Resources Book** *Making Static* pp. 20-21 *Summary: Making Connections* p. 26	**Magnetism and Electricity Teacher Guide** Benchmark Assessment Items 24, 27 pp. 426-427 Inv. 2: p. 133

FOSS AND CALIFORNIA STANDARDS

FOSS supports the following Physical Sciences Content Standards for grade 4.

STD	TEXT OF STANDARD	PRIMARY CITATIONS	SUPPORTING CITATIONS
1.f	*Students know* that magnets have two poles (north and south) and that like poles repel each other while unlike poles attract each other.	**Magnetism and Electricity Teacher Guide** Inv. 1: pp. 58-62, 86 **Grade 4 Science Resources Book** *When Magnet Meets Magnet* pp. 4-8 *Summary: The Force* pp. 16-18	**Grade 4 Science Resources Book** *Magnificent Magnetic Models* pp. 9-11 **Magnetism and Electricity Teacher Guide** Benchmark Assessment Items 12, 15 pp. 420, 422
1.g	*Students know* electrical energy can be converted to heat, light, and motion.	**Magnetism and Electricity Teacher Guide** Inv. 2: pp. 109-112, 114-115, 118, 121 **Grade 4 Science Resources Book** *Summary: Making Connections* pp. 27-28 *Electromagnets Everywhere* pp. 55-63	**Magnetism and Electricity Teacher Guide** Inv. 5: pp. 211-216, 223 Benchmark Assessment Item 21, p. 425 **Grade 4 Science Resources Book** *Edison Sees the Light* pp. 23, 25 *Summary: Click It* pp. 64-65