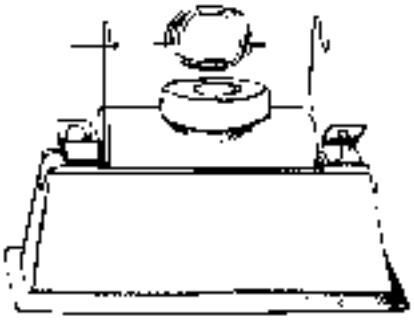
OVERVIEW
MAGNETISM AND ELECTRICITY



GOALS

The **Magnetism and Electricity Module** consists of five sequential investigations, each designed to introduce or reinforce concepts in physical science. The investigations provide opportunities for students to explore the natural and human-made worlds by observing and manipulating materials in focused settings using simple tools.

FOSS EXPECTS STUDENTS TO

- Observe the interaction of permanent magnets with a variety of common materials.
- Discover that magnets display forces of attraction and repulsion.
- Measure the change in force between two magnets as the distance between them changes.
- Identify materials that are conductors and insulators.
- Understand and construct simple open, closed, parallel, and series circuits.
- Learn how to make an electromagnet.
- Experience the relationship between the number of turns of wire around an electromagnet core and the strength of the magnetism.
- Use their knowledge of electromagnets to make a telegraph.
- Acquire vocabulary associated with magnetism and electricity.
- Exercise language, math, and social studies skills in the context of magnetism and electricity investigations.
- Develop and refine the manipulative skills required for making investigations in magnetism and electricity.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, and organizing.

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MAGNETISM AND ELECTRICITY MODULE MATRIX

SYNOPSIS	SCIENCE CONTENT	THINKING PROCESSES
1. THE FORCE Students work with permanent magnets to discover that iron is the only everyday material that sticks to magnets. They investigate variables that influence the force of attraction between two magnets and look for ways to detect the presence of a magnet.	• Magnets stick to metal objects made of iron. • Magnetic interactions are caused by the magnetic force. • Magnets display forces of attraction and repulsion that decrease with distance. • Magnetism can be induced in a piece of steel that is close to or touching a magnet.	• Observe magnetic interactions and sort objects based on whether they are affected by a magnet. • Measure the force of attraction between magnets. • Record and organize results of investigations.
2. MAKING CONNECTIONS Students investigate current electricity and circuits, the pathways through which electricity flows. They find that some materials permit the flow of electricity (conductors), and some don't (insulators).	• Electricity flows through pathways called circuits. • A switch is a device used to open and close circuits. • An open circuit is an incomplete electric pathway; a closed circuit is a complete pathway. • Materials that allow electricity to flow are conductors; those that do not are insulators.	• Build a test circuit and test objects for conductivity. • Predict conductivity of materials. • Sort materials based on whether they conduct electricity.
3. ADVANCED CONNECTIONS Students explore series and parallel circuits and compare the functioning of the components in each circuit.	• 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. Components each have a direct pathway to the energy source.	• Observe the functioning of different kinds of circuits. • Compare the brightness of lamps in different kinds of circuits. • Determine the defining characteristics of series and parallel circuits. • Analyze and solve circuitry problems.
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.	• A core of iron or steel becomes an electromagnet when electricity flows through a coil of insulated wire surrounding it. • There are a number of ways to change the strength of an electromagnet, including changing the number of winds of wire around the core.	• Observe the interaction between an electromagnet and objects. • Systematically investigate ways to strengthen electromagnets. • Compare the strength of electromagnets. • Organize data. • Conduct multiple trials, average results, and display results in a graph.
5. CLICK IT Students use all the concepts they have learned to build a telegraph system that enables them to send and receive messages. The last part of the investigation asks students to use their inquiry skills to design, conduct, and report their own investigations.	• An electromagnet placed in a complete circuit can be used to make a telegraph. • A switch can serve as a key in a telegraph system. • A code is a symbolic system used for communication. • Technology is the application of science.	• Explore the behavior of an electromagnet under different conditions. • Solve circuitry problems. • Encode and decode clicks produced by a telegraph.

INTERDISCIPLINARY EXTENSIONS	FOSS SCIENCE STORIES	TECHNOLOGY/HOME CONNECTION
Language Extension • Write a creative story about life from a magnet's point of view. **Math Extension** • Problem of the week. **Science Extensions** • Make a water compass. • Conduct more force investigations. • Explore different magnets.	See the Science Stories folio. • *Magnus Gets Stuck* • *Magnificent Magnetic Models* • *How Magnets Interact* • *Make a Compass*	www.fossweb.com Check the FOSS website for interactive simulations, to communicate with a scientist, for teaching tips, and to talk with other classes using FOSS. Home/School Connection: Students look for magnets at home. They imagine inventing something that uses magnets, and describe it with pictures and words.
Language Extensions • Make posters about safe electricity use. • Write about life without electricity. • Read *Dear Mr. Henshaw.* **Math Extension** • Problem of the week. **Social Studies Extension** • Research historical sources of energy. **Science Extension** • Examine the inside of a lightbulb.	See the Science Stories folio. • *Making Static* • *A Fictional Interview with Benjamin Franklin* • *Two Reference Sources about Edison*	Home/School Connection: Students inventory electrical fixtures and appliances in their homes and develop a list of rules and practices for using electricity safely.
Language Extension • Research inventors who have contributed to electricity use in everyday life. **Math Extension** • Problem of the week. **Science Extensions** • Find out how houses are wired. • Interview an electrician. • Build a flashlight; make a burglar alarm.	See the Science Stories folio. • *Illuminating Teamwork: A Story of the Edison Pioneers* • *A True Pioneer: Lewis Latimer*	Home/School Connection: Students are invited to look inside broken electric and electronic appliances and devices, like radios, tape players, and remote controls, to see some really advanced circuits.
Language Extension • Write short stories describing encounters (real or imaginary) with electromagnets. **Math Extension** • Problem of the week. **Science Extensions** • Make a rheostat. • Detect magnetism around current wires. • Compare magnets to electromagnets.	See the Science Stories folio. • *From Rags to Science: A Story of Michael Faraday* • *How Electromagnetism Stopped a War* • *Magnets and Electricity in Your Life*	Home/School Connection: Students read a short piece about electricity and the purpose of fuses and circuit breakers. They locate the box at home that contains them.
Language Extension • Read up on codes; create a code. **Math Extension** • Problem of the week. **Science Extensions** • Build a cardboard telegraph. • Make an electric quiz board. • Build a model motor.	See the Science Stories folio. • *Morse Gets Clicking: A Story of Samuel Morse*	Home/School Connection: Students will need some extra time at home to work on presenting their projects to the class.

FOSS AND NATIONAL STANDARDS

The **Magnetism and Electricity Module** emphasizes the development of observation and description skills and building explanations based on experience. This module supports the following National Science Education Standards.

SCIENCE AS INQUIRY

Develop students' abilities to do and understand scientific inquiry.

- Ask and answer questions.
- Plan and conduct simple investigations.
- Employ tools to gather data.
- Use data to construct reasonable explanations.
- Communicate investigations and explanations.
- Understand that scientists use different kinds of investigations and tools to develop explanations using evidence and knowledge.

CONTENT: PHYSICAL SCIENCE

Develop students' understanding of electricity and magnetism.

- Magnets attract and repel each other and certain kinds of other materials; electricity in circuits can produce light, heat, sound, and magnetic effects; electric circuits require a complete loop through which an electric current can pass.

SCIENCE AND TECHNOLOGY

Develop students' abilities in technological design.

- Identify a simple problem and propose a solution.
- Evaluate a product or design.
- Communicate a problem, design, and solution.

Develop students' understandings about science and technology.

- Scientists work collaboratively in teams and use tools and scientific techniques to make better observations.

HISTORY OF SCIENCE

Develop an understanding of science as a human endeavor.

- Science and technology have been practiced by people for a long time.
- People make discoveries about the natural world that contribute to global knowledge.