Magnets

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About **Magnets**

DeltaScienceModules, THIRD EDITION

Students discover the Law of Magnetic Attraction and much more about the principles that govern magnetic behavior and interaction. They experiment with magnets of various sizes and shapes, even our planet-sized magnet, to explore this invisible but observable force. Students find out which materials are attracted to magnets and which can "block" the passage of magnetic force. They demonstrate magnetic fields and polarity using iron filings. Then they make compasses that align with Earth's magnetic poles. They model temporary magnetism and use a simple circuit and an iron nail to create an electromagnet. A space shuttle video challenges students to consider the applications of magnets in our technological society.

In the Delta Science Reader *Magnets,* students read about magnets and magnetic fields. They learn how magnets are made, how magnets can create electricity, what magnets are used for, and how Earth is like a magnet. They also read about Michael Faraday, the famous nineteenth-century scientist who invented the electric motor and the electric generator, both of which use magnets. Finally, students learn about applications of magnets in magnetic resonance imaging (MRI) and maglev trains.

Overview Chart for Hands-on Activities

Hands-on Activity	Student Objectives
1 **The Floating Paper Clip** *page 13*	• observe a paper clip that appears to float in the air • form hypotheses to explain why the paper clip floats • investigate magnetic attraction
2 **What Does a Magnet Attract?** *page 19*	• guess which objects will be attracted to a magnet • observe that metal objects made of iron and steel are attracted to a magnet • observe that metal objects made of aluminum, copper, and brass are not attracted to a magnet • observe that nonmetal objects are not attracted to a magnet
3 **Can the Force Go Through It?** *page 25*	• guess which objects will "block" the force of magnetism • place objects made of different materials between a magnet and a magnetic object • investigate which materials allow the magnetic force to pass through them
4 **How Strong Is the Force?** *page 29*	• guess the strength of different magnets • measure the strength at different places on each magnet • discover that magnetic force increases as the distance between a magnetic object and a magnet decreases
5 **Magnetic Fields** *page 35*	• observe the pattern made by iron filings on a sheet of paper placed over a magnet • infer that the pattern is made by the invisible field lines in the field surrounding a magnet • compare the pattern made by a single magnet to the pattern made by two magnets placed near each other
6 **Investigating Magnetic Poles** *page 41*	• observe that the interaction between two magnets results in attraction or repulsion • learn that the ends of magnets are referred to as poles • investigate the Law of Magnetic Attraction
7 **Earth: A Giant Magnet** *page 47*	• discover that Earth acts like a giant magnet • observe the influence of Earth's magnetic poles on a magnet
8 **Making a Compass** *page 53*	• make a small compass to find north • compare their compass with a compass from the kit • deduce the directions north, south, east, and west
9 **Making a Magnet** *page 59*	• discover two ways that an iron-containing object can be magnetized temporarily • observe how temporary magnetism is lost or weakened
10 **A Different Kind of Magnet** *page 65*	• observe the effect that a wire with electric current flowing through it has on a compass • infer a relationship between electric current and magnetism
11 **Making an Electromagnet** *page 71*	• construct an electromagnet using a battery, a nail, and coils of wire • use an electromagnet to attract magnetic materials • vary the strength of their electromagnet
12 **Magnets in Space** *page 77*	• observe the interactions of magnets on Earth and in space • formulate their own questions about the magnets
Assessment *page 83*	• See page 83.

Process Skills	Vocabulary	Delta Science Reader
observe, hypothesize	**hypothesis, magnet**	pages 2–3
predict, observe, compare, classify	**magnetic, nonmagnetic**	pages 2–3
predict, use variables	**magnetism**	pages 4–5
predict, measure, compare, infer		pages 4–5
observe, infer, compare	**field lines, magnetic field**	pages 4–5
observe, define based on observations	**attract, Law of Magnetic Attraction, poles, repel**	pages 3, 4–5
observe, communicate	**geographic North Pole, geographic South Pole, magnetic north pole, magnetic south pole**	pages 7, 8–9
make and use models, compare	**compass**	pages 8–9
experiment, infer	**temporary magnetism**	page 6
observe, infer	**electromagnetism**	pages 10, 11, 13
make and use models, use variables	**electromagnet, ferrous**	pages 10, 11, 12, 13
observe, communicate	**microgravity**	page 7

See the following page for the Delta Science Reader Overview Chart.

Overview Chart for Delta Science Reader
Magnets

Selections	Vocabulary	Related Activity
Think About...		
What Is a Magnet? *page 2*	**attract, force, magnet, magnetic, magnetic pole, magnetism, metal, nonmagnetic, north-seeking pole, repel, south-seeking pole**	Activities 1, 2
• What Is a Magnetic Field? *page 4*	**field lines, magnetic field**	Activities 3, 4, 5, 6
• How Are Magnets Made? *page 6*	**permanent magnet, temporary magnet**	Activity 9
• How Is Earth Like a Magnet? *page 7*	**magnetic north pole, magnetic south pole**	Activities 7, 12
What Is a Compass? *page 8*	**compass, lodestone, magnetite**	Activities 7, 8
What Is an Electromagnet? *page 10*	**electric motor, electromagnet**	Activities 10, 11
How Can a Magnet Make Electricity? *page 11*	**generator**	Activities 10, 11
What Uses Do Magnets Have? *page 12*		Activity 11
People in Science		
• **Michael Faraday** *page 13*		Activities 10, 11
Did You Know?		
• **About MRIs** *page 14*		
• **About Maglev Trains** *page 15*	**friction**	

See pages 91–99 for teaching suggestions for the Delta Science Reader.

MATERIALS LIST

Magnets

Quantity	Description
8	aluminum foil, 5 cm × 5 cm*
1	ball, foam
16	batteries, D-cell*
8	battery holders with clips
1	bolt, metal
16	carts, plastic
8	cloths, flannel, 10 cm × 10 cm
8	compasses, magnetic
16	cups, plastic
8	dishes, plastic
75	dots*
1	dowel, wooden
8	emery cloths, 10 cm × 10 cm*
1	fishing line, nylon, 5 m
1	floating paper clip stand
1	iron filings, 150 g
8	magnet boats
8	magnetic/nonmagnetic objects, p/14
1	magnet, large bar
16	magnets, large
6	magnets, ring
16	magnets, rod
16	magnets, small
12	marbles, magnetic
1	marker, permanent, black
16	nails, iron
4	paper clips, p/100
2	paper, white, p/30*
4	string, 1.25 m*
1	tape, masking*
1	videotape, *Magnets in Space*
1	wire, enamel-coated, 18 m
1	**Teacher's Guide**
8	**Delta Science Readers**

Quantity	Description
	TEACHER-PROVIDED ITEMS
–	clothesline (optional)
–	paper, construction
–	paper towels
1	pitcher
11	rulers, metric
32	safety goggles
1	scissors
1	tack or pushpin
–	tape, transparent
1	VCR and monitor
–	water, tap

* = consumable item

† = in separate box

Activity Summary

In this Delta Science Module, students are introduced to many of the phenomena associated with magnetism. By experimenting with a variety of magnets and other materials, students identify the laws that govern magnetic behavior and interaction.

ACTIVITY 1 Students encounter a floating paper clip and offer explanations for this strange behavior. They soon discover that the paper clip is actually being held up by magnetism.

ACTIVITIES 2 and 3 Students investigate the force of magnetism. They find out which common materials are attracted to magnets, and which are not; which can block the passage of the magnetic force, and which cannot. They determine that the force of a magnet acting on a magnetic object is inversely related to the magnet's distance from that object.

ACTIVITY 4 Students compare the strengths of different magnets and see that bigger magnets are not necessarily stronger magnets. They also compare the strength of a single magnet at different points along its length and discover that force is concentrated at either end of a magnet rather than at the center.

ACTIVITY 5 Students use iron filings to visualize the invisible field lines that surround the magnets and notice the concentration of these lines at either end of the magnets. In this way students discover the polarity of magnets.

ACTIVITY 6 Students observe the interaction of poles (like poles attract, opposite poles repel) and define their observations as the Law of Magnetic Attraction.

ACTIVITY 7 Students discover that Earth is itself a giant magnet and that it interacts with the magnets found in its magnetic field just as two bar magnets interact when placed close together.

ACTIVITY 8 Students observe the effects of Earth's magnetic force when they construct their own compasses using floating magnets that, like real compass magnets, align themselves with the magnetic poles of the planet.

ACTIVITY 9 Students experiment to see if they can magnetize an object they identified as magnetic in Activity 2. They witness temporary magnetism when they see how a nail attached to, or stroked by, a permanent magnet becomes a temporary magnet.

ACTIVITY 10 Students discover that electric current flowing through a wire creates a magnetic field around the wire that can interact with the magnetic fields of other magnets.

ACTIVITY 11 Students create an electromagnet using a simple circuit and a steel nail. They find that this temporary magnet can be shut on and off simply by connecting or disconnecting the electric circuit. They learn that this feature is what allows electromagnets to operate many household appliances.

ACTIVITY 12 Students view and discuss a video of magnets being handled in space by astronauts on the space shuttle. They observe the behavior of spherical and ring magnets in the microgravity environment of the space shuttle and compare it to what they observe in their experiments on Earth.