

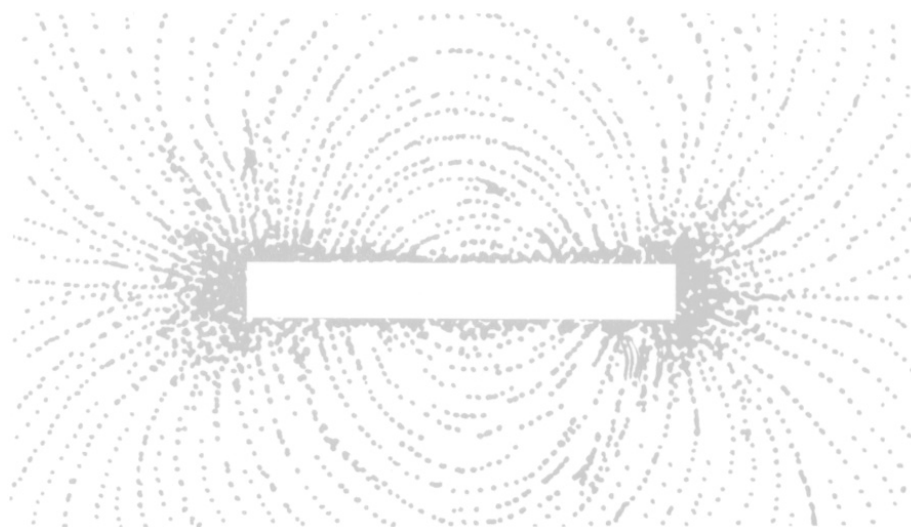
# Let's Do Science

Grade Two

## Magnetism

2

Magnetism



## Science Alberta Programs for Your Classroom



### Science-In-A-Crate

From digging for dinosaur bones to balancing a budget or learning about light, each trunk-sized "crate" contains everything you need to bring science and math to life in any learning environment. Science-In-A-Crate uses seven highly visual, hands-on and minds-on activities to illustrate how science is used in everyday situations, all directly linked to Alberta curriculum.

Crates are self-contained—they include everything you need to conduct science learning activities—including an activity guide with detailed, step-by-step instructions for each activity.

Visit [www.sciencealberta.org](http://www.sciencealberta.org) for a complete listing of the crates available or call 403-220-0077 for a program guide.

### Wonderville.ca

Step inside the whimsical world of Wonderville.ca, where colourful characters and enchanting environments stimulate learning through exciting online activities.

Wonderville.ca is an award-winning web site that makes science relevant, fun, and accessible to children, youth and families. Wonderville.ca is chockfull of world-class science content in a format that children and youth want to use—exciting digital activities, printable experiments, career videos and hidden science facts. The intriguing and engaging activities directly meet Alberta science curriculum knowledge outcomes from Grades 3 to 7.

Surf to Wonderville.ca to engage in the experience.



# Magnetism Before You Begin

The word *magnet* comes from the name of the ancient Greek region of Magnesia, where natural magnetic stones were found. Today, magnets are utilized in many common household items. Can you imagine what the world would be like without magnets? Calculators, televisions, digital watches, credit card machines and numerous other technological wonders would not exist.

In this unit, students explore the interactions of magnets with one another and with a variety of objects in the environment. In the process of investigation, they discover that magnets have two poles and that the strength of magnetic effects diminishes with distance. This knowledge forms a basis for the grade five unit Electricity and Magnetism.

## Topic C: Magnetism

(Suggested time: 6 weeks)

Note: Prior to teaching this topic, ensure that all magnets have been re-magnetized. Re-magnetizers are available from local educational distributors.

Before initiating the study of this topic, prepare a brief letter outlining the unit for parents. See *Innovations in Science, Level 2, Magnetic Attraction*, p. 30.

Purchase a variety of magnets of different shapes and sizes (bar magnets, horseshoe magnets, round magnets, ring magnets) from a local hardware store or an educational distributor. Students should be informed that magnets can be weakened if they are dropped, heated or placed in a strong magnetic field. Magnets that come with a metal bar, called a keeper, should be stored with the keeper in place to maintain the magnet's full strength. The keeper covers the poles when the magnet is not in use. Magnets should be separated with strips of wood or cardboard and should generally be kept away from computers and diskettes, magnetically coded library books, recording tapes, calculators and electrical motors since exposure to magnetism can damage these items.

Iron filings can be purchased from most educational distributors and may be used inside Zip-Lock bags or between enclosed acetate sheets or glass plates.

## Background Information

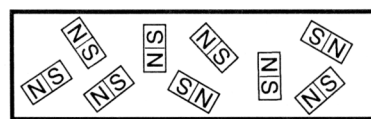
When someone mentions magnetism, the concept of attraction is usually the first thing that springs to mind. Metaphorically, we speak of animal magnetism or a magnetic personality—both expressions coined to denote attractive properties. When we talk of *magnetism* in scientific terms, we are referring specifically to an object's ability to attract iron and steel (an alloy of iron, small amounts of carbon and some other metals). Other substances, such as nickel and cobalt, are also affected by magnetism, but not to the same extent as iron and steel.

An object that exerts a magnetic force is called a *magnet*. Magnets come in many forms—bar magnets, horseshoe magnets, the variously shaped magnets you put on your refrigerator, the electromagnets discussed in the grade five unit Electricity and Magnetism, even the Earth itself—but all demonstrate a common set of properties. Magnets have a set of poles, commonly referred to as the *north-seeking pole* and the *south-seeking pole*. These poles are where the majority of the action takes place and a strict protocol is followed.

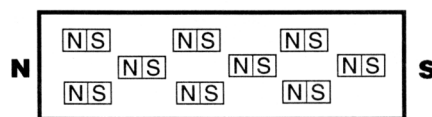
- North-seeking and south-seeking poles attract one another.
- North-seeking poles repel other north-seeking poles.
- South-seeking poles repel other south-seeking poles.

Unmagnetized items of iron or steel can be attracted to either pole of a magnet.

What is so special about iron and steel? Each atom of an iron or steel object is a miniature magnet! The atoms of an unmagnetized piece of iron or steel are arranged in random fashion, so an overall magnetic force is not evident. However, if the iron or steel is stroked in one direction with one pole of a magnet, the magnetic force of the magnet lines up the atoms with all the north-seeking poles pointing in one direction and all the south-seeking poles facing the other way. Once the atomic magnets are all aligned, the material behaves as a magnet (see Fig. 1).



Unmagnetized iron



Magnetized iron

Figure 1. Organization of atoms in pieces of unmagnetized and magnetized iron.

Hard steel retains its magnetic alignment for a very long time, becoming a permanent magnet. Soft iron loses its magnetism relatively quickly. Some alloys make very strong magnets, such as the alloy of aluminum, nickel and cobalt.

Originally magnetism was known to occur solely in lodestone (magnetite), an iron ore that is naturally magnetic. Today, there are several ways to produce magnets. As mentioned above, you can make a magnet by stroking a piece of iron or

steel with one pole of a permanent magnet. You can also turn an iron or steel object into a magnet by bringing it within the field of a permanent magnet. This inductive method yields a temporary magnet, which loses its magnetism as soon as it is removed from the vicinity of the permanent magnet. Yet another way to make a temporary magnet is with electricity. (See the grade 5 unit Electricity and Magnetism.)

Why do we call the two ends of a magnet the north-seeking and south-seeking poles? For thousands of years we have known that one end of a free swinging magnet always points toward a geographical location known as the north *geomagnetic pole*. The other end aligns itself with the south geomagnetic pole. It is speculated that flowing electric charges within the Earth's core produce a huge electromagnet and the poles are the locations where this electromagnet's force is felt most strongly. The geomagnetic poles do not coincide with the Earth's north and south geographic poles. The north and south designations simply reflect the hemisphere of the Earth in which each is located. In fact, the geomagnetic poles are not stationary. They roam around and, once in a great while, even switch places as the patterns of electric flow shift deep within the Earth. A May 2001 survey by the Geological Survey of Canada established that the north geomagnetic pole is moving north west at a rate of approximately 40 Km per year. For its most recent location visit the Natural Resources Canada website:

[http://gsc.nrcan.gc.ca/geomag/nmp/northpole\\_e.php](http://gsc.nrcan.gc.ca/geomag/nmp/northpole_e.php).

As evidenced by the effect of Earth's geomagnetic poles on the alignment of compasses all around the world, a magnet does not have to touch an object to attract it. Magnetism works through air and other substances as well. The area around a magnet where it can exert an influence on other pieces of steel or iron is called the magnet's *magnetic field*. The strength of a magnetic field depends on the number of iron atoms aligned within the magnet; the greater the number of aligned iron atoms, the greater the field strength. The magnetic field is strongest at the poles and diminishes with distance from those two locations.

Magnetic fields are measured in *gauss* units. A unit of one gauss is defined as the strength of the magnetic field produced one centimetre from a straight wire in which a current of five amperes is flowing. (See the grade 5 unit Electricity and Magnetism to discover how the flow of electricity creates magnetism.) The average strength of the Earth's magnetic field is about 0.5 gauss (0.3 gauss at the Equator, 0.7 gauss at the geomagnetic poles). A refrigerator magnet has a field measuring a few hundred gauss. The most powerful permanent magnets in existence are 3,000 to 4,000 gauss. The most powerful electromagnet to date is 730,000 gauss. Plates of iron and steel make useful shields against magnetism because the iron atoms divert the magnetic field, causing it to run along the sheet of metal rather than pass through it.

## Elementary Science Program of Studies

### General and Specific Learner Expectations

### Cross-curricular Connections

The following general and specific learner expectations have been taken directly from the 1996 Elementary Science Program of Studies. The specific learner expectations (SLEs) are referred to by number in the second column of the activities table.

#### General Learner Expectation

Students will be able to:

Describe the interaction of magnets with other magnets and with common materials.

#### Specific Learner Expectations

Students will be able to:

1. Identify where magnets are used in their environment and why they are used.
2. Distinguish materials that are attracted by a magnet from those that are not.
3. Recognize that magnets attract materials with iron or steel in them and, given a variety of metallic and nonmetallic objects, predict those that will be attracted by a magnet.
4. Recognize that magnets have polarity, demonstrate that poles may either repel or attract each other and state a rule for when poles will repel or attract each other.
5. Design and produce a device that uses a magnet.
6. Demonstrate that most materials are transparent to the effects of a magnet. A magnetic field will “pass through” such materials, whereas other materials interact with a magnet.
7. Compare and measure the strengths of magnets.

#### Language Arts

- Write a story about how a magnet is used to help someone solve a problem. You might provide the problems for the children. For example, a lady who is sewing drops her needle on the carpet.

#### Social Studies

- Create a street map and use a magnet to move a paper clip as if it were a car travelling through the streets; write directions to get to various places on the map.

## Children's Alternative Frameworks

### Physical Education

- Play magnetic tag. The child who is *it* is a magnet. The magnet tags other children who are then joined and must move together to try to attract other children like magnets.

### Mathematics

- After experimenting to discover how many objects a magnet can hold (i.e., washers, paper clips, pins, small nails), record findings in a bar graph.

Many children have misconceptions about magnetism. They believe all metallic objects are attracted by magnets, and that the size of a magnet determines its strength. They may also believe that magnetism can pass through paper but that it cannot pass through wood, a notebook or other thicker materials.

## Activities

Classroom teachers have identified the following activities that address the Specific Learner Expectations (SLEs) in the Program of Studies. The list is not prescriptive and teachers may select activities that are most appropriate for their students.

Activities have been listed under two headings. Key Activities and Extension Activities. Key activities are supported by authorized resources and identify “powerful and practical” means for achieving learner expectations. Extension activities represent alternative ways of achieving or supporting learner expectations.

### Key Activities

Key Activity	SLE	Print Resources	Essential Materials	Comments
Exploring magnets to discover what materials they attract	1, 2, 3	<p><i>Innovations in Science, Level 2, Magnetic Attraction (What's the Attraction?)</i>, p. 5</p> <p><i>Explorations in Science, Level 2, In Motion (What Does a Magnet Move?)</i>, p. 14</p> <p><i>Mostly Magnets</i> (Hoover et al.) (<i>Sticks to It</i>), p. 1</p> <p><i>Delta Science Module: Magnets (What Does a Magnet Attract?)</i>, p. 13</p>	a variety of magnets of different shapes and sizes, small objects (such as paper clips, washers, pens, etc.), shoe boxes, chart paper, paper strips	<p>The results are best recorded on a three-column chart labelled: Object, Attracted and Not Attracted.</p> <p><b>Caution:</b> keep the magnets away from the computer equipment and diskettes. Review with students safety issues regarding the use of magnets.</p> <p><b>Note:</b> magnets should not be stored clustered together because they will lose their strength.</p>

Key Activity	SLE	Print Resources	Essential Materials	Comments
Comparing and measuring the strength of different magnets	7	<i>Innovations in Science, Level 2, Magnetic Attraction (Mighty Magnets Centre), p. 9</i>  <i>Delta Science Module: Magnets (How Strong is the Force), p. 23</i>  <i>Mostly Magnets (Hoover et al.) (Holding Power), p. 23</i>	paper clips, ruler, magnets	Discuss “What is a fair test?”  The students can illustrate and/or write comparative sentences about the investigation (for example, the round magnet holds 12 paper clips, the bar magnet holds only 5). Math extension: arrange the results on a bar graph or pictograph.
		<i>Explorations in Science, Level 2, In Motion (Magnet Power), p. 15</i>	magnets, paper clips or washers, graph paper	When students are working with loose iron filings, explain that they shouldn’t blow on them and should use caution so the filings do not get into their eyes. Iron filings can also be placed in clear plastic bags.  Draw large to small circles on the sheet of paper like a target. Place the washers on the circles. Test different magnets to see if they can pull the washer out of the circle.
Discovering that unlike poles of a magnet attract and like poles repel	4	<i>Delta Science Module: Magnets (Investigating Magnetic Poles), p. 35</i>  <i>Mostly Magnets (Hoover et al.) (Face to Face and Floating Magnets), p. 53</i>		Students can use crayons to label the north and south poles on the magnet. Students should illustrate and write their findings in their logbooks/journals.

Key Activity	SLE	Print Resources	Essential Materials	Comments
Demonstrating that magnetism can pass through a variety of materials	6	<p><i>Innovations in Science, Level 2, Magnetic Attraction (Pulling Power Centre)</i>, p. 15</p> <p><i>Innovations in Science, Level 2, Magnetic Attraction (Hunting for Treasure Centre)</i>, p. 18</p> <p><i>Mostly Magnets</i> (Hoover et al.) (<i>Will a Magnet Attract Through These?</i>), p. 32</p> <p><i>Mostly Magnets</i> (Hoover et al.) (<i>Through it All</i>), p. 35</p> <p><i>Delta Science Module: Magnets (Can the Force Go Through It?)</i>, p. 19</p>	<p>construction paper, paper, cardboard, waxed paper, tin foil, cloth, plastic bag, wallpaper, magnets and objects that are attracted to magnets</p> <p>water table or dish pans filled with water, sand table or dishpans filled with sand, newspapers or plastic bags, paper clips or small nails, variety of magnets, 10 objects attracted by magnets</p>	Place the metal object on a table, cover the object with the test material, then test to see if the magnet is attracted to it.
Viewing magnetic fields	6	<p><i>Innovations in Science, Level 2, Magnetic Attraction (Magnetic Field Trip Centre)</i>, p. 12</p> <p><i>Mostly Magnets</i> (Hoover et al.) (<i>Magnetic Lines</i>), p. 49</p> <p><i>Delta Science Module: Magnets (Magnetic Fields)</i>, p. 29</p>	iron filings, steel wool, magnets	The students can draw pictures of the magnetic fields they create.
Creating games or mazes that use magnets	5, 6	<p><i>Innovations in Science, Level 2, Magnetic Attraction (Pulling Power Centre, In Action, Inventing)</i>, p. 16</p> <p><i>Mostly Magnets</i> (Hoover et al.) (<i>Hungry Hounds</i>), p. 57</p> <p><i>Explorations in Science, Level 2, In Motion (Magnet Maze)</i>, p. 23</p>	<p>dice, paper clips, magnets, construction paper</p> <p>magnets, paper clips, stiff cardboard</p>	
Finding Earth's magnetic poles		<i>Mostly Magnets</i> (Hoover et al.) ( <i>Magnetic Lines</i> ), p. 49		Tie a magnet to one end of a piece of string and a ruler to the other end. Dangle the magnet until it comes to rest. The magnet will be in line with the Earth's magnetic poles.

Key Activity	SLE	Print Resources	Essential Materials	Comments
Making a simple compass	4, 5	<i>Delta Science Module: Magnets (Making a Compass)</i> , p. 47  <i>Mostly Magnets</i> (Hoover et al.) <i>(Making a Compass)</i> , p. 77	needle, cork, magnet, water, container	
Making a temporary magnet	5	<i>Innovations in Science, Level 2, Magnetic Attraction (Taking the Mystery Out of Magnets, Extending the Experience)</i> , p. 22  <i>Delta Science Module: Magnets (Making a Magnet)</i> , p. 53  <i>Mostly Magnets</i> (Hoover et al.) <i>(Making Magnets)</i> , p. 72	nails, magnet, objects to test, paper	

## Extension Activities

Extension Activity	SLE	Print Resources	Essential Materials	Comments
Making information posters about magnets and magnetism	4	<i>Innovations in Science, Level 2, Magnetic Attraction (Taking the Mystery Out of Magnets)</i> , p. 21	poster paper, crayons, magnets	
Suspending a paper clip in mid-air		<i>Delta Science Module: Magnets (The Floating Paper Clip)</i> , p. 7	fishing line, magnet, paper clip, construction paper, tack, stand	
Testing for magnetism in rocks	2, 3	<i>Explorations in Science, Level 3, Rock Solid (That's Quite an Attraction)</i> , p. 14	collection of rocks, magnets, string, lodestone (magnetite)	
Identifying where magnets are used	1, 2	<i>Innovations in Science, Level 2, Magnetic Attraction Theme Card</i> , p. 18		Send a letter home to parents requesting they take their child on a home tour, looking for magnets. Keep an ongoing list in the classroom for students to record any new places magnets have been found.
Using magnets to move cork or styrene foam boats through water	5	<i>Innovations in Science, Level 2, Magnetic Attraction (Hunting for Treasure Centre, Extending the Experience)</i> , p. 19	corks, tacks, waxed paper, pins, magnets, water, containers	Attach a tack to the bottom of the boat.
Making electromagnets		<i>Delta Science Module: Magnets</i> , p. 65 <i>Mostly Magnets</i> (Hoover et al.) ( <i>Making an Electromagnet</i> ), p. 80	nail, wire, batteries, switch (optional), magnetic objects	
Using magnets to separate magnetic and non-magnetic articles		<i>Mostly Magnets</i> (Hoover et al.) ( <i>A Sorting Challenge</i> ), p. 15 <i>Mostly Magnets</i> (Hoover et al.) ( <i>Mining with Magnets</i> ), p. 45	sand, iron filings, magnet, wood chips, water	Mix the iron filings with wood chips. Use the magnet to separate the substances. Repeat by mixing the filings with other substances listed. Instead of using iron filings, you might try steel wool in clear bags or containers.

## Assessment

For a broader discussion of science classroom assessment techniques see *Assessing Student Learning* in the introduction of this publication on p. 15. Good places to begin looking for the unit-related ideas are *Explorations in Science* assessment handbooks, *Innovations in Science* teaching notes, Unit tests and Portfolio ideas, Alberta Education sample tests at [www.education.gov.ab.ca](http://www.education.gov.ab.ca) and Alberta Assessment Consortium at [www.aac.ab.ca](http://www.aac.ab.ca)

## Bibliography

Atwater, Mary et al. *Matter and Magnets: Teacher's Planning Guide*. New York: Macmillan/McGraw-Hill, 1993. ISBN 0-02-27497-2/1.

Baker, S. *Learning Tree 123 Magnets*. Bath, Avon, England: Cherrytree Press, 1990. ISBN 0-7451-5093-4.

Bryant-Mole, Karen. *Science All Around Me. Magnets*. Chicago, Illinois: Heinemann Interactive Library, 1998. ISBN 140340052-0.

CAMP. Classroom Assessment Materials Project, Grade 2, 1997. Available from Learning Resource Centre [www.education.gov.ab.ca](http://www.education.gov.ab.ca).

Campbell, Steve et al. *Explorations in Science, Level 3: Rock Solid*. Don Mills, Ontario: Addison-Wesley, 1992. ISBN 0-201-55505-0.

Campbell, Steve et al. *Explorations in Science, Level 2: In Motion*. Don Mills, Ontario: Addison-Wesley, 1992. ISBN 0-201-88126-8.

Campbell, Steve et al. *Explorations in Science, Level 1: Assessment Handbook*. Don Mills, Ontario: Addison-Wesley, 1993. ISBN 0-201-60683-6.

Catherall, E. *Exploring Magnets*. East Sussex, England: Wayland, 1989. ISBN 0-7502-0267-X.

Davies, Kay and Wendy Oldfield. *Electricity and Magnetism*. East Sussex, England: Wayland, 1991. ISBN 0-7502-0902-X.

Fitzpatrick, J. *Magnets*. London, England: Evans Brothers, 1984. ISBN 0-237-60208-3.

Hendry, Joreen. *Delta Science Module: Magnets: Teacher's Guide*. Hudson, New Hampshire: Delta Education, 1994. ISBN 0-87504-150-7.

Hoover, Evalyn et al. *Mostly Magnets*. Fresno, California: AIMS Educational Foundation, 1991. ISBN 1-88143123-1.

Lauw, Daphen and Lim Cheng Puay. *Science Alive! Magnets*. St. Catharines, Ontario: Crabtree Publishing Company, 2002. ISBN 0-7787-0609-5.  
[www.crabtreebooks.com](http://www.crabtreebooks.com).

Peturson, Rod and Neil McAllister. *Innovations in Science, Process and Inquiry, Level 2*. Toronto: Harcourt Brace & Company, Canada, 1996.

ISBN 0-7747-0189-7.

Robson, P. *Magnetism*. New York: Gloucester Press, 1992.

ISBN 0-531-17399-2.

Ward, A. *Experimenting with Magnetism*. New York: Chelsea House, 1991.

ISBN 0-7910-1509-2.

Ward, A. *Magnets and Electricity*. New York: Franklin Watts, 1992.

ISBN 0-501-14141-1.

Wilkes, A. *My First Science Book*. London, England: Dorling Kindersley, 1990.

ISBN 0-7737-2435-4.

Winnett, D. et al. *Discovery Science: Exploration for the Early Years*. Menlo

Park, California: Addison-Wesley, 1994. ISBN 0-201-29063-4.