ESSENTIAL **QUESTION**

What Are Magnets?

Engage Your Brain

Find the answer to the following question in this lesson and record it here.

Why do these rings seem to float?

ACTIVE **READING**

Lesson Vocabulary

List the terms. As you learn about each one, make notes in the Interactive Glossary.

Cause and Effect

Some ideas in this lesson are connected by a cause-and-effect relationship. The reason that something happens is a cause. The event that takes place as a result of a cause is an effect. Active readers look for effects by asking themselves, What happened? They look for causes by asking, Why did it happen?

Magnets Are Everywhere

You use magnets every day. They are in computers, televisions, speakers, and even microwaves.

ACTIVE **READING** As you read these two pages, draw circles around two things that affect a magnet's pull.

Barriers

Weak

A barrier between a magnet and iron items weakens a magnet's pull. The barrier here is paper.

Even Weaker

You can make the pull weaker by making the barrier bigger. Paper was added, so fewer objects are stuck to the magnet.

A **magnet** is an object that attracts iron and a few other metals. Magnetism is a physical property. Only some kinds of matter are magnetic. The magnets in these pictures are made of iron. They pull objects that also contain iron.

Do you see that in two of the pictures the pull is stronger? Different things affect the strength of a magnet's pull. The pictures show how two factors—barriers and distance—affect a magnet's pull.

Does It Have Pull?

iron nail, paper clip, pencil, crayon, rubber band, screw

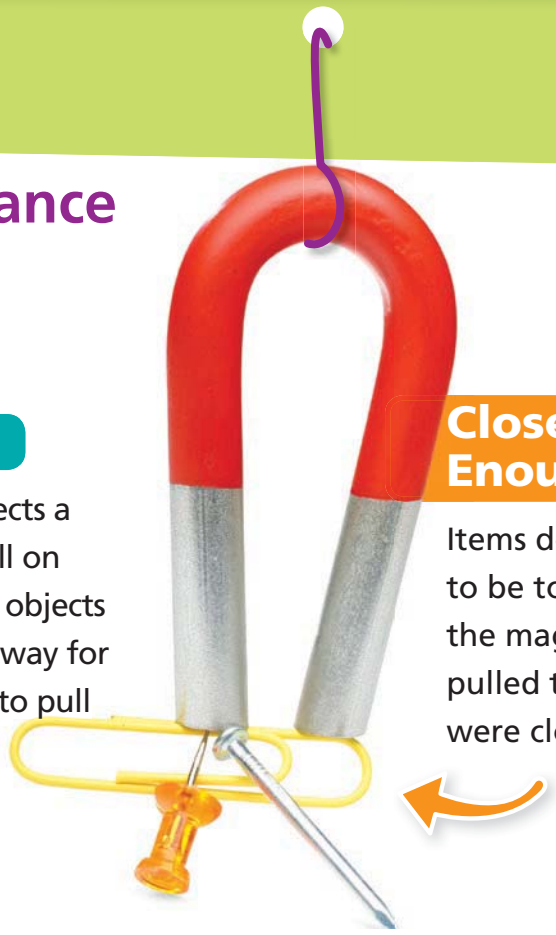
▶ Place each item from the box in the correct column.

Attracted by magnets	Not attracted by magnets

Distance

Too Far

Distance affects a magnet's pull on items. These objects are too far away for the magnet to pull them.

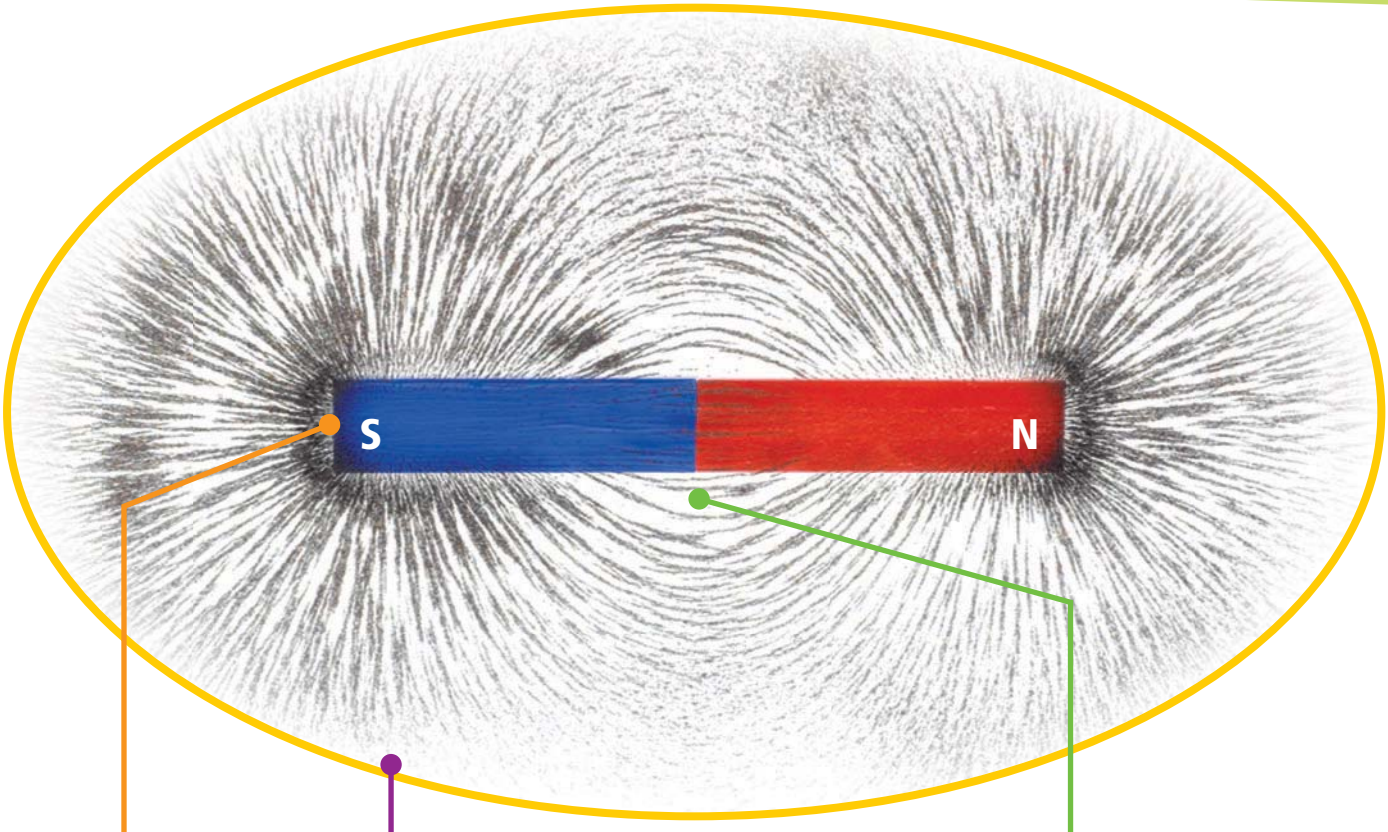


Close Enough

Items don't have to be touching the magnet to be pulled to it. These were close enough.

Magnetic Fields and Poles

You can feel the force between two magnets. You feel magnets pull together, and you feel them push apart. Why do they push and pull?



Strong

The magnetic field is strong at the ends of the magnet. These ends are called poles.

Magnetic Field

A **magnetic field** is the space around the magnet in which the force of the magnet acts. These iron filings show the shape of the magnetic field.

Weak

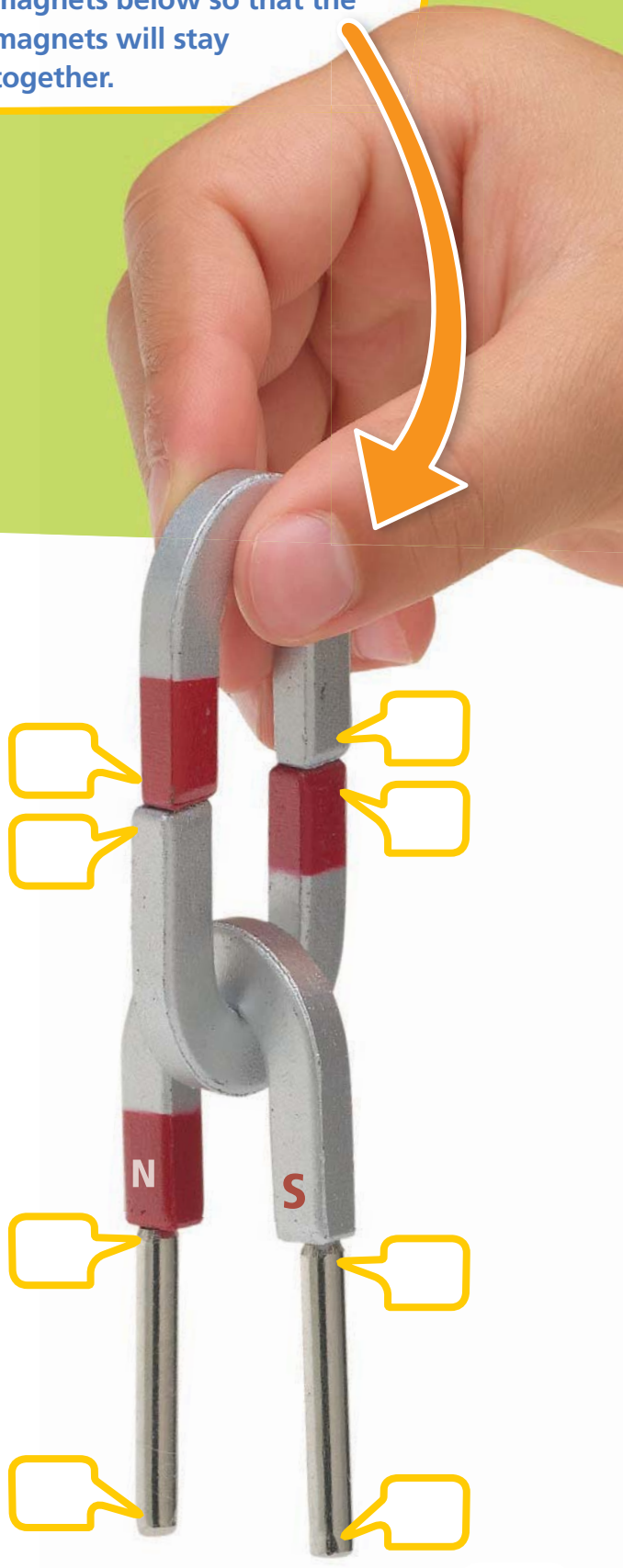
The magnetic field is weakest in the center of the magnet.

Each magnet has two ends, or poles. A **magnetic pole** is the part of the magnet where the force is the strongest. One is called the "south-seeking" pole, or *S* pole. The other end is the "north-seeking" pole, or *N* pole.

Earth has an *N* pole and an *S* pole. As a result, the whole planet is a magnet. Two *N* poles or two *S* poles are *like poles*, or similar poles. An *N* pole and an *S* pole are *unlike poles*.

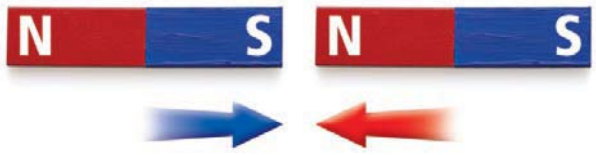
Label This!

Label the poles on the magnets below so that the magnets will stay together.



Unlike Poles

If you bring unlike poles of two magnets together, they will attract, or pull toward, each other. Unlike poles attract.



Like Poles

The *S* pole of one magnet will repel, or push away, the *S* pole of another magnet. Two *N* poles will also repel each other. Like poles repel.

Magnetic Force

The electromagnets on these pages show how closely electricity and magnetism are related.

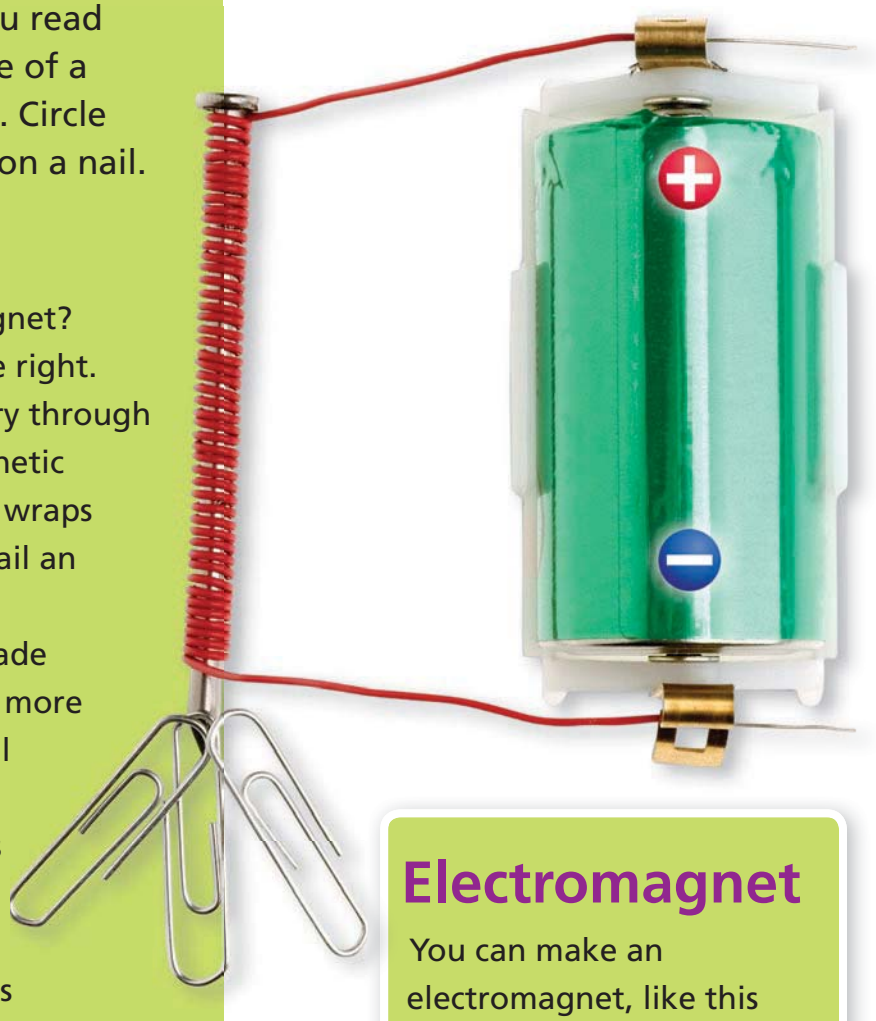
ACTIVE **READING** As you read this page, underline the cause of a magnetic field around a wire. Circle the effect this wire can have on a nail.

What makes an electromagnet? Look at the photo on the right. Electricity flows from the battery through a wire. This makes a weak magnetic field around the wire. The wire wraps around a nail. This makes the nail an **electromagnet**.

Can the magnetic field be made stronger? Yes, it can. Wrapping more coils of wire around the nail will strengthen the magnetic field. The nail will attract iron objects more strongly.

Suppose the flow of electricity stops. Then, the nail is no longer a magnet.

We use electromagnets every day. They are used in telephones, televisions, and motors. A **motor** is a device that uses electricity to make things move.



Electromagnet

You can make an electromagnet, like this one, with a D-cell battery.

DO THE MATH

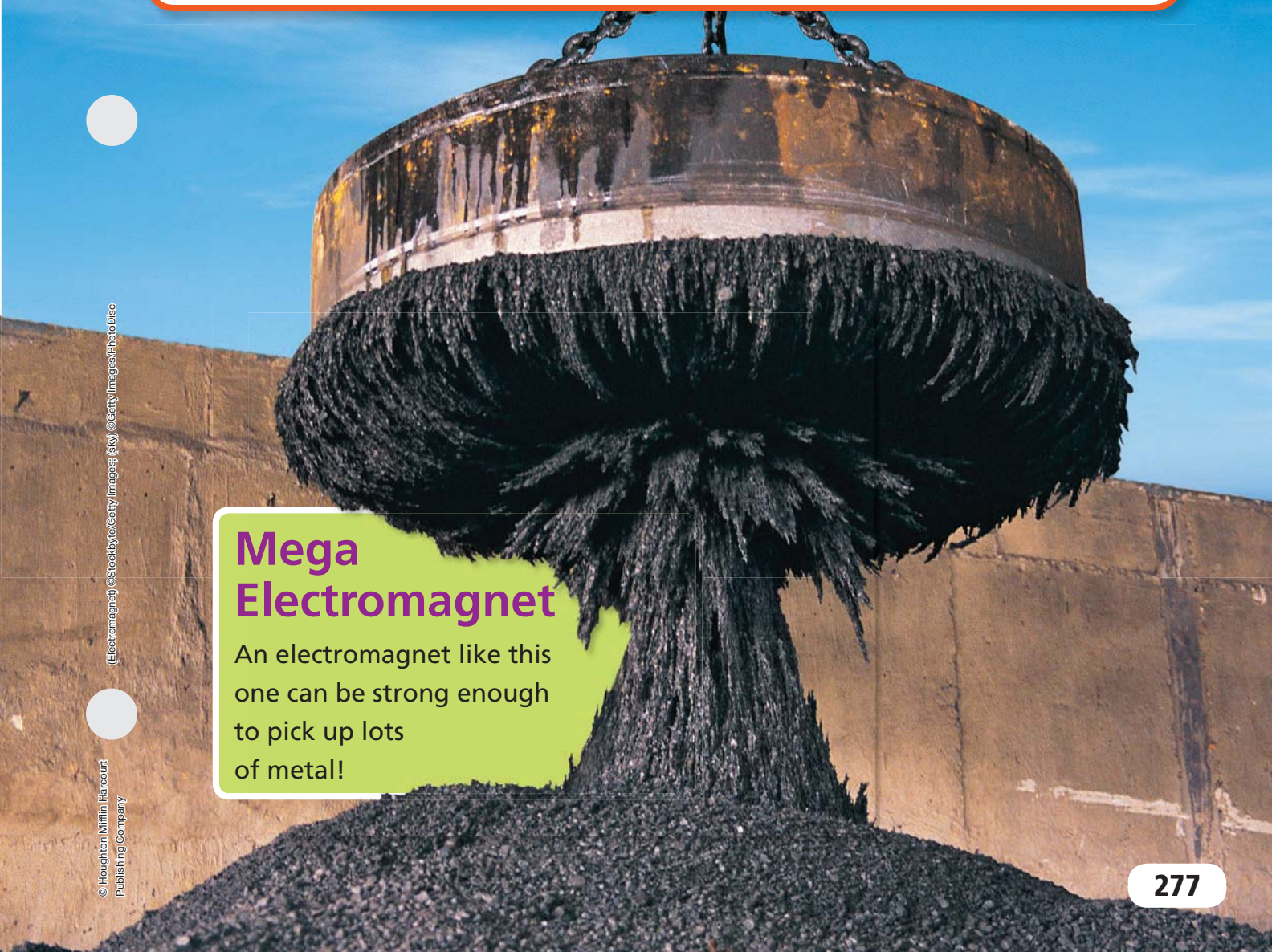
Graph the Data

A student recorded these numbers during an experiment with an electromagnet.

Number of Coils	Number of Paper Clips
10 coils	5 clips
20 coils	10 clips
30 coils	15 clips

Graph this information.

What do you conclude?



Mega Electromagnet

An electromagnet like this one can be strong enough to pick up lots of metal!

Magnetic Planet

Our whole planet acts like a giant bar magnet. It has poles that attract and repel. It also has a magnetic field.

Finding North

This compass has a needle with a magnetic tip. The tip points north because its north-seeking pole is unlike the magnetic pole near Earth's geographic North Pole. They attract.

Which Pole Is Which?

Earth's magnetic poles and geographic poles aren't in the same place. The north magnetic pole is about 700 km away from the geographic North Pole.

South Pole

Earth's magnetic force extends out from both poles. The magnetic field around Earth is like the magnetic field of much smaller bar magnets.

What Else?

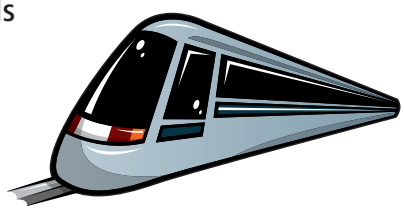
How do we use magnets every day? These are just some of the ways we use magnetic force.

Computer

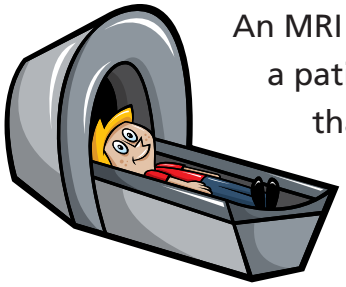
Hard drives use magnets to spin. The speakers use magnets, too.

Train

Maglev trains can go hundreds of miles an hour and never touch the tracks. Magnets lift up the trains and push them forward.

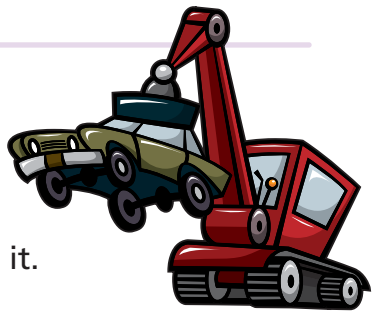


MRI



An MRI shows a picture of things inside a patient's body. It shows much more than an x-ray. The machine that takes the picture uses magnets.

Junkyard



These huge magnets are turned on to pick something up and then turned off to drop it. They're electromagnets.

▶ What magnets do you use at home?

_____

_____

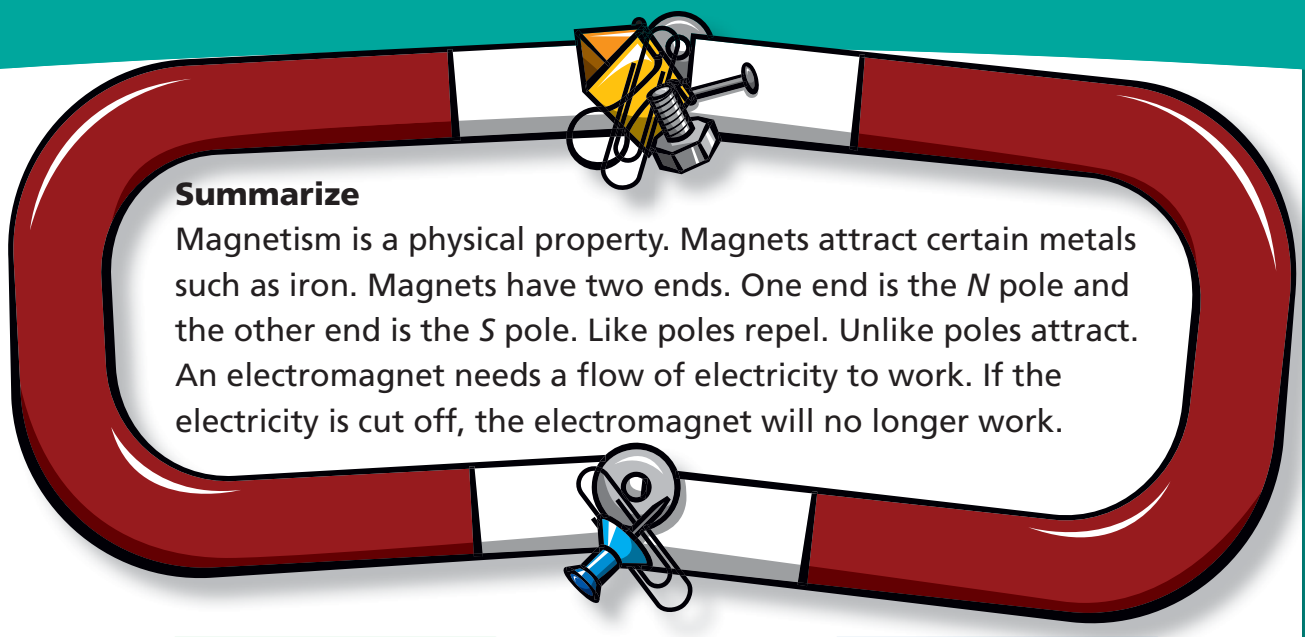
_____

Magnetic Field

Earth has iron inside it that moves around as Earth rotates each day. This makes a magnetic field. You can detect this force from anywhere on the planet.

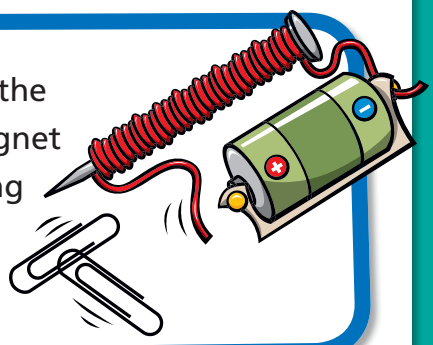
Sum It Up »

Use the information in the summary to complete the graphic organizer.



Summarize

Magnetism is a physical property. Magnets attract certain metals such as iron. Magnets have two ends. One end is the *N* pole and the other end is the *S* pole. Like poles repel. Unlike poles attract. An electromagnet needs a flow of electricity to work. If the electricity is cut off, the electromagnet will no longer work.

	Cause	Effect
1	 Two magnets are placed next to each other. The like poles of both face each other.	_____ _____ _____.
2	_____ _____ _____.	Whatever the electromagnet was holding falls. 

Brain Check

Name _____

Vocabulary Review

1 Use the clues to unscramble the words in the box. Use the word bank if you need help.

1. **eeltronmcetag**: a magnet made with a battery	
2. **elop**: The end of a magnet	
3. **delif**: The force that wraps around a magnet	
4. **teamgn**: a material that pulls iron to it	
5. **pleer**: two like poles do this	
6. **catrtta**: two unlike poles do this	
7. **tronh** and **stouh**: what the two poles are called	
8. **rootm**: a device that uses electricity and is used to make things move	

WORD BANK:

pole repel electromagnet attract

north magnet field

south motor

(br) ©Corbis

Apply Concepts

2 Circle the objects that can be magnetic. Draw a box around the objects that are not magnetic.


paper


scissors


rock


iron key


Earth

3 Make a list of things in your classroom that have magnets in them.

_____ _____ _____

_____ _____ _____

_____ _____ _____

4 Draw and label a diagram of a bar magnet. Show the poles and the magnetic field.

5 The two magnets below are next to each other. You try to press them together, but they will not touch. Label the magnetic poles N and S.

6 The two magnets below are next to each other. They move toward each other. It's hard to pull them apart. Label the magnetic poles N and S.

7 Describe what is happening in each of the pictures. Which picture shows like poles? Which picture shows unlike poles?

_____ _____

_____ _____

_____ _____

8 Suppose you put a magnet in a drawer filled with nails. It doesn't pick up any of the nails. What does this tell you about the nails in the drawer?

_____

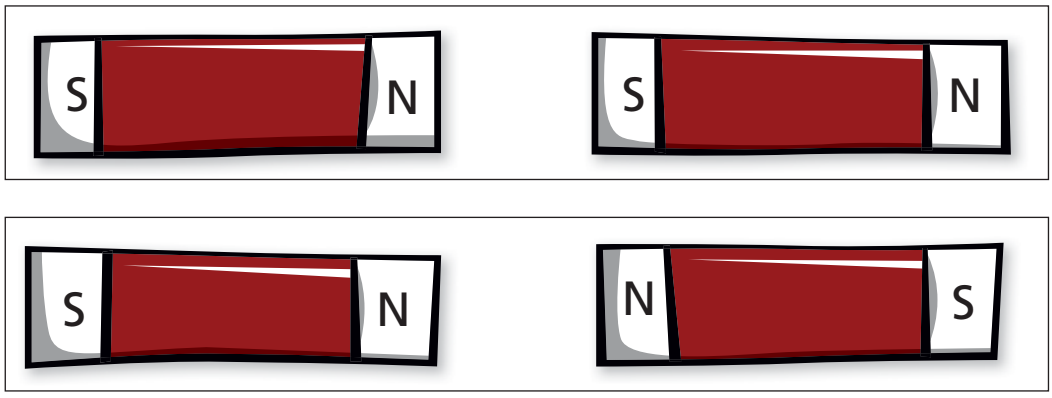
9 Why does a compass point north? Explain.

_____

_____

_____

10 Draw the lines of the magnetic fields between the two magnets in each pair.



Take It Home! With a family member, find an object that uses magnets in your home. Use the Internet to research what the magnet does. Together, draw a diagram to explain how the object works.