Lesson 27

The POWER of Magnets

Chances are there's a magnet on your refrigerator. It's probably holding up a photo, a drawing, or some other piece of paper. Have you noticed that the magnet sticks to the refrigerator but not to the paper? Do you know why?

This refrigerator magnet is actually pulling on the refrigerator.

A magnet attracts objects with iron in them. The refrigerator door is probably made of steel, which is made from iron. Paper has no iron in it. That's why the magnet doesn't stick to it.

If you ever spill a box of pins, a good way to pick them up is with a magnet. The magnet will pull the pins toward it. Most of the pins will stick to the ends, or poles, of the magnet. That's because the poles are the most powerful part of a magnet.

Some magnets are bars. Other magnets are shaped like horseshoes.

The power of a magnet is strongest at its poles, whether it is a bar magnet or a horseshoe magnet.

Poles and Fields

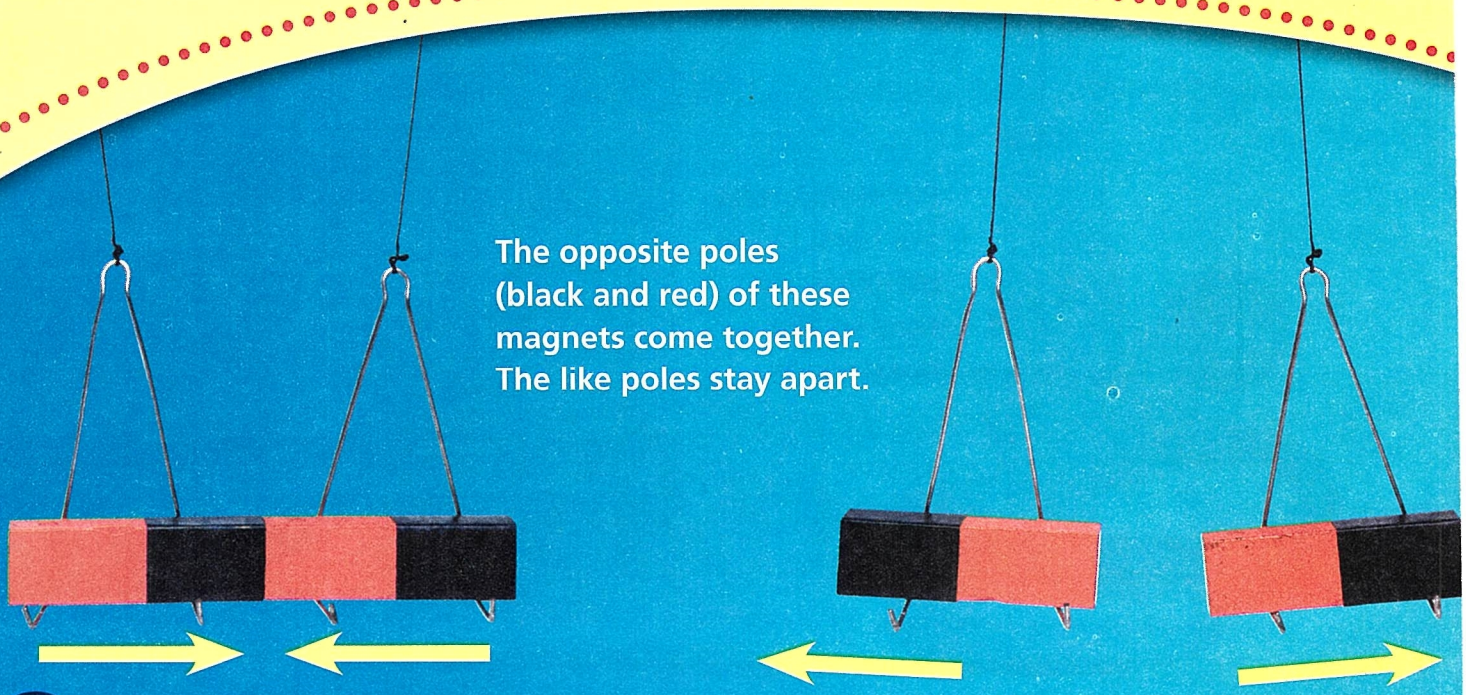
A magnet has a north pole and a south pole. What happens if you try to touch the north pole of one magnet to the south pole of another magnet? They'll stick together. Opposite poles attract each other.

Will two north poles or two south poles stick together? No, they won't. In fact, they will repel, or push each other away. Like poles repel each other.

This special force that attracts or repels is called magnetic force. A magnet's force is not felt just at its poles. A magnet creates a whole area, or field, of force around it.

Do you want to see a magnetic field? Sprinkle iron filings around a magnet. The iron filings will form a pattern of lines. They show the magnetic field, where the magnet's force works. The lines are closest together at the poles, where the force is strongest.

A magnetic field is invisible, but these iron pieces show where it is.



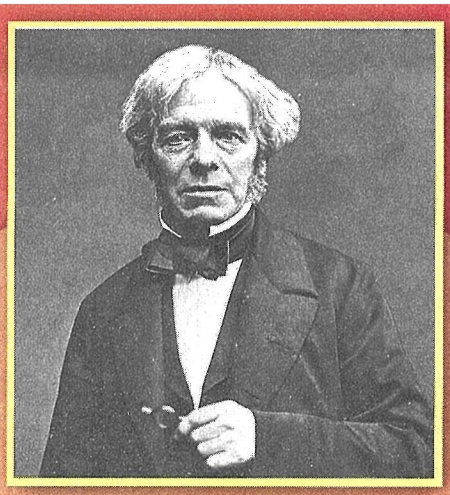
The opposite poles (black and red) of these magnets come together. The like poles stay apart.

Electromagnets: Turn Them On, Turn Them Off

Some magnets can be turned on and off. If you need a magnet whose force you can control like this, you want an electromagnet. In an electromagnet, wire is wrapped around metal. Electricity can flow through the wire. When you turn the electricity on, the metal becomes a magnet! It is an electromagnet. When you turn the electricity off, the metal stops being a magnet.

Junkyards use huge electromagnets to move old cars. A special crane turns electricity on. That turns a core of metal into a magnet. The car sticks to the magnet, and the crane moves the car with ease. Then the electricity is turned off, and the magnet turns back into plain metal. The car drops into place.

Electromagnets are useful for two reasons: They can be powerful enough to move a car, and they can be turned on and off.



Michael Faraday's Electric Idea

In 1820, people first learned about electromagnets. That year one scientist saw a magnetic field produced when electricity ran through a metal wire. His observation made another scientist, Michael Faraday, curious. Faraday asked himself: If electricity can produce a magnetic field, can a magnetic field produce electricity?

Faraday tested his idea. In one experiment, he moved a magnet through a coil of wires. Electricity was produced! In another, he moved the coil of wires around a magnet. Again, electricity was produced.

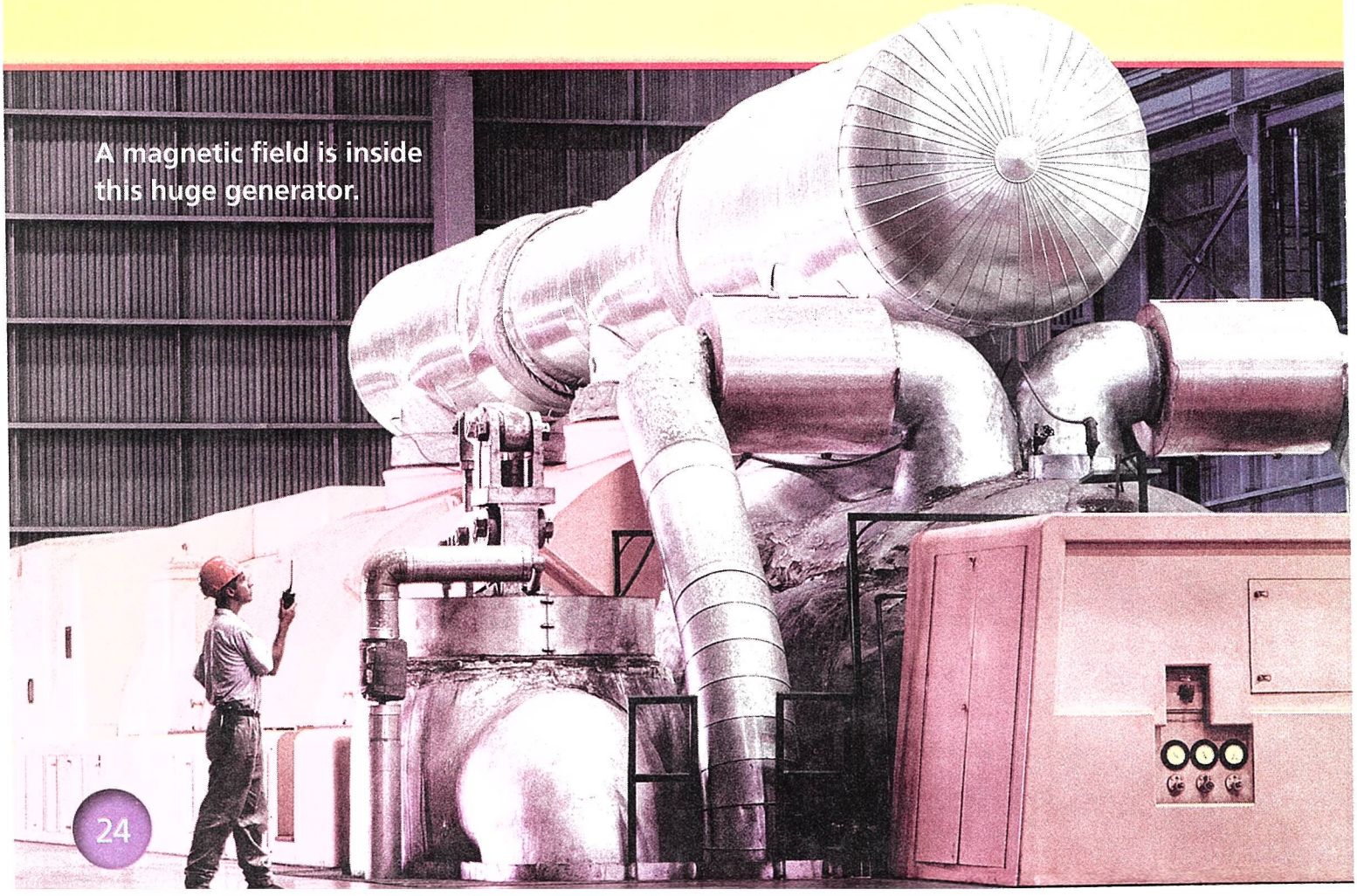
Faraday's work led to two important inventions: the electric generator and the electric motor. The electric generator produces electricity with a magnetic field. The electric motor uses electricity to run things. Now people could use magnets to make electricity do their work for them!

Electric Generators

Generate means "produce or make." An electric generator uses a magnetic field and moving wire coils to produce electricity, just as Michael Faraday discovered.

A power company near your home builds generators. Electricity from these generators comes through power lines into your home. It lets you turn on lights, watch TV, and listen to music. Think of all the times you use electricity. You are using electricity produced in a magnetic field.

Every time you turn on a light switch, electricity comes through a wire. Every time you plug in a cord, electricity comes through the wire. Remember, too, that electricity creates a magnetic field. So every time electricity comes through a wire in your home, it produces a magnetic field. How many magnetic fields do you think are in your home?



A magnetic field is inside this huge generator.

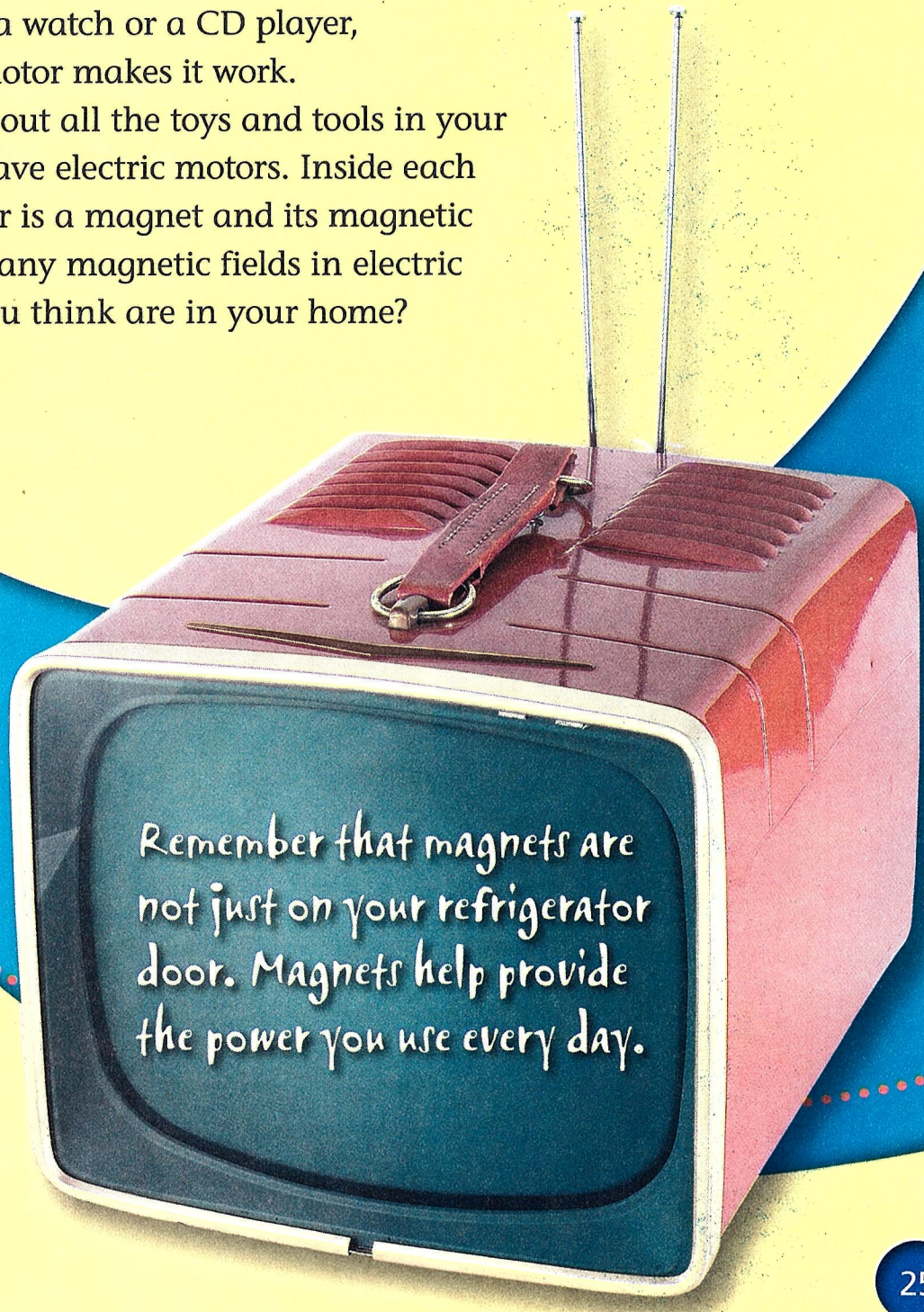
Electric Motors

Some electricity that comes into your home is used to power electric motors. An electric motor uses electricity to run things. When you plug in and turn on a hair dryer or a fan, an electric motor makes it work.

Some electric motors get their power from batteries. When you put a battery in a watch or a CD player, an electric motor makes it work.

Think about all the toys and tools in your home that have electric motors. Inside each electric motor is a magnet and its magnetic field. How many magnetic fields in electric motors do you think are in your home?

Batteries like these give power to electric motors.



ELECTRO

You may not know it, but you live with electromagnets all around you. Here are just a few examples.

Ding-dong! **Pressing a doorbell turns an electromagnet on. The magnet makes a striker or arm move. It hits a bell, and the doorbell rings.**

Did you know that electromagnets help you dry your hair? Any machine with an electric motor uses an electromagnet to turn working parts on and off. So a blow dryer, vacuum cleaner, refrigerator, washing machine, and radio all have electromagnets.

MAGNETS AND YOU

Electromagnets even help you have fun!

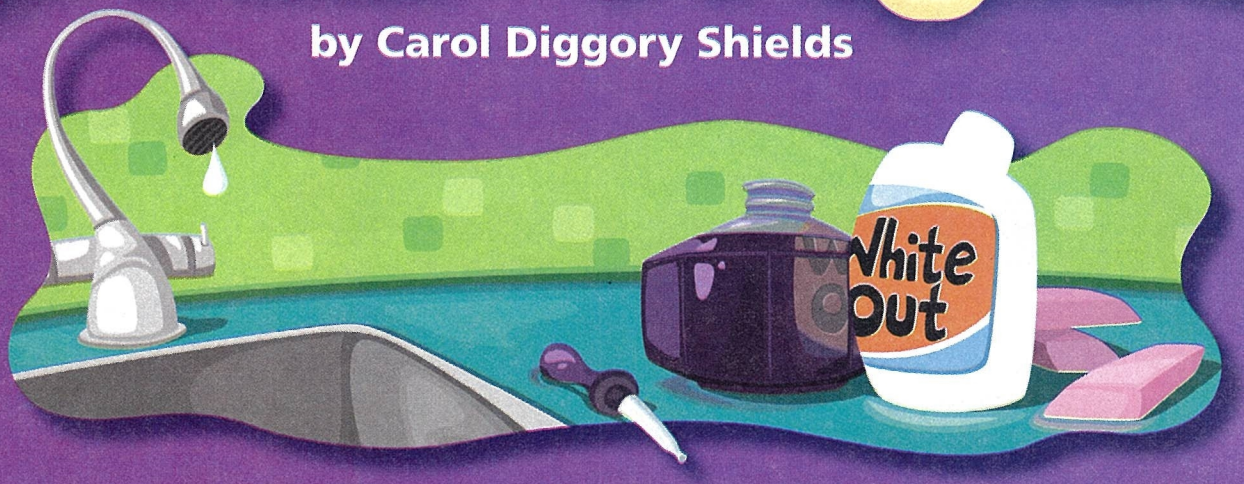
A computer uses electromagnets too. They help store information on the computer's hard drive so you can find it later.

Music pumps out of a stereo's speakers because of electromagnets. Inside, the cone has a coil attached to it. Around that is a magnet. Electricity creates a magnetic field. This vibrates, or shakes, the coil. The cone moves, too. That's what makes the sounds you hear.

Poetry Place

Science Fair Project

by Carol Diggory Shields



PURPOSE:

The purpose of my project this year
Is to make my brother disappear.

HYPOTHESIS:

The world would be a better place
If my brother vanished without
a trace.

MATERIALS:

3 erasers
White-out
Disappearing ink
1 younger brother
1 kitchen sink

PROCEDURE:

Chop up the erasers.
Add the white-out and the ink.
Rub it on the brother
While he's standing in the sink.

RESULTS:

The kid was disappearing!
I had almost proved my theorem!
When all at once my mom
came home
And made me re-appear him.

CONCLUSION:

Experiment a failure.
My brother is still here.
But I'm already planning
For the science fair *next* year.

magnet

by Valerie Worth

This small
Flat horseshoe
Is sold for
A toy: we are
Told that it
Will pick up pins
And it does, time
After time; later
It lies about,
Getting its red
Paint chipped, being
Offered pins less
Often, until at
Last we leave it
Alone: then
It leads its own
Life, trading
Secrets with
The North Pole,
Reading
Invisible messages
From the sun.

Discuss Poetry

Compare and contrast form in these two poems. How does each poet arrange her words? Notice capitalization, punctuation, rhyme, and line breaks.

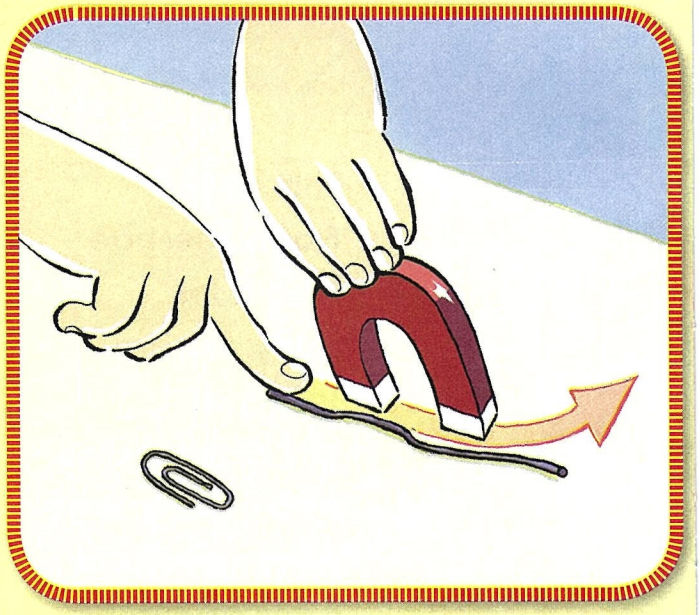
Activity Central

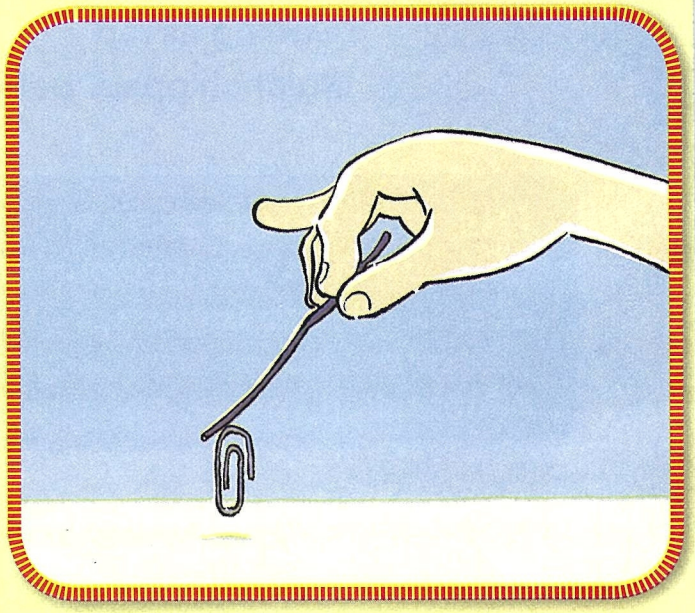
Make a Magnet

Amaze your friends! Tell them you can pick up one paper clip with another without clipping them together. It's not magic. It's magnetism!

Materials

- 1 magnet
- 1 large paper clip
- 1 small paper clip





1. Straighten out the large paper clip. Set it on a table so it's flat.
2. Hold one end of the paper clip down with a fingertip.
3. Hold the magnet in your other hand. Gently, but firmly, slide the magnet along the paper clip from one end to the other. Then lift the magnet up and away from the paper clip.
4. Repeat Step 3 about ten times. Always stroke the magnet in the same direction.
5. Carefully pick up the magnetized paper clip. Use its tip to pick up the small paper clip.

Do the Magnet Jump

Did you know you can make metal objects "jump"?

1. Tape the ruler onto a table so it won't move.
2. Tape the magnet so one end is facing the beginning of the ruler.
3. Place the pin along the ruler an inch or two away from the magnet. Gently nudge the object toward the magnet until it "jumps" toward the magnet.
4. Record the mark where the object was right before its jump.
5. Repeat Steps 3 and 4 with the other objects. Record the distance each one jumps.

After you do the activity, explain the directions to a classmate.

Materials

1 ruler
1 magnet
tape
a straight pin
a small and a large paper clip
a nail

Object	Distance "Jumped"
straight pin	
small paper clip	
large paper clip	
nail	

Your Turn

Wow!

What an Invention!

You've been reading about useful inventions—the magnet, the electromagnet, the electric motor, and others. Think about something *you'd* like to invent. What would it do?

Your invention can be simple or complicated. It can be useful or silly. It can even be something that already exists but that you wish you had invented.

Write a description of your invention and what it does. Then draw a picture of it.

Invention Tips

- State your invention's name.
- Make a drawing of your invention and label its parts.
- Write a description of what your invention does and how it works.