Lakeshore®

MAGNETS

PHYSICAL SCIENCE LAB

Targets standards in these areas:

- Identify properties of magnets
- Use a compass
- Recognize that magnets have poles that repel and attract each other

Perfect for science centers, our hands-on lab is a fun, engaging way for students to explore magnets! Children just display one of the seven experiment cards in the wooden stand and follow the step-by-step instructions to complete the activity. Plus, the back of each card features background information on the concept covered by the experiment—so students learn important facts as they work.

What's Included

- 2 canisters of steel shapes
- 2 blue trays
- 2 compasses
- 2 bar magnets
- 4 brick magnets
- 2 ring magnet stands
- 8 ring magnets
- 2 electromagnets
- 2 battery cases
- 2 red wires with clamps
- 2 blue wires with clamps
- 20 steel-ringed chips
- 7 experiment cards
- Wooden stand

Note: To use the electromagnets, you will need "AA" batteries, which are not included. Do not mix old and new batteries. Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.

Also, some experiments require additional materials that are commonly found in the classroom. The names of these items are printed in italics in the "You will need" section of the experiment cards.

Before You Begin

Reproduce the experiment cards for students to complete in pencil. Then gather the required materials (listed at the top of the cards), and place two "AA" batteries inside each of the battery cases.

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Using the Materials

Discuss magnetism with your students. You may want to briefly explain the scientific method and how scientists use experimental evidence to answer questions about the natural world. Point out that each experiment in the lab is meant to answer a specific question about magnetism. Here are suggested discussion questions to ask your students:

- What is magnetism?
- What things do magnets attract and repel?
- Are things naturally magnetic, or can they be made magnetic?
- How are magnets useful in the real world?

Now discuss the following terms, which students will read on the backs of the experiment cards:

magnetism: magnetic force; a magnet's ability to attract metal objects
magnetic field: the area affected by a magnet
nonmagnetic: unable to attract metals or to be attracted by magnets
permanent magnet: a magnet that always has a magnetic force
temporary magnet: an object that becomes a magnet only when it's near another magnet
electromagnet: a piece of metal with a wire wrapped around it; when electricity goes through the wire, the metal becomes a magnet
compass: a magnetic needle that can spin freely and always points north
poles: the opposite ends of a magnet, where its magnetic forces are strongest
like poles: magnetic poles that repel each other
unlike poles: magnetic poles that attract each other
north pole: the part of a magnet that will always point north
south pole: the part of a magnet that will always point south

Finally, select an experiment for students to conduct, and place the card in the wooden stand. Then set out the required materials (including a photocopy of the experiment card for each student). Remind students to read the information on the back of the card before beginning the experiment on front.

Extension Activity

Encourage students to do independent research to learn more about the seven concepts covered in this lab. Invite children to get nonfiction books from the school library or search the Internet for information on the terms and concepts on the experiment cards. Then ask students to share their findings with the whole class or a small group of classmates. Invite students to use this research to develop and conduct new magnetism-related experiments. Finally, prompt children to share the results of their experiments at a science fair.

Meeting Individual Needs

ELL

Before students conduct an experiment, review the important terms on the back of the card. You can also use any pictures on the back of the card to help explain the terms. Then introduce each of the experiment's required components. Finally, allow students to conduct the experiment with a partner.

Reteach/Extra Support

Working with a small group or an individual student, read the passage, terms, and definitions on the back of a card, checking for understanding as you go. Then discuss the directions on the front of the card. Encourage children to refer to the information on the back of the card as they conduct the experiment.

Challenge

After students complete an experiment, invite them to write a summary paragraph of the experiment's results. Remind children to include the important terms from the back of the card in their summaries.

Informal Assessment Ideas

- After students complete an experiment, collect their papers and review their work. Keep the papers in students' files.
- Create a quiz to check students' understanding of the important terms on the cards. For easy reference, the terms and definitions are listed on page 2 of this guide.

Summary of Experiment Outcomes

Magnetism

Students will explore a magnet's magnetic field and learn that magnets can attract metal through nonmagnetic materials.

Electromagnets

Students will learn that an electromagnet is a piece of metal that becomes a temporary magnet when electricity runs through a wire wrapped around it.

Shared Magnetic Force

Students will learn that a temporary magnet attracts metal by borrowing a permanent magnet's force.

Diagramming a Magnetic Field

Students will learn that all magnets, including Earth, have lines of force.

Magnetic Attraction

Students will learn that the forces of a magnet's north and south poles make a magnetic field.

Floating Magnets

Students will learn that unlike poles attract each other and like poles repel each other.

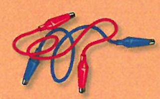
A Magnet's Strongest Points

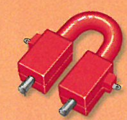
Students will learn that a magnet's force is strongest at its north and south poles.

ELECTROMAGNETS

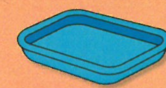
Name ______________________

You will need:


Red and Blue Wires


Horseshoe Magnet


Steel Shapes


Tray

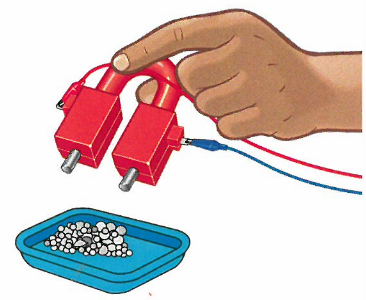

Battery Case with 2 "AA" Batteries Inside

1. Read the back of this card. Place the steel shapes in the tray. Hold the horseshoe magnet over the shapes. Are the shapes attracted to the magnet?

2. Clamp one end of the red wire to a metal loop on the battery case, and clamp the other end to a loop on the magnet. Clamp the blue wire to the two remaining metal loops on the battery case and magnet. You've made an electromagnet!

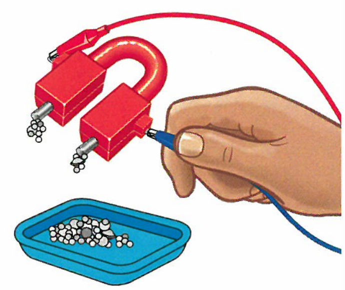
3. Hold the electromagnet over the steel shapes.

What happens?	Why does this happen?

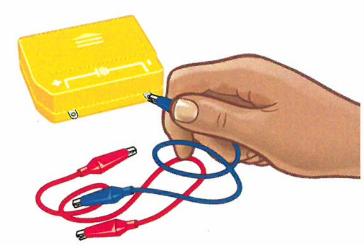


4. Use the electromagnet to pull some steel shapes out of the tray. Now unclamp one of the wires.

What happens?	Why does this happen?



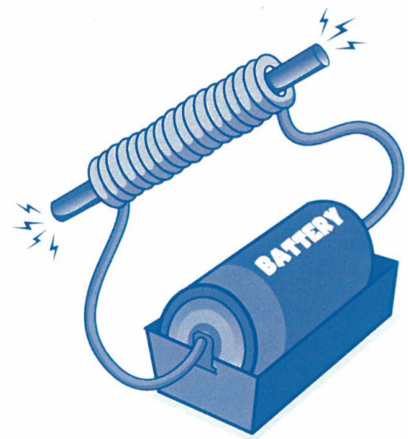
5. In your own words, explain how an electromagnet works.



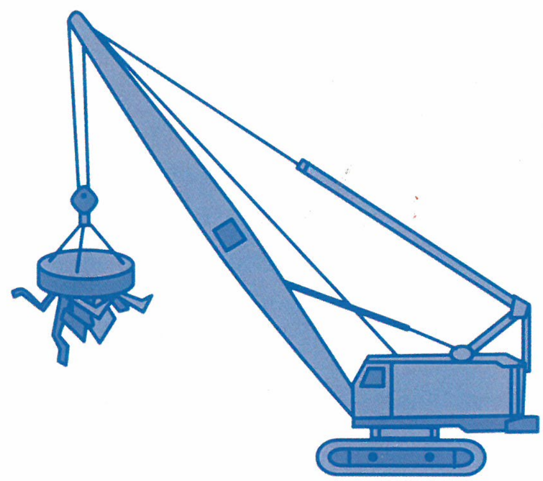
6. Disconnect the battery case from the electromagnet so the batteries don't wear down.

HOW DO ELECTROMAGNETS WORK?

An **electromagnet** is a metal rod with a wire wrapped around it. When electricity goes through the wire, the rod becomes a magnet. How does this happen? An electric current is a flow of small particles called electrons, which create **magnetism** when they move in the same direction. When an electromagnet's wire has electricity running through it, the rod's electrons move in the same direction and make a **magnetic field**. The rod is a temporary magnet. When the electricity is turned off, the rod is no longer magnetic.



electromagnet



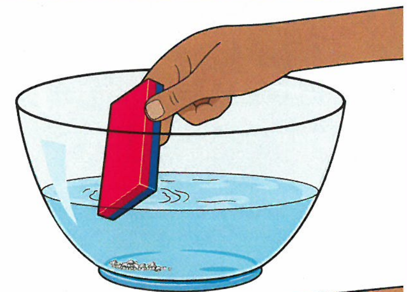
Cranes in junkyards have giant electromagnets for lifting and moving heavy scraps of metal. After the crane operator lifts the metal with the magnet, she can drop the metal by turning off the magnet's electricity. Electromagnets have many uses. For example, when you put coins into a vending machine, they roll between two electromagnets. Coins have different magnetic fields because they are different sizes and are made of different types of metals. The electromagnets in a vending machine measure each coin's magnetic field. Then they send the data to a small computer inside the vending machine. The computer is programmed to match magnetic fields to the coins they belong to. This is how a soda machine "knows" whether you put in a nickel or a quarter!

Important Terms	
magnetism	Magnetic force; a magnet's ability to attract metal objects
electromagnet	A piece of metal with a wire wrapped around it; when electricity goes through the wire, the metal becomes a magnet
magnetic field	The area affected by a magnet

MAGNETISM

Name ____________________

You will need:

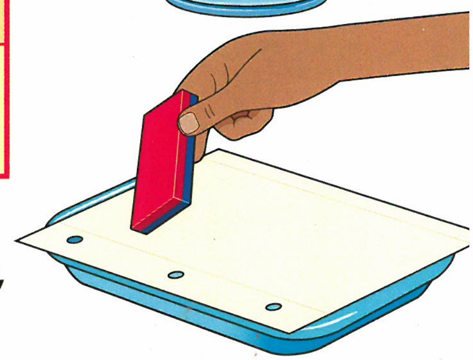


1 Read the back of this card.

2 Place the steel shapes in the bowl.
Pour water into the bowl until it is about half-full.

Predict if the magnet will attract the shapes in water.	Lower the magnet into the water. Does the magnet work?

Remove the steel shapes from the water after this step.

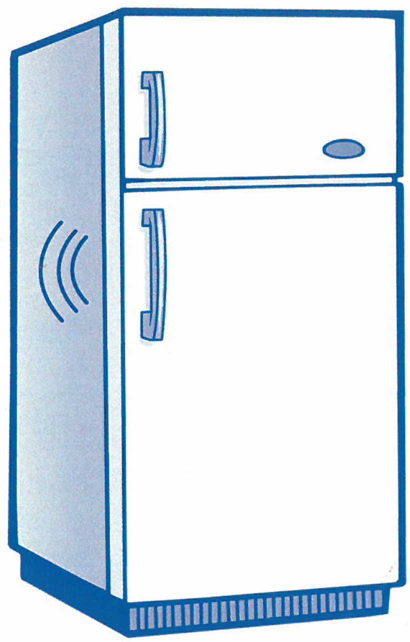


3 Place the steel shapes in the tray. One at a time, place paper, cardboard, tissue, and cloth over the tray. Predict and test to see if the magnet attracts the steel shapes through each material.

Material	Predictions	Observations	Did It Work?
Paper			
Cardboard			
Tissue			
Cloth			

HOW DO MAGNETS MOVE THINGS WITHOUT TOUCHING THEM?

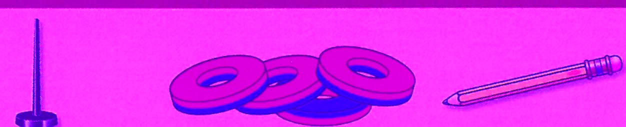
Around every magnet, there is an area called a **magnetic field**. Because of its magnetic field, a magnet doesn't have to touch a metal object to attract it. If a magnetic field is strong, the magnet can attract metal through **nonmagnetic** materials, such as water or plastic. For example, a refrigerator door has a long, thin magnet on each of its four edges—but you can't see these magnets because they are covered with plastic! The door stays shut because its magnet strips cling to the door frame's metal surface through the plastic. If you hold a refrigerator door open about an inch and then let go, the door will close on its own! This is because the magnetic fields of its magnet strips are strong enough to attract metal through both plastic and air!



Try the following experiment to see how a magnetic field works. First place some steel shapes in an empty bowl. Then lower a magnet into the bowl without letting it touch the shapes. As you move the magnet closer to the shapes, you will see the shapes jump to the magnet. This happens because the shapes are in its magnetic field! If you put a nonmagnetic material near the shapes, such as a sheet of paper, the

Name ______________________

You will need:



Ring Magnet Stand | Ring Magnets | *Pencil*

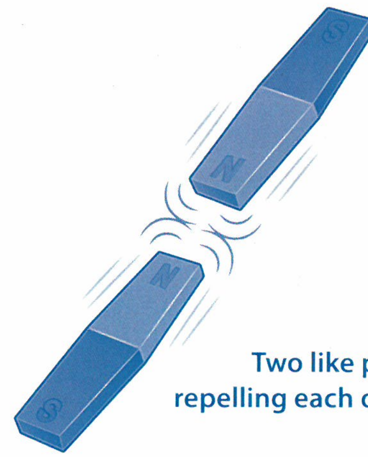
1. Read the back of this card.
2. Slide a ring magnet—red side down—onto the stand.
3. Remove the magnet, flip it over, and slide it back onto the stand.

What happens?	Why?

4. Slide the remaining ring magnets onto the stand one at a time.

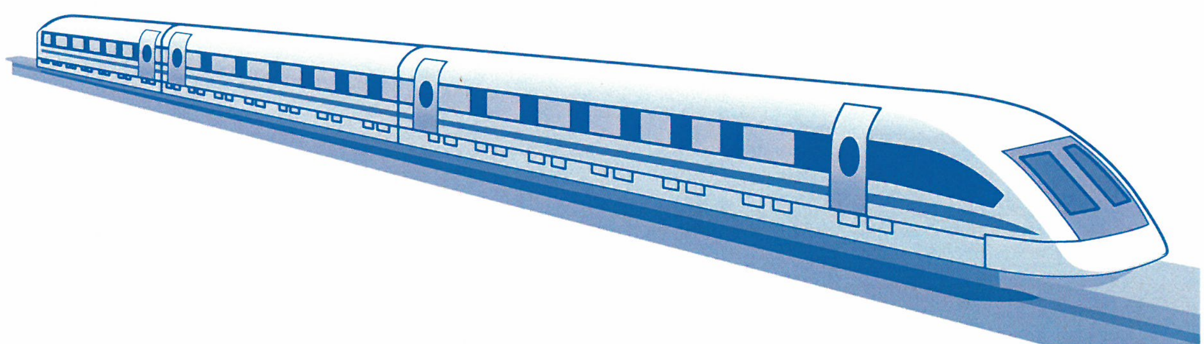
WHAT ARE LIKE AND UNLIKE POLES?

Every magnet has a north pole and a south pole. These are the areas where a magnet's force is strongest. A basic rule of magnetism is that **unlike poles** attract each other and **like poles** repel each other. *Attract* means *to bring near*, and *repel* means *to push away*. A magnet's north pole brings another magnet's south pole closer to itself while pushing that magnet's north pole away.



Two like poles repelling each other

If you hold a bar magnet close to another bar magnet that is hanging freely, the hanging magnet will slowly turn until it comes together with the magnet you're holding! This happens because the magnet in your hand is attracting the hanging magnet's unlike pole even as it's repelling the hanging magnet's like pole. Did you know that some magnets' poles are strong enough to help us travel from one place to another? In Japan, there is a train that uses magnets to ride on air! There are strong magnets on the train and in the tracks. The magnets have like poles, so they repel each other and make the train hover!

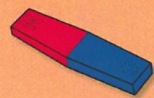


Important Terms	
unlike poles	Magnetic poles that attract each other
like poles	Magnetic poles that repel each other

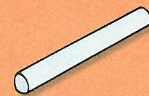
A MAGNET'S STRONGEST POINTS

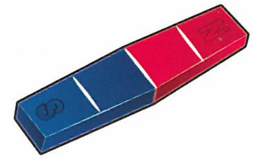
Name ___________________________

You will need:

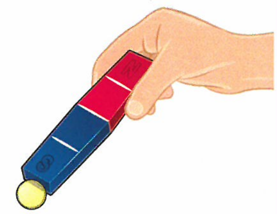

Bar Magnet


Steel-Ringed Chips


Chalk

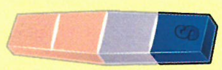
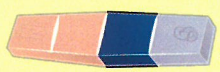
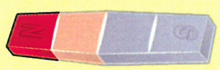
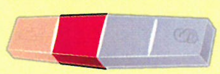


1 Read the back of this card. Use chalk to mark four equal sections on the bar magnet so that it looks like the illustration at right.



2 Which sections of the magnet do you think are the strongest? Which sections do you think are the weakest? Predict how many steel-ringed chips each section will hold, and write your predictions in the chart below.

3 Pick up a chip and try to hang it from a section of the magnet. If it hangs, continue adding one chip at a time to see how many chips the section will hold. Write the results in the chart below. Repeat for the other three sections of the magnet.

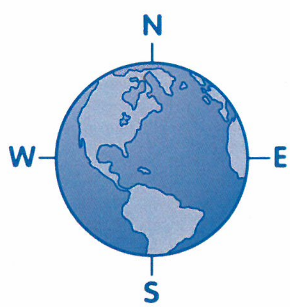
Section	Predicted Number of Chips	Actual Number of Chips
South pole (end) 		
South center 		
North pole (end) 		
North center 		

4 **Why do you think some parts of the magnet are stronger than others?**

WHAT ARE MAGNETIC POLES?

A magnet's **north pole** and **south pole** are the areas where its magnetic force is strongest. And the forces between these poles make a magnetic field, which is the area around a magnet where its force can attract or repel certain metals. A magnetic field is what lets a magnet move objects without touching them! You can test this by spreading small iron shavings on a table and setting a strong magnet next to them. You will see that most of the shavings cling to the magnet's poles!

What is the biggest magnet you can think of? You might be surprised to know that our own planet is a giant magnet! Just like any other magnet, Earth has a north pole and a south pole. These are the areas where Earth's magnetic force is strongest. The force of Earth's magnetic north pole is strong enough to attract the magnetic needle in a compass! Because the needle in a compass points north, we can also tell where south, east, and west are. This is how Earth's magnetic poles help us find our way when we are lost!



Important Terms	
north pole	The part of a magnet that will always point north
south pole	The part of a magnet that will always point south