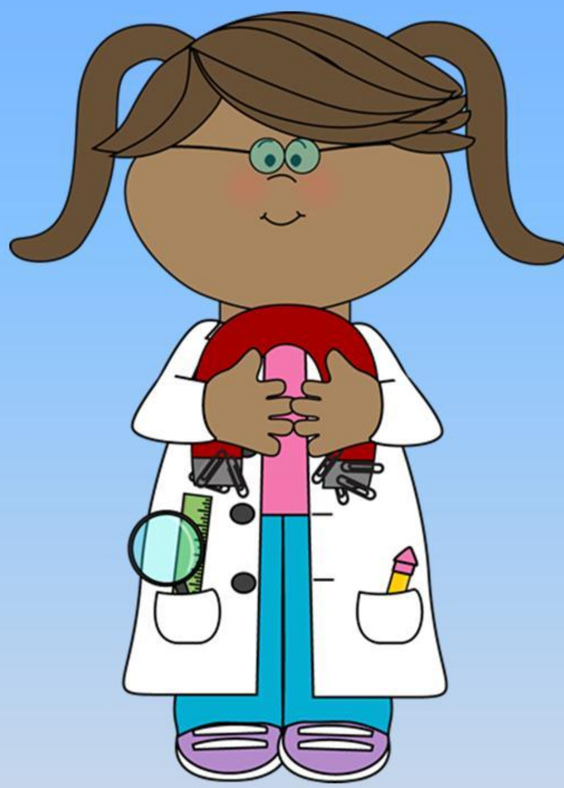
Hands-On Minds-On Science Explorations

Grades 3-5

Electricity & Magnetism



Hands-On Minds-On Publications

By Beth R. Davis, Ed. S., NBCT

TABLE OF CONTENTS

NAME ________________________________ DATE ________________

BULBS AND BATTERIES

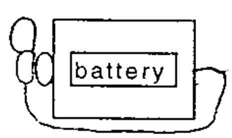
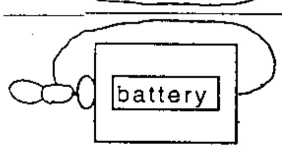
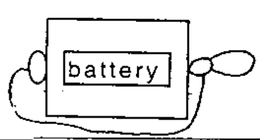
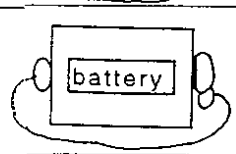
Background Information: When you flip a switch, plug in an appliance, or turn on a light, a current runs through an electrical system. **Current** is the flow of electric charges from one point to another. Electric current is measured in a unit called **amperes.** One source of electricity is a battery, otherwise known as a **dry cell.** Electricity is delivered to a light bulb at the contact point. That is the place on the light bulb where the wire touches the battery or bulb to transfer the electricity.

PROBLEM STATEMENT: How many ways can you light a flashlight bulb using a D-cell battery and a foil ribbon?

MATERIALS: masking tape, aluminum foil, batteries, and flashlight bulb

PROCEDURE:

1. Stick 30 cm strip of masking tape to a piece of aluminum foil and cut the extra foil along the edges of the tape.
2. Fold the masking tape lengthwise so that the foil is on the outside. Flatten the foil ribbon along the side of you table.
3. Look at each picture and predict whether the bulb will light. Test your prediction and record your results on the data table.

Model	Hypothesis: Will it light?	Results: Did it light?	Was your hypothesis supported?
			
			
			
			

1. Another name for a battery is a ____.

2. The flow of electric charge from one point to another is called _______________.

3. The point where the battery or bulb touches the wire is called the _____________.

4. The unit that is used to measure current is called ___________________________.

5. Name 5 things that use electricity:

________________________, _________________________, __________________

________________________, ______________________ NAME ___________________________________ DATE __________________

CIRCUITS

BACKGROUND INFORMATION: When you turn on a light, you complete a circuit so an electric current can flow to a light bulb. **A circuit** is an electrical path in which a current returns to its source. There are two different types of circuits. **Series circuits,** consisting of only a single path for current to follow, have limited use because any change affects all items connected to the circuit. **Parallel circuits** allow current to follow more than one path and are used to connect all household wiring. They allow all lights and appliances to operate at the same voltage even if items are disconnected from the circuit.

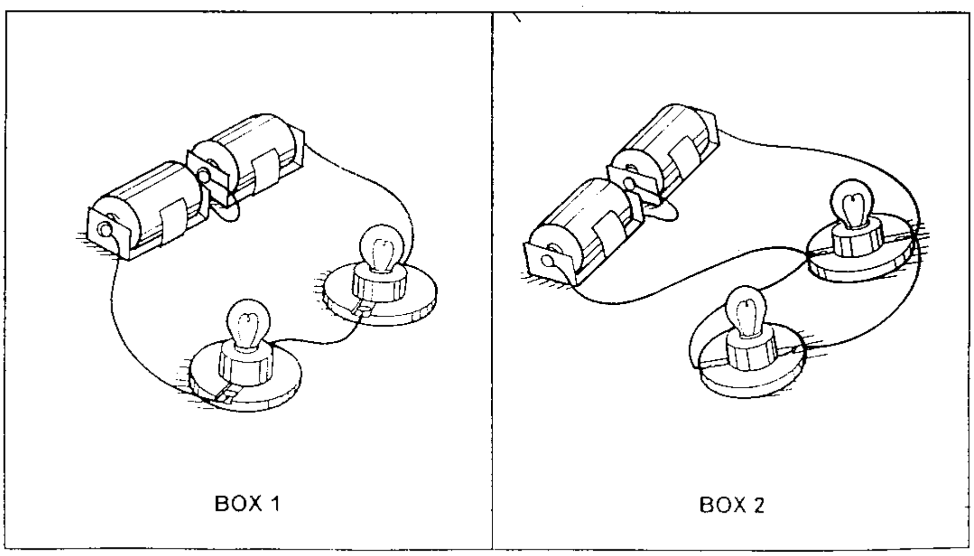
PROBLEM STATEMENT: How are parallel and series circuits different? In Which circuit will the bulbs burn brighter?

HYPOTHESIS: Predict which will burn brighter, the parallel or the series circuit.

MATERIALS: 2 flashlight bulbs, 4 copper wires, 2 D-cell batteries and battery holders

PROCEDURE:

1. Set up a series circuit as shown in box 1.
2. While the bulbs are on, unscrew one of the bulbs. Record your observations.
3. Set up a parallel circuit as shown in box 2.
4. While the bulbs are on, unscrew one of the bulbs. Record your observations.



RESULTS:

1. How do you know your circuits were complete?

2. In the series circuit, what did you notice about the brightness of both bulbs?

3. In the parallel circuit, what did you notice about the brightness of both bulbs?

4. What happened when you unscrewed a bulb in the series circuit? Why?

5. What happened when you unscrewed a bulb in the parallel circuit? Why?

6. In some types of Christmas lights, the entire string of lights would not work if one of the bulbs were bad. What kind of circuit is this? Parallel or series?

CONCLUSION: Was your hypothesis supported? Which circuit burned brighter? Parallel or series?

NAME ________________________________ DATE ______________________

CONDUCTORS & INSULATORS

Background Information: A conductor is any material that allows electrons to flow freely through it. In insulator stops the flow of electrons.

PROBLEM STATEMENT: Which materials will be conductors of electricity and which will be insulators?

MATERIALS: eraser, cardboard, copper penny, rubber stopper, metal washer, chalk, brass fastener, paper clip, metal spoon, battery, foil ribbon, and flashlight bulb

HYPOTHESIS: Fill in the chart at the bottom of the page with your prediction for each item.

PROCEDURE:

1. Stick 30 cm strip of masking tape to a piece of aluminum foil and cut the extra foil along the edges of the tape.
2. Fold the masking tape lengthwise so that the foil is on the outside. Flatten the foil ribbon along the side of your table. Attach the foil ribbon to the base of a flashlight bulb by folding it around the bulb and twisting it tight.
3. Place the item loose end of the foil ribbon under the battery.
4. Place the item being tested on top of the battery.
5. Place the contact point of the battery on top of the item being tested. If the bulb lights, the item being tested is a conductor. If the bulb does not light, the item being tested is an insulator. Record your data.

Item tested:	Prediction: Conductor or Insulator	Results: Conductor or Insulator	Was your hypothesis supported?
Metal spoon			
Eraser			
Cardboard			
Copper penny			
Rubber stopper			
Metal washer			
Chalk			
Brass fastener			

Paper clip			

Graph your results here:

Conductor & Insulator Graph

	6			
	5			
	4			
# of items	**3**			
	2			
	1			
	0			
		Conductor		**Insulator**

Electric Charge

RESULTS: Tell which items were conductors and which were insulators.

CONCLUSION: How many items supported your hypothesis?

Tell what you learned in science today:

EXTRA CREDIT: Think of other items that would be conductors and insulators and list them below:

Conductors:

Insulators:

NAME ________________________________ DATE ___________________

CREATING AN ELECTROMAGNET

Background Information: An electromagnet is a device that connects to an electric circuit. When the circuit is closed, electricity flows through the electromagnet, and it produces magnetism. When the circuit is open, the electricity stops flowing and the magnetism is turned off. An electromagnet can be turned on and off with a switch. By winding a wire into a coil, one magnetic field is added on to another, making the magnet stronger. The magnetism is made greater by placing a core of steel, or a rivet in the center of the coils. The more winds of the coil, the stronger the magnet. Some things that use electromagnets are starters on cars, doorbells buzzers, and telephone ringers.

PROBLEM STATEMENT: How many washers will a 30-wind electromagnet hold?

HYPOTHESIS: (Make your prediction for 30 winds after testing 20 and 40 winds.)

MATERIALS: circuit base, D-battery, switch or alligator clips, rivet, washers, and cup

PROCEDURE:

1. After constructing the circuit base, test the rivet for magnetic strength by placing the rivet on top of the washers to see if it will pick up any washers.
2. Take up 150cm of insulated wire Start with 15cm of wire at the head of the rivet. Wrap the wire so that it winds around the rivet 20 times.
3. Test the rivet to see if it has gained magnetism by being wrapped by the wire.
4. Be sure that the switch is open. Add electricity by connecting one end of the wire to the battery and the other end to the switch.
5. Close the switch. With the switch closed, place the rivet head in the pile of washers and move it around. Hold the rivet over a cup. Open the switch and let the washers fall into the cup. Count how many washers a 20-wind rivet held. Record your results.
6. Wrap 20 more winds so that you have a 40-wind rivet. Close the switch and hold the rivet over the washers again. Place a cup underneath the rivet. Open the switch and let the washers fall into the cup. Count how many washers a 40-wind rivet held. Record your results.
7. Make your hypothesis for a 30-wind electromagnet. Remove 10 winds and test for the results.

Data Table:

20 winds	30 winds	40 winds

Results: Summarize your results by using the data table:

Graph your results here:

Electromagnet graph

	48					
	46					
	44					
	42					
#	40					
Of	38					
	36					
W	34					
A	32					
S	30					
H	28					
E	26					
R	24					
S	22					
	20					
H	18					
E	16					
L	14					
D	12					
	10					
	8					
	6					
	4					
	2					
	0					
		20 winds		30 winds		40 winds

# of winds

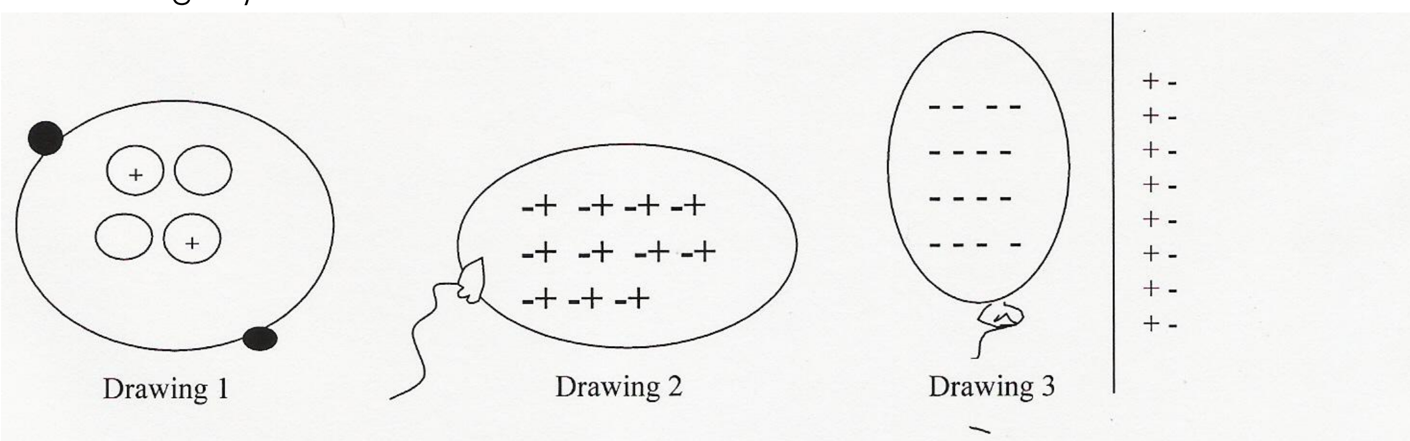
Explain some things you use in your daily life that use electromagnets.

Name____ Date__________________________

Friction & Static Electricity

"Don't Rub Me Wrong"

Background Information: All matter is made up of tiny particles called atoms. Each atom contains 3 basic parts. PROTONS have a positive electric charge (+). ELECTRONS have a negative electric charge (-). Neutrons have no electric charge. Protons and neutron are I the nucleus or the core of an atom, while electros orbit around the nucleus.. (See drawing #1). Most objects, such as balloons have about the same number of electrons as protons, making them electrically balances (se drawing #2). FRICTION (rubbing two objects together) causes objects to gain or lose electrons. When this occurs, the object becomes electrically charged. This is called static electricity. If an object gains electrons when it is rubbed, it becomes negatively charged, because it has more electrons (-) than protons (+). If an object loses electron when it is rubbed, it becomes positively charged because it has more protons (+) than electrons (-). A basic principle of electric charges is that like charges repel and unlike charges attract. When a balloon is rubbed on your hair, it gains electrons from your hair and becomes negatively charged. You hair becomes positively charged and will stick up because like charges repel. When the negatively charged balloon is brought near your hair, it will be attracted because unlike charges attract. When a negatively charged balloon is brought near a wall, it induces a positive charge near the surface of the wall. When a negatively charged balloon is brought near a wall, it induces a positive charge near the surface of the wall. (The electrons on the balloon repel electrons near the surface of the wall) Since opposite charges attract, the balloon sticks to the wall (see drawing #3)



Problem Statement: What effect do statically charged objects have on one another?

Materials: 2 balloons, tiny pieces of paper plastic wrap hair dryer, paper towels
small objects to be tested: safety pins, salt, small, pieces of aluminum foil, Styrofoam packing pieces, dental floss (not waxed), puffed cereal

Hypothesis: Fill in the data table with your predictions. Predict whether each material will be attracted to the plastic wrap.

Procedure:

1. Inflate two balloons and tie the ends.
2. Use the balloons to try to pick up tiny pieces of paper from the floor.
3. Rub the inflated balloons several times against your hair or clothing.
4. Use the balloons to again try to pick up the tiny pieces of paper.
5. Looking at the materials at your table, predict what will happen if you charge the plastic wrap and hold it above the objects listed in the materials list sheet. Test each item and record your findings on the data table.
6. Charge the plastic wrap by placing it flat on a desk and rubbing it with a paper towel.
7. Two members of the group should lift the charged plastic wrap by the four corners and slowly lower it until it is 6-10 cm above one of the objects to be tested.

Data Table

Material to be tested	Hypothesis (Will the item be attracted to the plastic wrap?)	Results (Was the item attracted to the plastic wrap?)	Conclusion (Was your hypothesis supported?)
1			
2			
3			
4			
5			
6			
7			

Attraction Graph

Not attracted								
Attracted								
	0	1	2	3	4	5	6	7

# of items

Results: Summarize your results telling which items were attracted and which were not.

What caused the plastic wrap to stick to the table and other objects when it was rubbed with a paper towel?

Once the plastic wrap is charged, why did it pick up some objects, but not others

Explain what would happen if a positively charged object and a negatively charged object were brought together.

Explain what would happen if two positively charged objects were brought together.

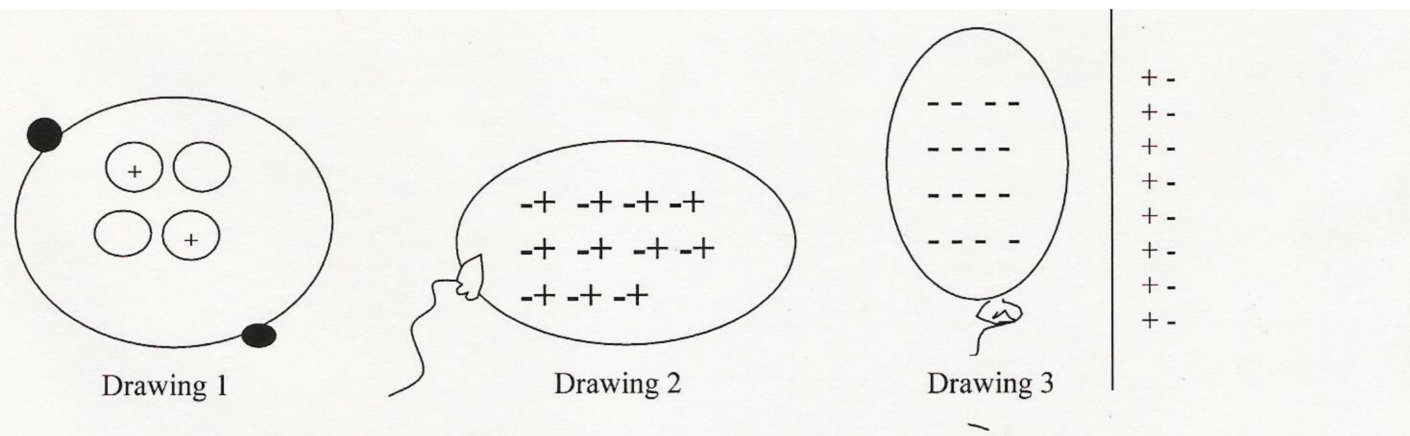
Explain what would happen if two negatively charged objects were brought together.

Name______________________________________ Date______________________

Friction & Static Electricity

"Don't Rub Me Wrong"

Background Information: All matter is made up of tiny particles called atoms. Each atom contains 3 basic parts. PROTONS have a positive electric charge (+). ELECTRONS have a negative electric charge (-). Neutrons have no electric charge. Protons and neutrons are in the nucleus or the core of an atom, while electrons orbit around the nucleus. (See drawing #1). Most objects, such as balloons have about the same number of electrons as protons, making them electrically balances (see drawing #2). FRICTION (rubbing two objects together) causes objects to gain or lose electrons. When this occurs, the object becomes electrically charged. This is called static electricity. If an object gains electrons when it is rubbed, it becomes negatively charged, because it has more electrons (-) than protons (+). If an object loses electron when it is rubbed, it becomes positively charged because it has more protons (+) than electrons (-). A basic principle of electric charges is that like charges repel and unlike charges attract. When a balloon is rubbed on your hair, it gains electrons from your hair and becomes negatively charged. Your hair becomes positively charged and will stick up because like charges repel. When the negatively charged balloon is brought near your hair, it will be attracted because unlike charges attract. When a negatively charged balloon is brought near a wall, it induces a positive charge near the surface of the wall. (The electrons on the balloon repel electrons near the surface of the wall) Since opposite charges attract, the balloon sticks to the wall (see drawing #3)



Drawing 1 Drawing 2 Drawing 3

Problem Statement: What effect do statically charged objects have on one another?

Materials: 2 balloons, tiny pieces of paper plastic wrap hair dryer, paper towels
small objects to be tested: safety pins, salt, small, pieces of aluminum foil, Styrofoam packing pieces, dental floss (not waxed), puffed cereal

Hypothesis: Fill in the data table with your predictions. Predict whether each material will be attracted to the balloon.

Procedure:

1. Inflate two balloons and tie the ends.
2. Use the balloons to try to pick up tiny pieces of paper from the table.
3. Rub the inflated balloons several times against your hair or clothing.
4. Use the balloons to again try to pick up the tiny pieces of paper.
5. Looking at the materials at your table, predict what will happen if you charge the balloon and hold it above the objects listed in the materials list sheet. Test each item and record your findings on the data table.
6.

Data Table

Material to be tested	Hypothesis (Will the item be attracted to the plastic wrap?)	Results (Was the item attracted to the plastic wrap?)	Conclusion (Was your hypothesis supported?)
1 bits of paper		attracted	
2 alum foil		attracted	
3 plastic chips		Not attracted	
4 rice crispies		attracted	
5 steel pins		attracted	
6 styrofoam		attracted	
7			

Attraction Graph

Not attracted	X						
Attracted	X	X	X	X	X		
	1	2	3	4	5	6	7

# of items

Results: Summarize your results telling which items were attracted and which were not.

The following were attracted: paper, foil, rice crispies, steel pins, Styrofoam.
The following were not attracted: plastic chips

What caused the items to stick to the balloon when it was rubbed with a cotton shirt or head?

The static electric charge

Once the balloon was charged, why did it pick up some objects, but not others?

Some items had greater mass

Explain what would happen if a positively charged object and a negatively charged object were brought together.

They would attract

Explain what would happen if two positively charged objects were brought together.

They would repel

Explain what would happen if two negatively charged objects were brought together.

They would repel

NAME ____________________________________ DATE __________________

STATIC ELECTRICITY

BACKGROUND INFORMATION: Have you ever walked across a carpeted floor on a dry day and been shocked by a spark as you reached out to touch something? If you touch the object again, you will receive little or no shock at all. This is an example of static electricity. **Static electricity** occurs where an electric charge builds up on the surface of an object. In this example, your body is a conductor of electricity. A **conductor** is a material that allows electrons to move easily through it. An **insulator** inhibits the flow of electrons. An electroscope detects electric charges by the process of induction. **Induction** occurs where a charge is produced in a conductor as a result of being held close to , but not touching an object.

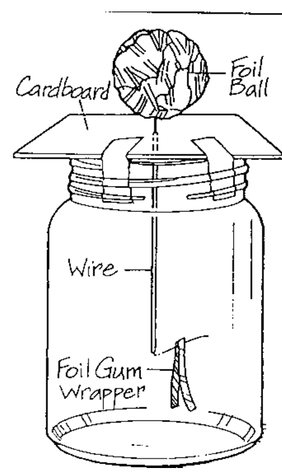
PROBLEM STATEMENT: How does an electroscope detect static electricity?

HYPOTHESIS:

MATERIALS: 4X4 cardboard square, insulated copper wire, aluminum foil, glass jar, tape, scissors, balloon, and wool cloth

PROCEDURE:

1. Poke a hole in the center of the cardboard. Push the wire through the hole. Bend the end of the wire to form an L-shaped hook.
2. Form a ball from aluminum foil and push it onto the straight end of then wire.
3 Cut a small strip of foil. Hang it over the Hook so that the two leaves of the foil hang side by side.
4. Place the cardboard and wire device so that the foil leaves are inside the jar and the foil ball is on the outside. Secure the cardboard to the jar with tape.
5. Blow up the balloon. Rub the inflated Balloon with the wool. Touch the balloon to the foil ball and move it away. Observe the foil leaves inside the jar.
6. Touch the ball with your hand.
7. Repeat step 5,but only bring the balloon within a fraction of an inch from the ball.



RESULTS & CONCLUSIONS:

1	**What happened to the foil leaves when the balloon touched the foil ball?.**
2.	**What happened to the foil leaves when the balloon was moved away from the foil ball?**

3. What happened to the foil leaves when you touched the foil ball?
4. What charge did the balloon have before it was rubbed with the wool?
5. What charge did the balloon have after it was rubbed with the wool?
6. By what method was the electroscope charged when the balloon was placed near the foil ball?
7. What was your job today? What did you do?
8. Tell about the other ways we investigated static electricity:

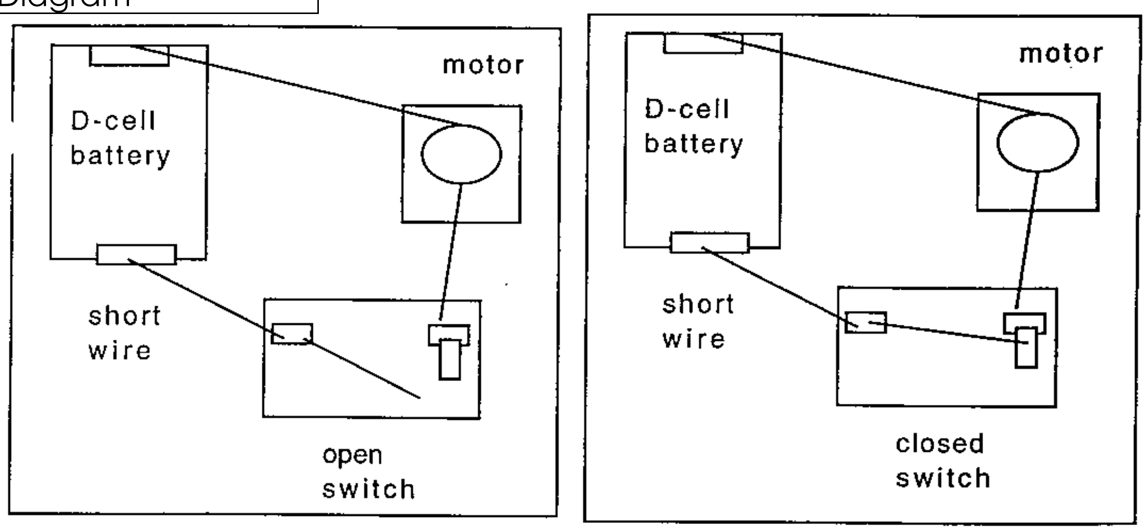
NAME ________________________________ DATE ________________

SWITCHES AND MOTORS

Background Information: In order for electricity to do work, It must first be directed or channeled into a circuit. You can think of a circuit as an electrical circle. A circuit is a path for the electricity to follow in lighting a light, buzzing a buzzer, or operating a motor. Once a complete path from one end of the battery through the motor or bulb, and back to the other end of the battery is completed you have a closed circuit. If the path is disturbed or broken at any location during the path, the circuit is open and will not permit electricity to flow, and the motor will not operate, the bulb will not light, and the buzzer will not buzz. A switch is a device that is used to open and close circuits. This is how circuit breakers work. Switches are used for convenience and safety. When a switch is closed, the circuit or path of electricity is complete. Switches are used to turn on and off lights, tape recorders, televisions, computers, and toys.

In this activity, you will follow directions to construct a circuit board with a motor and a switch. When you have a complete path of electrical current, your motor will turn on. When you add the switch, you can turn on and off the motor.

Circuit Board Diagram



PROCEDURE: Take turns following the steps below with your partner.

1. Orient the circuit base so that the two holes are on top.
2. Carefully snap the D-cell battery into the battery holder.
3. Place the switch with your eraser and the motor as shown above on the circuit base. Be sure that the switch is open.
4. Press the clip with your eraser on the (+) side of the battery and slide in the wire from the motor.
5. Press the clip on the right side of the switch and slide the other wire from the motor.
6. Connect the short wire to the (-) end of the battery and to the left end of the switch.

7. Close the switch and your circuit will be complete.

Show What You Know About Electricity

1. A circuit is a ________________________ for the electricity to follow.
2. When a switch is closed, the circuit or path of electricity is ________________.
3. Once a complete path from one end of the battery through the motor or bulb, and back to the other end of the battery is completed you have a _________________________.
4. In order for electricity to do work, it must first be directed or channeled into a _________________.
5. If the path is disturbed or broken at any location along the path, the circuit is ____________________.
6. A _______________________ is a device that is used to open and close circuits.
7. Switches are used for _________________ and ________________________.
8. You can think of a circuit as an electrical ___________________________.
9. Switches are used to ____ ____.

Name________________________________ Date______________________________

CIRCUITS

BACKGROUND INFORMATION There are two basic types of electric circuits – series and parallel. In both types of circuits, a complete path beginning and ending with the power source (the D-cell) is necessary before current can flow and provide energy to the power users (the bulbs). Any break in the path stops the movement of charges. In a series circuit, there is only one pathway for the current and a break in the circuit will stop the current. In a parallel circuit, there may be several pathways. If there is a break in one pathway, the current will pass through the other pathways. The current will stop only if all of the pathways have breaks. Resistance is also a factor in electric circuits. Resistance is any thing that hinders the flow of electricity. The amount of resistance is determined by the material, length, thickness, etc. of the conductor; the number of electrical devices, such as motors, bulbs, etc. that are part of the circuit; and the type of circuit – series or parallel.

Look at a string of Christmas tree lights. Christmas tree lights were connected in such a way that if one light burned out, the whole string of lights would go out. Someone would have to check each bulb to find the one that was burned out. Christmas tree lights are examples of series circuits. Today newer strands may have an alternate path for electricity to flow through if a bulb burns out. Today you will try out both a parallel and series circuit.

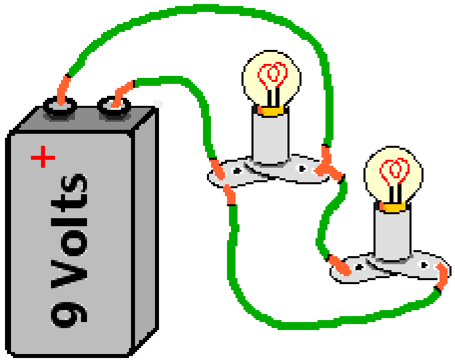
Problem Statement: Which circuit will be brighter; a parallel or series circuit?

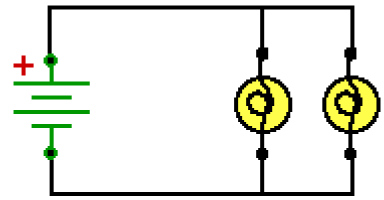
Hypothesis: Which do you predict will be brighter?

Materials:
2 D-cells, 3 flashlight bulbs and holders, 7 pieces of wire (15-20 cm) 2 pieces of wire (30-40 cm)

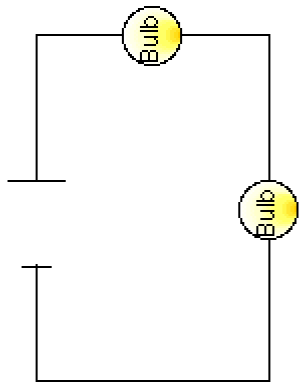
Try This…*Make a light in such a way that when you unscrew one, the other one goes out? Make a light in such a way that when you unscrew one, the other one stays lit?*

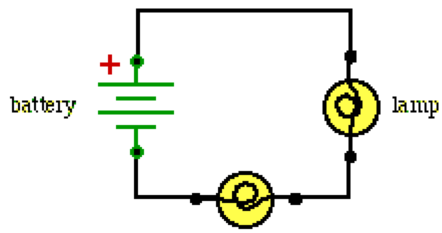
Use the diagrams to help you to construct a **parallel circuit**:





Use the diagrams to help you construct a **series circuit**:





Results: Tell which circuit burned brighter.

How many pathways are in a series circuit?__________

In the diagram above, how may pathways are in the parallel circuit?____________

What would happen if one bulb in a series circuit is unscrewed?

What would happen if one bulb in a parallel circuit is unscrewed?

Write **two** sentences telling something new you learned today:

Name____ Date____________________

MAGNETIC FIELD LINES

BACKGROUND INFORMATION A **magnetic** field exists in a magnet and in the space around it. The magnetic field is strongest near the poles. The shape of a magnet's magnetic field is shown by the magnetic field lines that spread out from both poles and meet in a series of extended arcs. The magnetic field lines may also be called flux. The earth acts as if there were a large bar magnet running from north to south through the middle of it. The earth does have magnetic north and south poles and a magnetic field, but the magnetic north pole is not at the earth's geographic north pole; it moves constantly at a rate of about fifteen miles per year.

Problem Statement: Where are the magnetic field lines of a magnet?

MATERIALS: 2 magnets rod or bar magnet (1 per student) 1 compass (if poles of magnets are not marked) iron filings, 1 small, clear jar with lid ,1 map with a global view of the earth, cooking oil 1 zip lock bag, one small paper plate, variety of magnets: bar, ring, horseshoe, safety goggles

Take a few moments with your partner to do the following:

1. Make *your magnet attract or repel your partner's magnet.*

2. See *how many poles your magnets have* _______________

3. Where are they located? _______________________________________

4. Use a compass to find the north and South Pole of your magnet. Mark the magnet with a piece of tape. Record what happens when the following poles are held together:

Write attract or repel for each

North and North	South and South	North and South

SAFETY TIP: When using iron filings, you must wear safety goggles. Never rub your eyes after handling iron filings. They can harm your eyes.

In this activity, you will see the magnetic field on a magnet.

Procedure:

1. Place a paper plate in on top of a bag and place a magnet in the bag under the plate. Seal the bag.
2. Sprinkle iron filings on the plate over the magnet. The filings should be arranged so that you can see the magnetic field. Notice where there are the most filings on the plate and draw what you see in box 1. Carefully pour the filings off of the plate.
3. Place a second magnet under the plate so that unlike poles are touching each other. The magnets should be attracted to each other. Slowly pour the filings over the two magnets. Draw the magnetic field in box 2. Carefully remove the filings.
4. Place the magnets so that like pole are touching. You will need to hold them carefully as they will be repelling. Pour the filing over the two magnets and draw the field in box 3.

Pole lines of one magnet	Pole lines of two magnets with unlike poles attracting	Pole lines of two magnets with like poles repelling

How would you describe the pattern formed by the iron filings?

Where were the lines closest together?

What do you think this means?

Place a picture of a world map on top of the plate. Place the magnet in the bag under the plate. Sprinkle the filings on top of the world map. Sprinkle iron filings on the map until the magnetic field lines are visible.

Where on the map were the most iron filings concentrated?

Which part of the earth has the strongest magnetic power?

Tell something you learned during this lab. What was you favorite part?

Name____ Date____________________

MAGNETIC FIELD LINES ANSWER KEY

BACKGROUND INFORMATION A **magnetic** field exists in a magnet and in the space around it. The magnetic field is strongest near the poles. The shape of a magnet's magnetic field is shown by the magnetic field lines that spread out from both poles and meet in a series of extended arcs. The magnetic field lines may also be called flux. The earth acts as if there were a large bar magnet running from north to south through the middle of it. The earth does have magnetic north and south poles and a magnetic field, but the magnetic north pole is not at the earth's geographic north pole; it moves constantly at a rate of about fifteen miles per year.

Problem Statement: Where are the magnetic field lines of a magnet?

MATERIALS: 2 magnets rod or bar magnet (1 per student) 1 compass (if poles of magnets are not marked) iron filings, 1 small, clear jar with lid, 1 map with a global view of the earth, cooking oil 1 zip lock bag, one small paper plate, variety of magnets: bar, ring, horseshoe, safety goggles

Take a few moments with your partner to do the following:

5. Make *your magnet attract or repel your partner's magnet.*

6. See *how many poles your magnets have* ___**2**___

7. Where are they located? **North and south side of the magnet**

8. Use a compass to find the north and South Pole of your magnet. Mark the magnet with a piece of tape. Record what happens when the following poles are held together:

Write attract or repel for each

North and North	South and South	North and South
Repel	**Repel**	**Attract**

SAFETY TIP: When using iron filings, you must wear safety goggles. Never rub your eyes after handling iron filings. They can harm your eyes.

In this activity, you will see the magnetic field on a magnet.

Procedure:

5. Place a paper plate in on top of a bag and place a magnet in the bag under the plate. Seal the bag.
6. Sprinkle iron filings on the plate over the magnet. The filings should be arranged so that you can see the magnetic field. Notice where there are the most filings on the plate and draw what you see in box 1. Carefully pour the filings off of the plate.
7. Place a second magnet under the plate so that unlike poles are touching each other. The magnets should be attracted to each other. Slowly pour the filings over the two magnets. Draw the magnetic field in box 2. Carefully remove the filings.
8. Place the magnets so that like pole are touching. You will need to hold them carefully as they will be repelling. Pour the filing over the two magnets and draw the field in box 3.

Pole lines of one magnet	Pole lines of two magnets with unlike poles attracting	Pole lines of two magnets with like poles repelling

How would you describe the pattern formed by the iron filings?

More filings are in the center of the magnet, less farther away from the poles.

Where were the lines closest together?

The center

What do you think this means?

Magnetic field is strongest at the center

Place a picture of a world map on top of the plate. Place the magnet in the bag under the plate. Sprinkle the filings on top of the world map. Sprinkle iron filings on the map until the magnetic field lines are visible.

Where on the map were the most iron filings concentrated?

Toward the core of the earth

Which part of the earth has the strongest magnetic power?

The core

Tell something you learned during this lab. What was you favorite part?

Answers may vary

NAME______________________________________ DATE_____________________

WHAT ITEMS WILL A MAGNETIC FIELD PASS THROUGH

BACKGROUND INFORMATION: A magnet **attracts,** or pulls near it, objects made of **iron, steel, cobalt, and nickel.** The Earth is surrounded by a magnetic field. The field is what would be produced by a large bar magnet buried inside the Earth. The poles of this imaginary magnet are located near the North and South poles. Scientists think that the Earth's magnetism may be produced as a result of electric currents flowing through the liquid iron that forms the Earth's outer core. The fact that a magnet always aligns itself with the north-south lines of the Earth's magnetic field makes the use of a compass possible. A compass consists of a magnetized needle mounted on a pivot so that it is free to rotate. The needle always points north-south and is therefore useful for finding direction.

PROBLEM STATEMENT: WHAT ITEMS WILL A MAGNETIC FIELD PASS THROUGH?

HYPOTHESIS: Circle the items that you predict a magnetic field will pass through:

Glass plastic paper wood water aluminum

MATERIALS: glass, plastic, paper, wood, water, aluminum, iron filings, bar magnet

TELL WHAT YOU WILL DO TO BE SAFE IN THE LAB TODAY:

PROCEDURE:

1. Pour 15 ml of iron filings on a paper plate. Pass the magnet under the plate. Record what happened.
2. Pour 15 ml of iron filings on a piece of wood. Pass the magnet under the wood. Record what happened.
3. Pour 15 ml of iron filing in a glass jar. Pass the magnet under the jar. Record what happened.
4. Pour 15 ml of iron filings on an aluminum pan. Pass the magnet under the pan. Record what happened.
5. Pour 15 ml of iron filings in a plastic container. Pass the magnet under the container. Record what happened.

6. Pour 15 ml of water in a plastic container. Pass the magnet under the container. Record what happened.

RESULT TABLE: Record what happened, whether the magnetic field passed through each item.

ITEM	YES	NO	DESCRIBE WHAT HAPPENED
PAPER			
WOOD			
GLASS			
ALUMINUM			
PLASTIC			
WATER			

CONCLUSION: How many items did you guess correctly? Write a fraction to represent that number.

I guessed ___________ items correctly. My guess was _________accurate.

MAGNET QUIZ

1. List the items that the magnetic field passed through.
2. A magnet pulls things near. A word that means the same as pulls near is ___________.
3. A magnet attracts items made of ____________, ___________, __________, & ___________.
4. A needle of a magnetic compass always points ______________________.
5. The Earth is surrounded by a ________________________.

Name____________________________ Date____________

MAPPING A MAGNET

Just like the Earth has a north and south pole, magnets also have a north and south pole. A ***compass*** is a tool used to show direction. You can use a compass to map a magnet and find the north and south pole. When like poles are held together, they will ***repel*** (push away). When unlike poles are held together, they will ***attract*** (come together).

Problem Statement: What will happen when the north pole of one magnet is held next to the south pole of another magnet.

Hypothesis: What is your prediction?

Materials: two magnets, compass, masking tape

Procedure:

Step 1: Place a piece of tape on each side of the magnet.

Step 2: Hold the side of the magnet on the short side of the compass. Record where the red needle is pointing, either north or south. Mark "N" or "S" on the tape.

Step 3: Repeat step 2 for the other side of the magnet.

Step 4: Once you have mapped the magnet, make your predictions on the table and record what happened.

What do you predict will happen when you hold:	Are the poles alike or unlike?	What do you think will happen? Attract or Repel	Results: What happened? Attract or Repel	Was your hypothesis supported? Yes or No
North to North				
South to South				
South to North				
North to South				

Results:
When like poles are held together, they will always________________.

When unlike poles are held together, they will always______________.

A ____________ is a tool used to show direction.

When two magnets come together, they _________________.

When two magnets push away, they ____________________.

Write two sentences telling something you learned today:

1.____

____

2. ____

____

NAME________________________________ DATE________________

WHAT IS A MAGNET?

BACKGROUND INFORMATION: A **MAGNET** is an object that **attracts** (brings near) metals such as iron and steel. The ends of a magnet are called **POLES**. A magnet has a **north pole** and a **south pole.** The poles are equal in strength. The north pole of one magnet attracts the south pole of another magnet. The south pole of a magnet attracts the north pole of another magnet. This is because opposite poles attract. The north pole of a magnet will **repel,** or push away, the north pole of another magnet. The south pole of a magnet will repel, or push away, the south pole of another magnet. This is because like poles repel.

PROBLEM STATEMENT: What kind of objects will be attracted to a magnet?

MATERIALS: magnet, pencil, thread, pin, aluminum foil, cooper penny, paper clip, penny, shoelace, plastic box, steel wool, toothpick, nail, aluminum can, marble, plastic spoon, rubber ball, marble

HYPOTHESIS: List the items you predict will be magnetic:

PROCEDURE: 1. Test each of the items on your table. If it is attracted to the magnet, place a check in the magnetic section of the chart. If it is not attracted, place a check on the non-magnetic section of the chart. Also write what the objects are made of.

Name of item	The item is made of...	Magnetic	Non-magnetic

RESULTS: Write a sentence telling which items were magnetic.

Graph your data:

Magnetic or Not?

Number of items	7			
	6			
	5			
	4			
	3			
	2			
	1			
	0			
		Magnetic items		Non-Magnetic Items

Type of item

Item Graph

Number of items	9							
	8							
	7							
	6							
	5							
	4							
	3							
	2							
	1							
	0							
		Wood		Metal		Plastic		Glass

What the item was made of

CONCLUSION: (Was your hypothesis supported? What did you learn about magnets today?)
