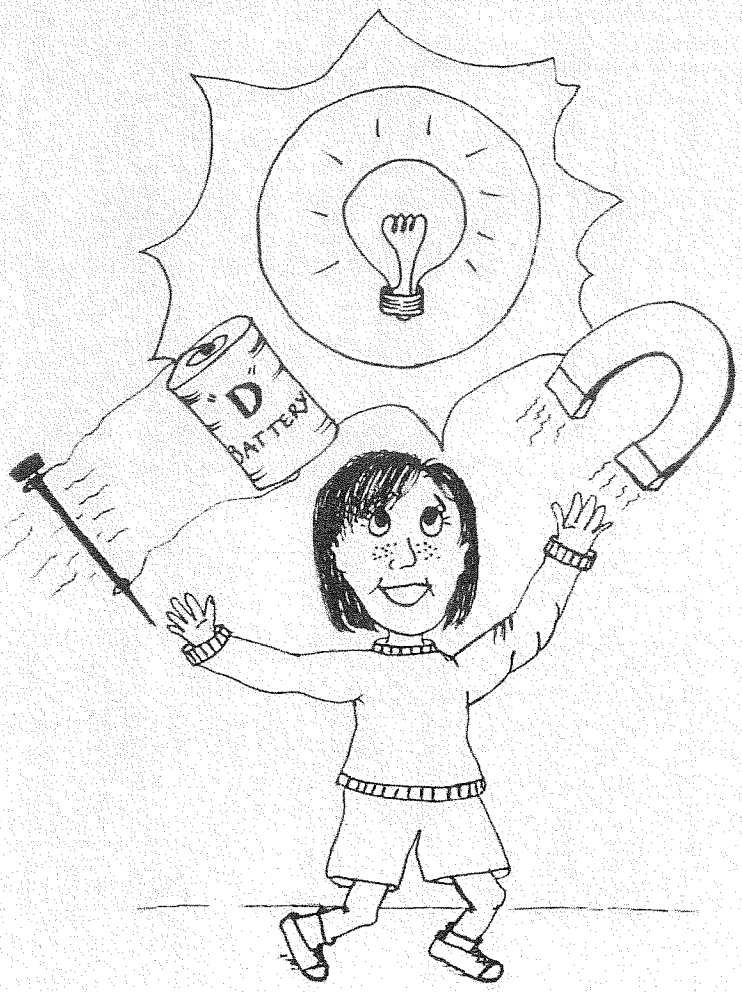
BATTLE CREEK AREA
Mathematics & Science Center

Student Journal

4PS1

Energy Transfer



A Fourth Grade Unit
supporting the
Michigan Science K-7 Content Expectations

Name: _____

Name: _____

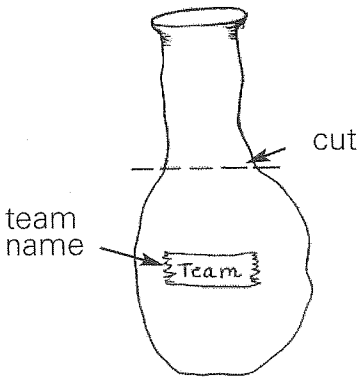
Date: _____

ACTIVITY 1

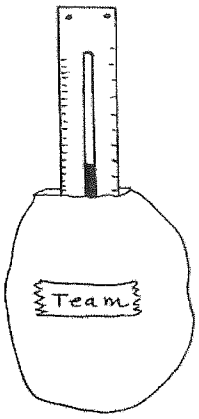
Heat It Up!

1. Cut the black and white balloons at the base of the neck.

2. Write your team name on a piece of tape.



3. Place the tape on the balloon.



4. Record the beginning temperatures on the thermometers.

White balloon beginning temperature: _____

Black balloon beginning temperature: _____

5. Place one thermometer into each balloon.

6. Place the balloons under the lamp.

ACTIVITY

Heat It Up! (cont.)

Name: _____

Date: _____

1

Heat It Up! Investigation

1. Write the question you are investigating.

_____

_____

_____

2. Write what you think will happen.

_____

_____

_____

3. List the materials you will use.

4. Write the steps you took.

Name: _____

Date: _____

5. Make a data table to record your results.

6. Write what you conclude from your investigation.

_____

_____

_____

_____

_____

_____

_____

ACTIVITY

Heat It Up! (cont.)

Name: _____

Date: _____

1

1. Write the new question you are investigating.

_____

_____

_____

2. Write what you think will happen.

_____

_____

_____

_____

3. List the materials you will use.

4. Write the steps you will take.

Name: _____

Date: _____

5. Make a table to record your data and observations.

6. Write what you conclude from your investigation.

ACTIVITY

Rubbing, Burning, and Electricity

Name: _____

Date: _____

2

1. On the Data Table below, record the beginning temperature (room temperature) on the thermometer.

2. Record the temperature between clasped hands after 15 seconds.

3. Record the temperature between clasped hands after 15 seconds of rubbing.

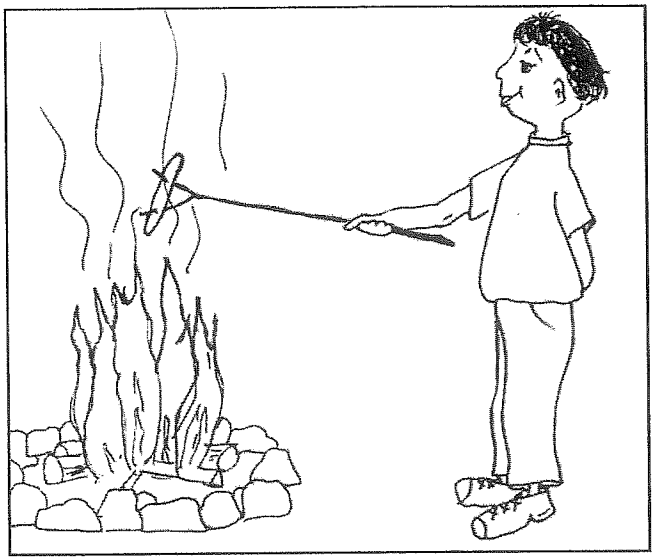
Hand Rubbing Data Table

Team member	Room Temperature		Temperature Between Clasped Hands		Temperature Between Clasped Hands After Rubbing	

Name: _____

Date: _____

1. The Rodriguez family was on a camping trip. They enjoyed roasting hot dogs over the campfire. Write a caption for the illustration that describes the heat energy transfer from the flame of the fire to the roasting hot dog.



2. Draw and write another way the hot dogs could be heated.

A C T I V I T Y

Heat Energy Investigation

Name: _____

Date: _____

3

1. Write what question you are investigating.

_____

_____

_____

2. Write what you think will happen.

_____

_____

_____

_____

3. Materials needed:
   a. 1/2 cup of water
   b. 1/2 cup ice
   c. 2 thermometers

4. Procedure - Steps to follow:
   a. Fill one measuring cup with 125 ml of crushed ice.
   b. Fill one measuring cup with 125 ml of hot water.
   c. On the Data Table, record the temperature on the thermometers before placing them into the hot and cold cups.
   d. Place one thermometer into each cup.
   e. Record the temperature of the hot water cup and ice cup on the Data Table.
   f. Pour the hot water over the crushed ice.
   g. Record the temperature of the mixture of hot and cold water immediately after they were combined and then every 2 minutes for 10 minutes.
   h. Create a graph using the data collected from the investigation.

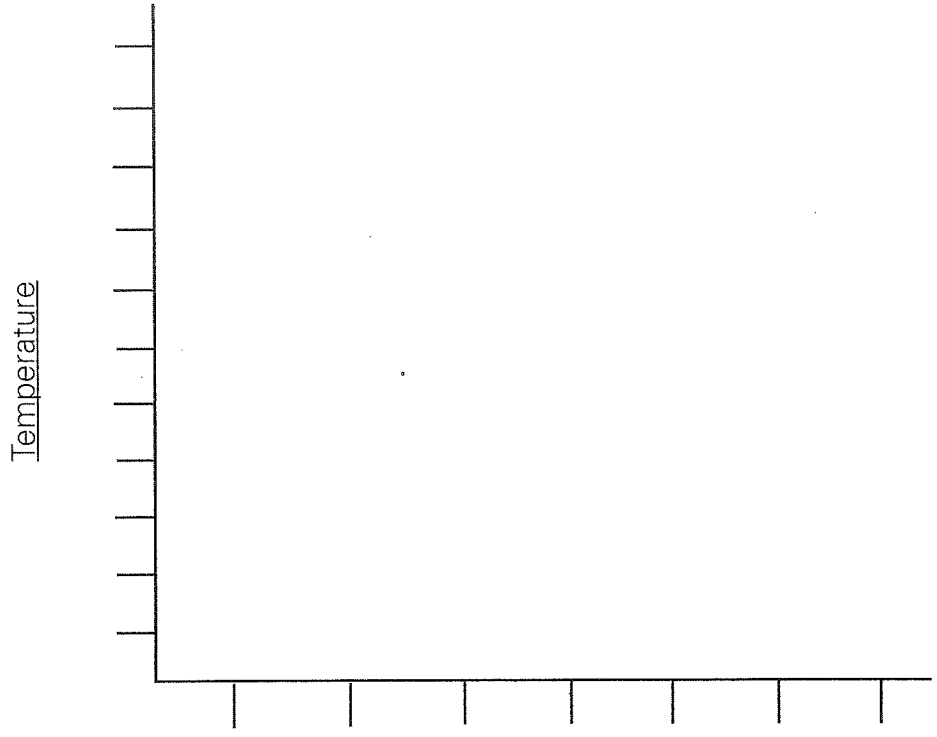
Name: _____

Date: _____

5. Results: Data Table and Graph

Temperature (Celsius)	Hot Water	Ice	Hot Water and Ice Combined					
Before placed in cup								
After placed in cup								
After hot water and ice combined			0 min.	2 min.	4 min.	6 min.	8 min.	10 min.

Combining Hot Water and Ice



Time (2 minute intervals

A C T I V I T Y

Heat Energy Investigation (cont.)

Name: _____

Date: _____

3

6. What conclusion can you draw based on your data?

Name: _____

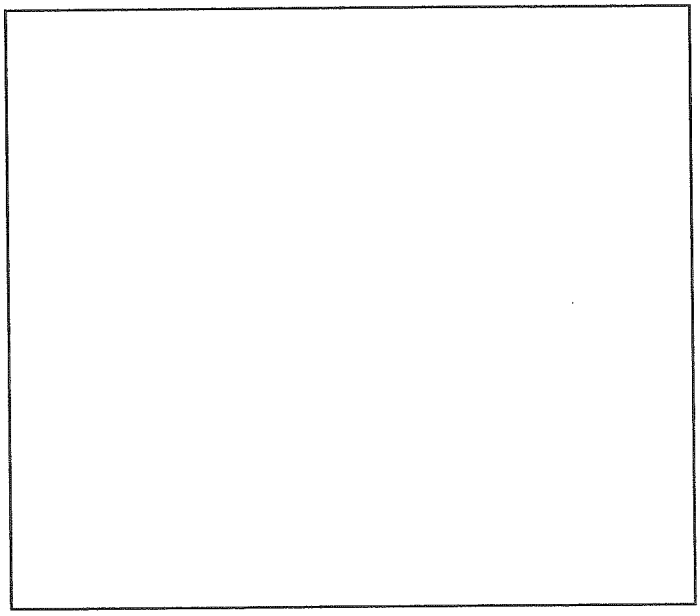
Date: _____

JOURNAL

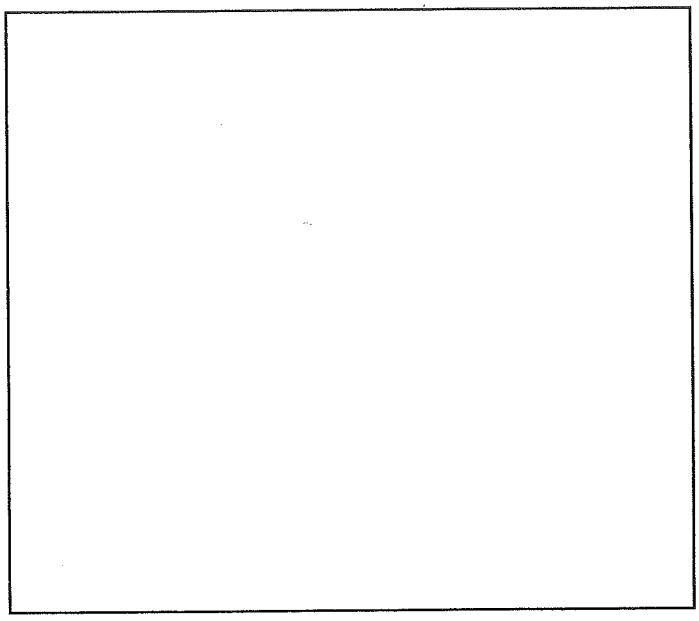
Electricity As a Form of Energy

4

1. Draw a picture of the change caused by the static electricity in the rubbed balloon or plastic comb. Write a description of the change you observed.



2. Draw a picture of the object you observed that uses current electricity. Describe how the current electricity is transferred to a useful form of energy.



ACTIVITY

How Many Ways Can You Make a Light Bulb Light?

Name: _____

Date: _____

5

1. Draw a diagram of one way you got your bulb to light.

2. Draw a diagram of one way that you tried where the light bulb did not work.

Name: _____

Date: _____

ACTIVITY 5

How Many Ways Can You Make a Light Bulb Light? (cont.)

3. Compare the diagrams. Why do you think the bulb lit in the first diagram and not in the second diagram?

4. Draw a diagram of another way you got your bulb to light. Why do you think the bulb lit in this diagram?

How Many Ways Can You Make a Light Bulb Light? (cont.)

Name: _____

Date: _____

5

Thomas Edison

As a young boy, Thomas Edison was curious about the world around him and how things worked. He looked for answers to his questions by reading and experimenting. When he was 9 years old his mother gave him a science book. Before long he had completed every experiment in the book and spent all of his money on chemicals for the experiments.

As a young man, Edison began inventing devices that helped make jobs easier to perform, like an automatic telegraph transmitter and a receiver that could work by itself. He experimented up to 112 hours a week. He created a laboratory and brought in a team of mechanics and electrical engineers who worked together to solve problems.

Edison is known for his persistence in solving problems. For instance, he and his team tried to find the best filament for a light bulb. It took 1200 experiments before they found the right one. When he was asked why he kept trying after so many failures, he said he thought each trial was a success because he learned something from it.

1. What do you think Edison meant when he said each trial was a success because he learned something from it?

_____

_____

_____

_____

2. How many trials did it take for you to light your light bulb? _____

3. What did you learn from the trials?

_____

_____

_____

_____

Name: _____

Date: _____

JOURNAL

How Many Ways Can You Make a Light Bulb Light? (cont.)

5

1. Describe the evidence you observed that shows how electrical energy is transferred in a circuit.

2. From what you have learned, what places on the battery and bulb must be touched in order for the bulb to light? Draw and explain.

3. Challenge: Work with a partner and find a way to make the bulb light when it is not touching the battery. Draw a diagram of your set-up.

ACTIVITY

What Is an Electrical Circuit?

Name: _____

Date: _____

6

Parts of an Electric Circuit	What the part does in the circuit	Examples
Source		
Path		
Load		

Light Bulb Circuit

Draw a diagram of the light bulb and label any parts of the bulb you know.

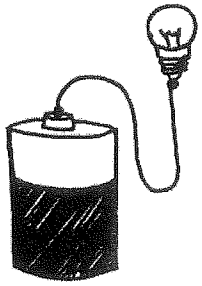
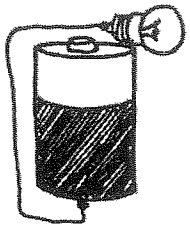
Name: _____

Date: _____

ACTIVITY 6

What Is an Electrical Circuit? (cont.)

Predict which diagrams represent a complete circuit so the bulb will light. Circle YES in each box where the circuit is complete and the bulb lights. Circle NO in each box where the circuit is not complete and the bulb does not light.

 1 YES NO	 2 YES NO
 3 YES NO	 4 YES NO
 5 YES NO	 6 YES NO

Use your materials to test each electrical circuit.

Draw a square around YES in each box where the circuit is complete and the bulb lights.

J O U R N A L

What Is an Electrical Circuit? (cont.)

Name: _____

Date: _____

6

Draw and label a complete circuit using two wires, one bulb, and one battery. Use arrows to show how electrical energy is transferred to light energy.

Name: _____

Date: _____

ACTIVITY 7

What Materials Are Good Conductors of Electricity?

1. Write the question you are investigating.

_____

_____

_____

2. Write what you think will happen.

_____

_____

_____

_____

3. List the materials you will use.

4. Write the steps you took.

What Materials Are Good Conductors of Electricity? (cont.)

Name: _____

Date: _____

5. Results: Make a data table to record your findings.

Name: _____

Date: _____

JOURNAL

What Materials Are Good Conductors of Electricity? (cont.)

7

6. Conclusion: Write what you found out from your investigation.

A C T I V I T Y

Open and Closed Circuits, Making a Switch

Name: _____

Date: _____

8

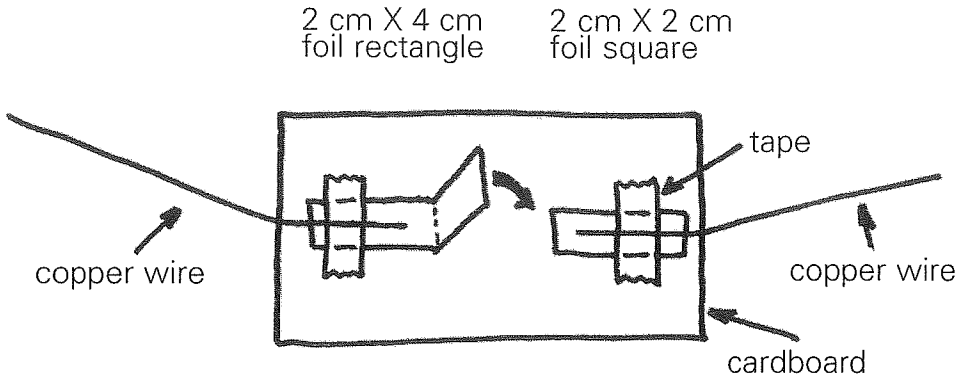
Constructing and Testing a Switch

1. Fold one piece of aluminum foil into a 2 cm x 4 cm rectangle.

2. Fold the second piece of aluminum foil into a 2 cm x 2 cm square.

3. Tape the aluminum foil rectangles to the cardboard so they overlap.

4. Tape the exposed ends of the copper wires to the aluminum foil.



5. How would you make a complete circuit? Test your prediction.

_____

_____

_____

Name: _____

Date: _____

6. How did you get the bulb to light?

_____

_____

_____

7. Draw a simple diagram of your electric circuit and switch. Be sure to label these parts of your drawing: battery (source), wires (path), light bulb (appliance or load), switch.

8. Explain how the switch works in your electric circuit.

_____

_____

_____

_____

9. Write a rule about an electric circuit that includes the word *switch*.

_____

_____

_____

_____

J O U R N A L

Open and Closed Circuits, Making a Switch (cont.)

Name: _____

Date: _____

8

1. What evidence do you have that the aluminum foil switch changes an open circuit to a closed circuit?

2. Would you use two pieces of paper for a switch? Why or why not?

3. Give three examples of objects in your home that use switches.

4. What other materials could you use to make a switch?

Name: _____

Date: _____

ACTIVITY 9

What Materials Are Attracted to a Magnet?

1. Predict if the items in the bag are or are not attracted to a magnet. Sort the items according to your predictions. Use the data table to write down your predictions. (Put a check in the correct column.)

2. Using a bar magnet, test your predictions to see if the objects are or are not attracted to a magnet. (Put a check in the correct column.)

Object	Prediction		Actual	
	Attracted	Not Attracted	Attracted	Not Attracted
plastic spoon				
iron nail				
paper clip				
washer				
paper				
safety pin				
styrofoam peanut				
rubber band				

J O U R N A L

What Materials Are Attracted to a Magnet? (cont.)

Name: _____

Date: _____

9

1. How are all of the objects that are attracted to the magnet alike?

2. How are all the objects that are not attracted to the magnet alike?

3. What conclusions can you make from this activity?

4. What evidence was there in the data to support your conclusion?

Name: _____

Date: _____

ACTIVITY 10

Magnetic Attraction

Object Bag A	Prediction		Actual	
	Attracted	Not Attracted	Attracted	Not Attracted
paper clip				
iron nail				
metal bolt				
scissors				

Object Bag B	Prediction		Actual	
	Attracted	Not Attracted	Attracted	Not Attracted
pie pan				
penny				
foil				
nail				
screw				

1. Using the data on your chart from the materials in Bag A, What can you say about the kinds of materials that are attracted to a magnet?

_____

_____

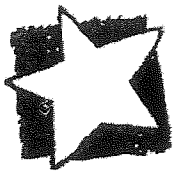
_____

2. Using the materials from Bag B, what can you say about the kinds of materials that are attracted to the magnet?

_____

_____

_____



A C T I V I T Y

Magnetic Attraction (cont.)

Name: _____

Date: _____

10

1. Write the question you are investigating.

_____

_____

_____

2. Write what you think will happen.

_____

_____

_____

_____

3. Draw or write how you will investigate the question.

Name: _____

Date: _____

ACTIVITY 10

Magnetic Attraction (cont.)

4. Predict the distance between the magnet and paper clip when the paper clip begins to move. Record the actual distance where the paper clip moved to the magnet.

Distance	Prediction	Actual

5. Write what you found out.

ACTIVITY

Magnetic Attraction (cont.)

Name: _____

Date: _____

10

6. Predict whether the magnet will attract the paper clip through the following materials. Record your results.

Material	Prediction		Actual	
	Yes	No	Yes	No
cloth				
paper				
cardboard				
block of wood				

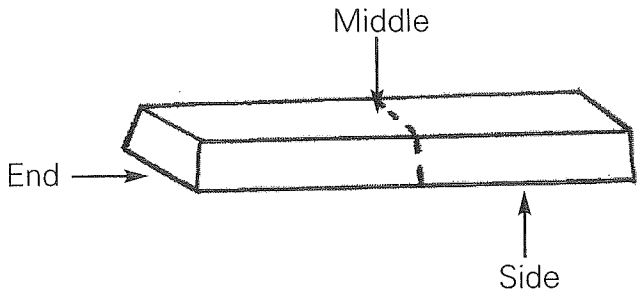
7. Write a conclusion statement about the magnetic attraction through materials.

Name: _____

Date: _____

ACTIVITY 11

What Part of the Magnet Is the Strongest?



Use the drawings to identify the parts of the bar magnet and the horseshoe magnet. Spread the paper clips on the desk. Lower the bar magnet horizontally toward the paper clips until the magnet is about 2 cm to 3 cm above them. When the paper clips begin to move or jump toward the magnet, stop. Then lift the magnet up and observe where the paper clips are located. Record your results in the Data Table below.

Data Table

Number of paper clips moved	end	middle	side
Trial 1			
Trial 2			
Trial 3			

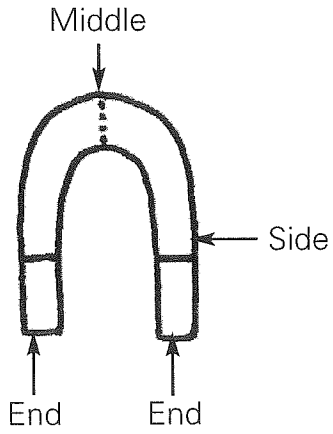
ACTIVITY

What Part of the Magnet Is the Strongest? (cont.)

11

Name: _____

Date: _____



Repeat the activity, using the horseshoe magnet. Remove the keeper from the magnet. Place the magnet in different positions to test the attraction of the paper clips to each part of the magnet. Record your results in the Data Table below.

Data Table

Number of paper clips moved	end	middle	side
Trial 1			
Trial 2			
Trial 3			

Name: _____

Date: _____

JOURNAL

What Part of the Magnet Is the Strongest? (cont.)

11

1. Draw how the bar magnet looked when you lowered it close to the paper clips.

2. Draw how the horseshoe magnet looked when you lowered it close to the paper clips.

J O U R N A L

What Part of the Magnet Is the Strongest? (cont.)

Name: _____

Date: _____

11

Compare the results of the two experiments in the next two questions.

3. Which part of the magnets appeared to be strongest?

4. Support your answer with evidence.

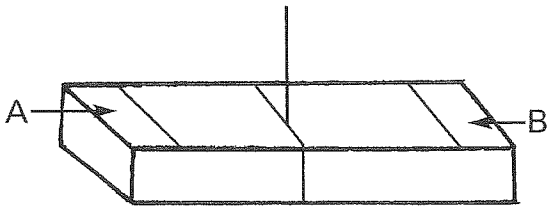
Name: _____

Date: _____

ACTIVITY 12

How Do Magnets Affect One Another?

1. Place a small piece of masking tape on each end of one of the magnets. Label the ends of the magnet "A" and "B". Tie a piece of fish line around the middle of that magnet. Hold the fish line so that the magnet is horizontally suspended.



2. Put one piece of tape on one end of the second bar magnet. Pick up the second bar magnet. Bring the marked pole near the "A" pole of the hanging bar magnet. OBSERVE and DESCRIBE what happens.

_____

_____

_____

_____

_____

_____

3. Predict what will happen if you bring the unmarked pole of the second bar magnet near the "A" pole of the hanging magnet. Use what you observed in step 2 to help you predict.

_____

_____

_____

ACTIVITY

How Do Magnets Affect One Another? (cont.)

Name: _____

Date: _____

12

4. Now bring the unmarked pole near the "A" pole of the hanging magnet. DESCRIBE what happens.

5. Predict what you think will happen if you bring the marked pole of the second bar magnet near the pole labeled "B" of the hanging magnet.

6. Now bring the marked pole of the second bar magnet near the pole labeled "B" of the hanging magnet. OBSERVE and DESCRIBE what happens.

Name: _____

Date: _____

JOURNAL

How Do Magnets Affect One Another? (cont.)

12

Two unmarked magnets are placed near each other.

1. What evidence would convince you that these two poles are unlike poles?

2. What evidence would convince you that these two poles are like poles?

3. How would you set up an investigation to test your ideas from Questions #1 and #2?

ACTIVITY

13 Which Way Is North?

Name: _____

Date: _____

1. Make a holder for the bar magnet. Loop and tie the fishing line around the middle of the magnet.

2. Hold the fishing line attached to the magnet above your desk so that the magnet is free to swing.

3. When the magnet stops spinning, the magnet's north-seeking pole points north.

4. Place a small piece of tape on the north-seeking pole of the magnet. Label it *N*. Place a small piece of tape on the south-seeking pole of the magnet. Label it *S*.

CAUTION: When using the compass, do not place it near the magnet.

5. Which way is the colored end of the compass needle facing? _____

6. Turn the compass a few times. What do you observe?

_____

_____

_____

7. How is the compass needle like the freely swinging magnet?

_____

_____

_____

8. Are the poles of the colored end of the magnet and the North Pole opposite poles or like poles? _____ How do you know that?

_____

_____

Name: _____

Date: _____

JOURNAL

Which Way Is North? (cont.)

13

1. Suppose you had a bar magnet and the *N* and *S* markings at the ends had been rubbed off. How could you tell which end was the magnet's north-seeking pole and which was the magnet's south-seeking pole?

2. Suppose you have a metal bar that is shaped like a magnet. How can you use the information you learned from this experiment to tell if it is a magnet?

ACTIVITY

Make the Connection: Heat Energy, Electricity, Magnetism

14

Name: _____

Date: _____

1. Draw and label a diagram of your complete circuit with a switch.

2. Draw and label a diagram of one example of how electrical energy can transfer to heat energy.

Name: _____

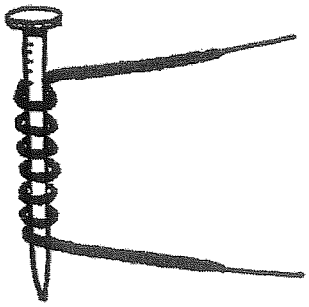
Date: _____

ACTIVITY 14

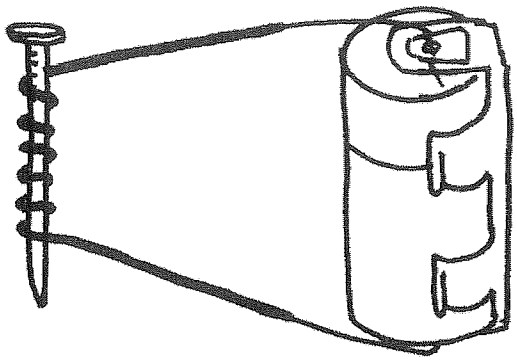
Make the Connection: Heat Energy, Electricity, Magnetism (cont.)

Using Electricity to Produce Magnetism

1. Wrap the 60 cm copper wire around the nail 20 times, leaving 20 cm of wire free at each end.



2. Connect one end of wire to the positive end of the battery and the other end of the wire to the negative end of the battery.



3. Hold the electromagnet near the paper clips. Draw what you observe.

Make the Connection: Heat Energy, Electricity, Magnetism (cont.)

Name: _____

Date: _____

4. Disconnect one side of the electromagnet. Explain what happened to the paper clips.

_____

_____

_____

_____

_____

_____

_____

_____

_____

5. Reconnect the electromagnet. Observe the paper clips.

6. The battery and the wire coiled around the iron nail shows how electricity can produce _____.

Key Terms

absorb – Absorb is to take in.

attract - To attract means to pull toward one another. Iron and steel objects are attracted to magnets.

battery - A battery is an electric cell that provides electricity or a power source for a variety of electrical devices. The battery is a source in an electrical circuit.

Celsius - Celsius is a scale of measurement on a thermometer on which the interval between the freezing point and boiling point of water is divided into 100° with 0° representing freezing and 100° boiling.

closed circuit - A closed circuit has a complete path, which allows electricity to flow continuously.

compass - A compass is a tool that uses a magnetic needle to indicate direction on the Earth's surface by pointing toward the north.

conductor – A conductor is a material that allows electricity to flow through it. Metals are examples of good conductors.

current electricity - Current electricity is the flow of electric charge through a wire or another conducting material.

decrease - Decrease is to grow or become less. A decrease in heat shows a lesser (cooler) temperature.

electricity - Electricity is a form of energy that is found in nature (lightning, static) and can also be produced through rubbing, chemical reactions, and generators. Electricity is produced through the movement of electrical charges.

electromagnet – An electromagnet is produced when electricity flows through a coil of wire wrapped around an iron bar. It acts like a magnet.

Key Terms (cont.)

energy – Energy is the ability to do work or cause change. Things change when there is a transfer of energy.

energy transfer - Energy transfer is the passing or movement of one form of energy to another.

Fahrenheit - Fahrenheit is a scale of measurement on a thermometer on which the boiling point of water is as 212° above zero and the freezing point is 32° above zero.

friction - Friction is the rubbing of surfaces. Friction can produce heat energy.

heat energy (heat) – Heat energy is energy associated with the difference in the temperatures between objects. Heat energy can change things.

increase - Increase is to grow or become greater. An increase in heat shows a greater (warmer) temperature.

iron filings - Iron filings are shaved bits or iron metal. Iron filings are used to demonstrate magnetic field, magnetic poles, and lines of force.

light bulb - A light bulb is a lamp or light source whose light is produced by the glow of a heated wire. The light bulb requires an electrical circuit to heat the wire.

lines of force - Lines of force are the invisible lines that make up a magnetic field. The lines of force are closer together and stronger at the poles of a magnet.

load - A load is the part of a circuit that uses electricity by giving off light, sound, heat, or increasing magnetic interaction. Light bulbs, motors, and electromagnets are examples of loads.

magnet - A magnet is a material that has the ability to attract iron, steel, or an iron alloy.

Key Terms (cont.)

magnetic – A magnetic material is a substance that is attracted to a magnet and can act like a magnet.

magnetic field - A magnetic field is the area of attraction and repulsion that surrounds a magnet.

magnetic pole - A magnetic pole is a place on a magnet where the magnetic effect is the strongest. The two ends of a bar magnet are its poles.

magnetically attract – If two objects magnetically attract each other, they are pulled toward each other. Iron and steel objects are magnetically attracted to magnets. When two unlike poles of magnets are placed near, they are magnetically attracted.

magnetically repel - If two objects magnetically repel each other, they are pushed away from each other. When two like poles of magnets are placed near, they are magnetically repelled.

open circuit - An open circuit has a break in the conducting material of the path. Electricity cannot flow continuously in an open circuit.

path - A path is the part of a circuit along which electricity travels. The path is made of conducting material.

reflection – Reflection is light that bounces off a surface.

repel - To repel means to push away from one another.

simple circuit - A simple circuit is the circular path of electric current, from the source of energy and back. A complete circuit includes a source, path, and load.

solar energy – Solar energy is energy associated with the light that is generated by the sun. Solar energy can be transferred to heat energy.

Key Terms (cont.)

source - A source is the part of a circuit that pushes electric current from the conducting material along the path. Batteries are examples of a source.

static electricity - Static electricity is a stationary electric charge that is built up on a material. Static electricity is charges of electricity that do not flow.

switch - A switch is a device made of conducting material that can open and close an electric circuit.

temperature - Temperature is the degree of hotness and coldness as shown on a thermometer.

thermometer - A thermometer is an instrument used to measure temperature using a scale marked in degrees. Temperature is measured in Celsius or Fahrenheit.

wire - The wire in an electrical circuit provides a path for the flow of electrons from the source (battery) to the load (light bulb).