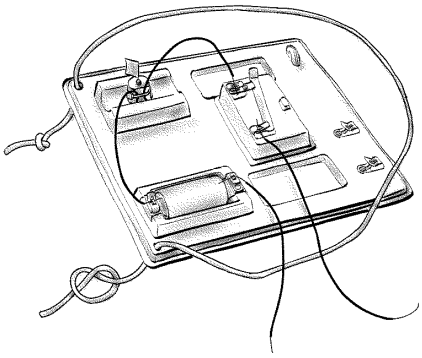
LETTER TO PARENTS

Cut here and paste onto school letterhead before making copies.

SCIENCE NEWS

Dear Parents,



Our class is beginning a new science unit using the **FOSS Magnetism and Electricity Module**. We will investigate permanent magnets, build electric circuits powered by D-cells (flashlight batteries), and explore electromagnetism.

You can increase your child's understanding and interest in magnetism and electricity by asking him or her to talk about the investigations we are doing at school. Also, watch for Home/School Connections sheets that I will be sending home from time to time. These activities describe ways the whole family can look more closely at magnetism and electricity around your home. You may find **magnets** at work holding notes on the refrigerator or securing cabinets closed; **electricity** powering lamps, televisions, and flashlights; and **electromagnets** in motors and speakers. It can be lots of fun to make inventories of magnets and electrical appliances.

To help your child investigate circuitry you may provide an old broken appliance for him or her to take apart. You can explore the appliance together to discover how it is wired and where connections are made.

One thing we will stress in our study of magnetism and electricity at school is safety. You may want to review your home safety rules for magnetism and electricity as well.

- Never put any object other than a certified plug into wall sockets.
- Do not open the case of an electrical appliance that is plugged in.
- Do not bring magnets near computers, videotapes, or audio recordings.

We are looking forward to many weeks of exciting investigations with this Magnetism and Electricity Module. If you have any questions or comments, or have expertise you would like to share with the class, please drop me a note.

Comments: _____

_____

_____

_____

_____

TEST-OBJECTS INVENTORY SHEETS

TEST-OBJECTS INVENTORY

2 Shiny nails
2 Dull nails
2 Soda straws
2 Sponges
2 Black rocks
2 River pebbles
2 Pieces of screen
2 Paper fasteners
2 Paper clips
2 Pieces of copper
2 Screws
2 Pieces of yarn
2 Pieces of cardboard
2 Rubber bands
2 Brass rings
2 Craft sticks
2 Washers
2 Plastic chips
2 Pieces of aluminum foil

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Name _____

Date _____

MAGNETIC OBSERVATIONS

1. How does your magnet interact with test objects?

THINGS THAT STICK	THINGS THAT DON'T STICK

MAGNETS ONLY STICK TO _____

2. Where did you detect iron or steel in the classroom?

THINGS MADE OF IRON OR STEEL	THINGS THAT ARE NOT IRON OR STEEL

3. Describe what happens when two magnets come together.

_____

_____

_____

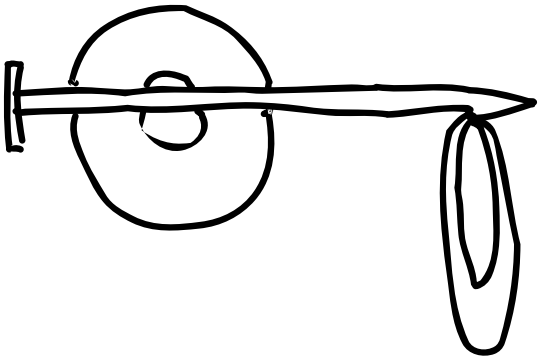
_____

_____

Name _____

Date _____

RESPONSE SHEET—MAGNETS



Students in a fourth-grade class were investigating which objects stick to magnets. One of them drew a picture in his journal like the one you see above, and then wrote,

I was surprised! I had a nail stuck to a magnet, and when I accidentally touched the nail to a paper clip, the paper clip stuck to the nail. I wonder why this happens.

Write a note to this student. See if you can help him understand more about what is happening.

Name _____

Date _____

THE FORCE

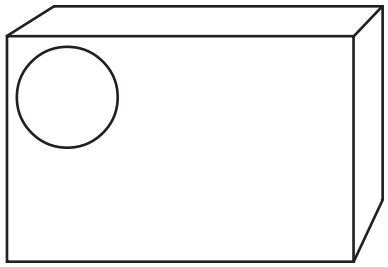
Name _____

Date _____

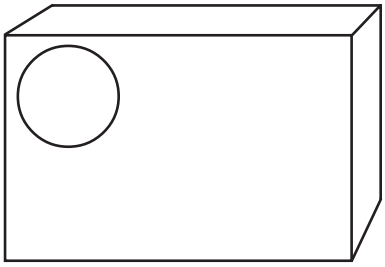
DETECTING MAGNETS

1. Draw where you found magnets in the box.
2. Explain how you know the magnets are there.
3. If you explore more boxes, record your observations on the back of this paper.

Write the box number in the circle.



Write the box number in the circle.

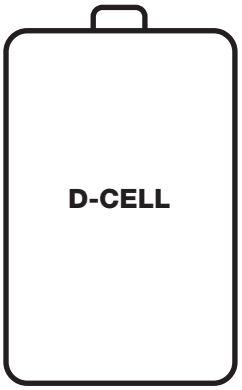


4. Which device worked the best for detecting magnets? Why do you think so?

Name _____

Date _____

THE FLOW OF ELECTRICITY



CONNECT THE D-CELL TO THE BULB ABOVE.

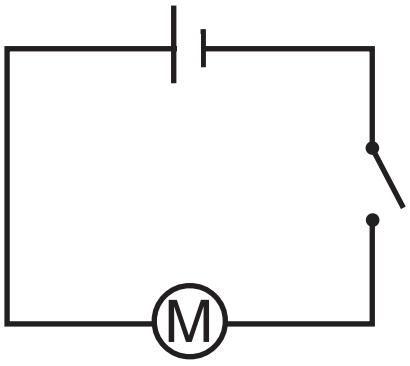
Use arrows to show how the electricity flows. Use large and small arrows if you need to show different amounts of electricity. Describe below how electricity flows in your drawing above.

Name _____

Date _____

DRAWINGS AND SCHEMATICS

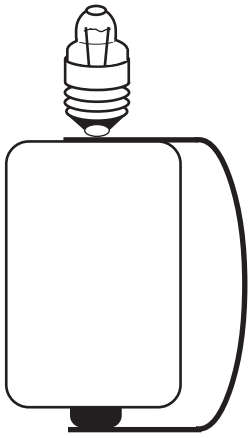
DRAWING OF A BATTERY AND BULB CIRCUIT	SCHEMATIC DIAGRAM OF A BATTERY AND BULB CIRCUIT
	

KEY TO SYMBOLS FOR SCHEMATIC DIAGRAMS		A SCHEMATIC DIAGRAM SHOWING A BATTERY, SWITCH, AND MOTOR
D-CELL		
WIRES		
SWITCH		
LIGHTBULB		
MOTOR		

Name _____

Date _____

RESPONSE SHEET—BULBS



1. Look at the diagram above. Do you think the bulb will light? Why or why not?

2. If you don't think the bulb will light, draw a picture here to show a way to light the bulb.

Name _____

Date _____

CONDUCTORS AND INSULATORS

1. List the test objects that are conductors and insulators.

CONDUCTORS	INSULATORS

2. List the classroom objects that are conductors and insulators.

CONDUCTORS	INSULATORS

3. What do you notice that is similar about all the conductors? What can you say about the insulators?

_____

_____

_____

_____

_____

Name _____

Date _____

MYSTERY CIRCUITS

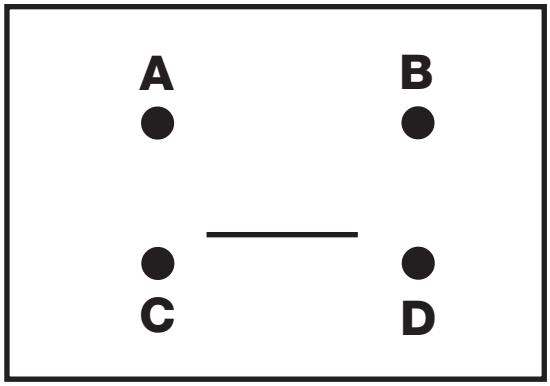
1. Use the bulb, D-cell, switch, and wires to construct an electric circuit to turn the bulb on and off.

2. Draw a schematic diagram of your circuit.

3. Find the mystery board on the table. Some of the paper fasteners on the mystery board are connected by hidden wires. Find out which paper fasteners are connected by wires.

Draw on this picture to show where the hidden wires are.

Write the number of your mystery board on the line.



Explain how you know where the wires are.

_____

_____

_____

_____

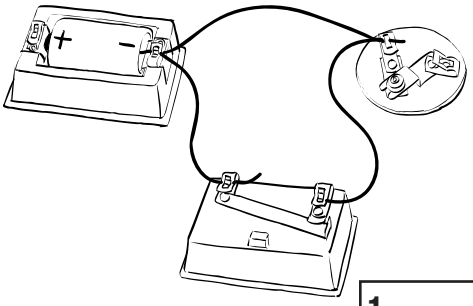
_____

Name _____

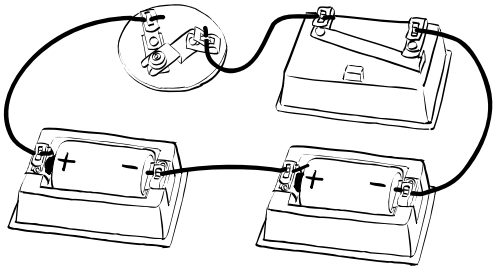
Date _____

MAKING CONNECTIONS

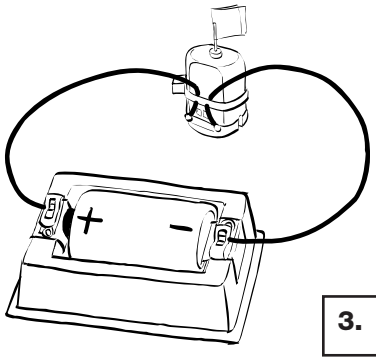
Look at the pictures below. If the bulb will light or the motor will run, write "Yes" in the box below the circuit. Write "No" if the circuit will not make the bulb light or the motor run.



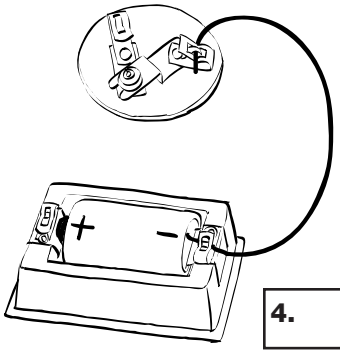
1.



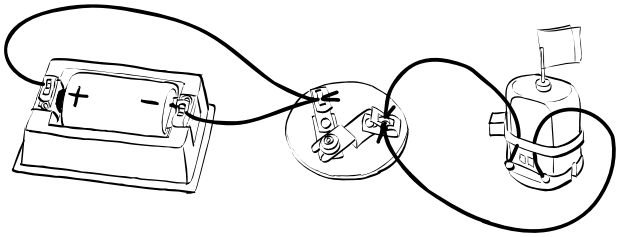
2.



3.



4.



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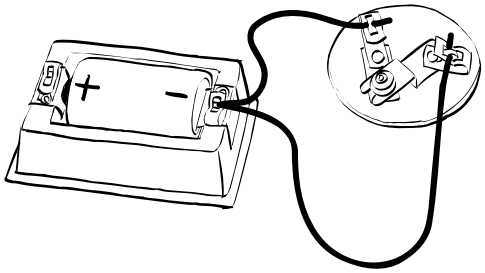


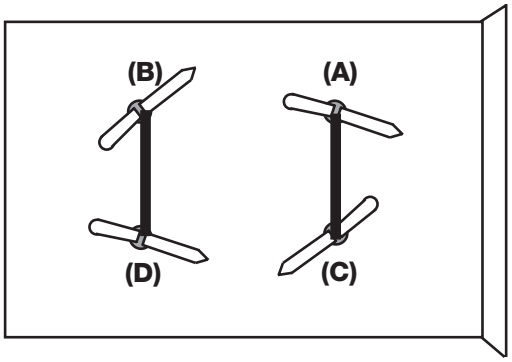
6.

Choose one of the circuits above that will NOT work. Explain what you would do to fix it.

MYSTERY-BOARD DESIGNS

HOW TO CONSTRUCT MYSTERY BOARDS

1



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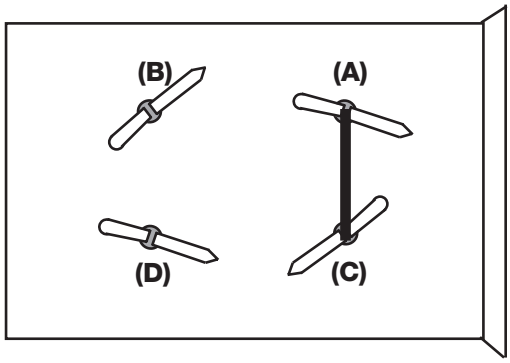

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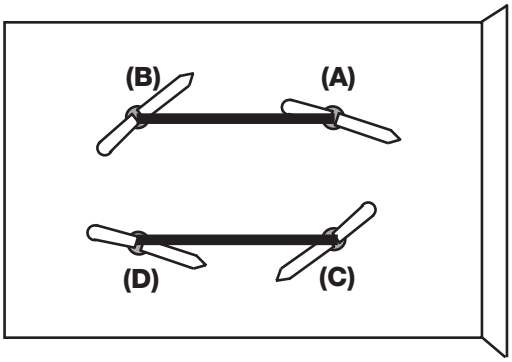

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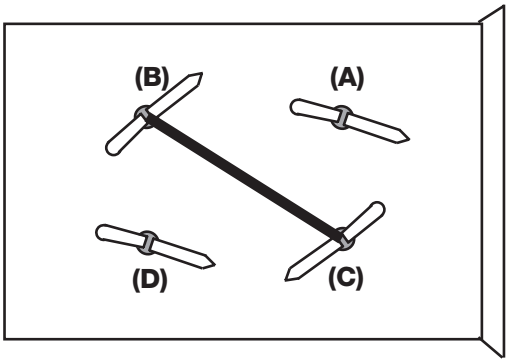

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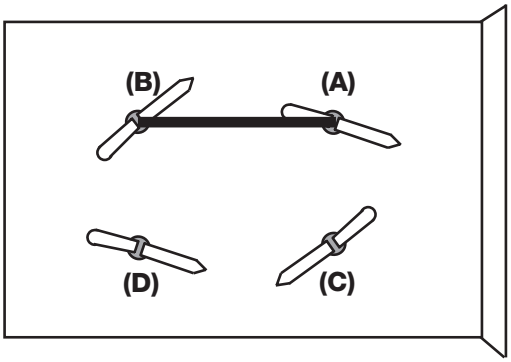

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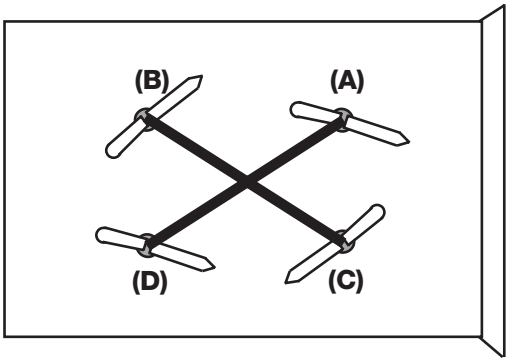

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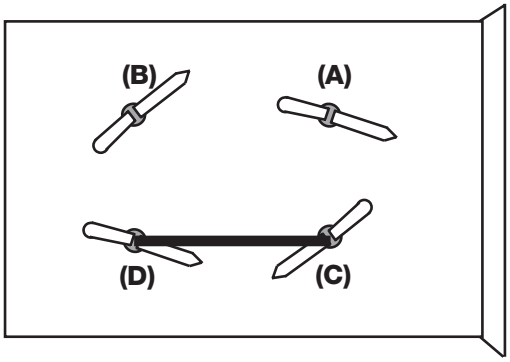
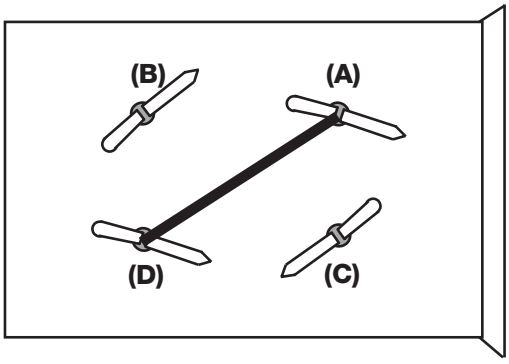
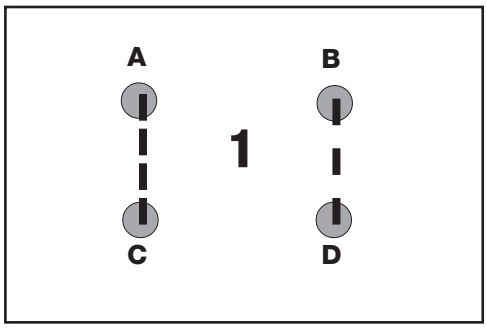


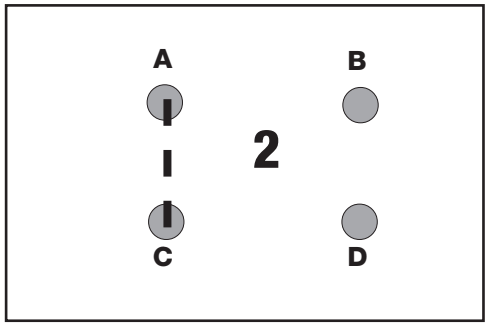
8

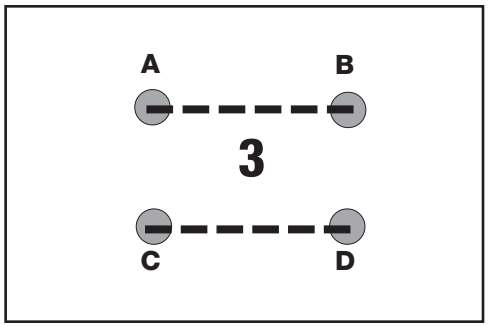


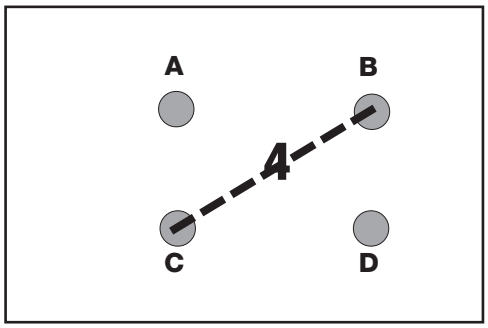
MYSTERY-BOARD KEYS

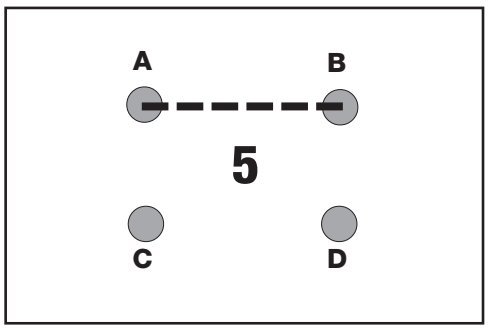
ANSWERS TO THE MYSTERY BOARDS

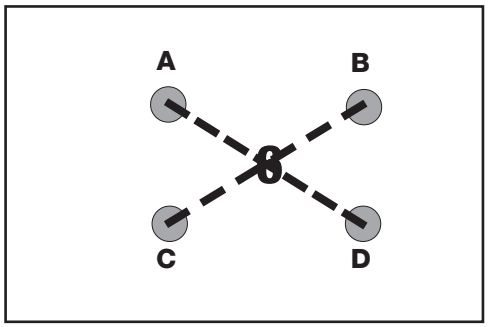


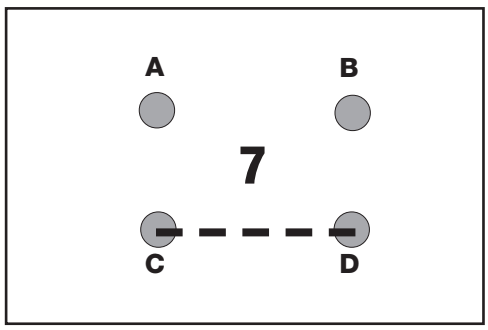


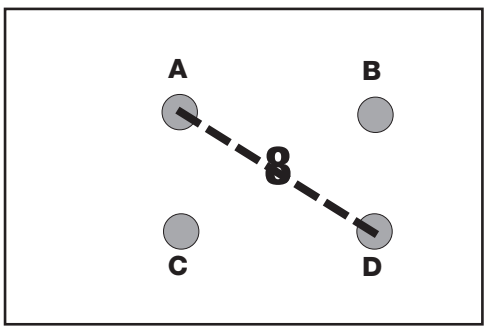












Name _____

Date _____

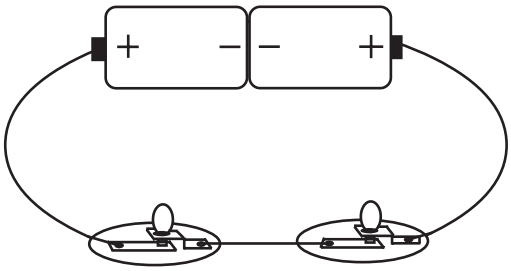
ADVANCED CONNECTIONS

1. I think I can light two bulbs with this circuit.	***2. This is one way I made two bulbs light.*** ***This is a _____ circuit.***
3. This is how I made two bulbs shine brightly with one battery. ***This is a _____ circuit.***	***4. This is another way to make more than one bulb shine.***

Name _____

Date _____

RESPONSE SHEET—CIRCUIT DESIGN



A student thought she could get two lamps shining brightly with this circuit. Use drawings and writing to explain what you think about her plan.

Name _____

Date _____

RECOMMENDATION TO THE BOARD

MEMO

Date: _____

To: Board of Directors

From: _____

Re: Recommendation for new light design

1. This is a schematic diagram of the best design for a string of eight lights.

2. This is a _____ circuit.

3. This design is the best because

_____

_____

_____

_____

_____

_____

_____

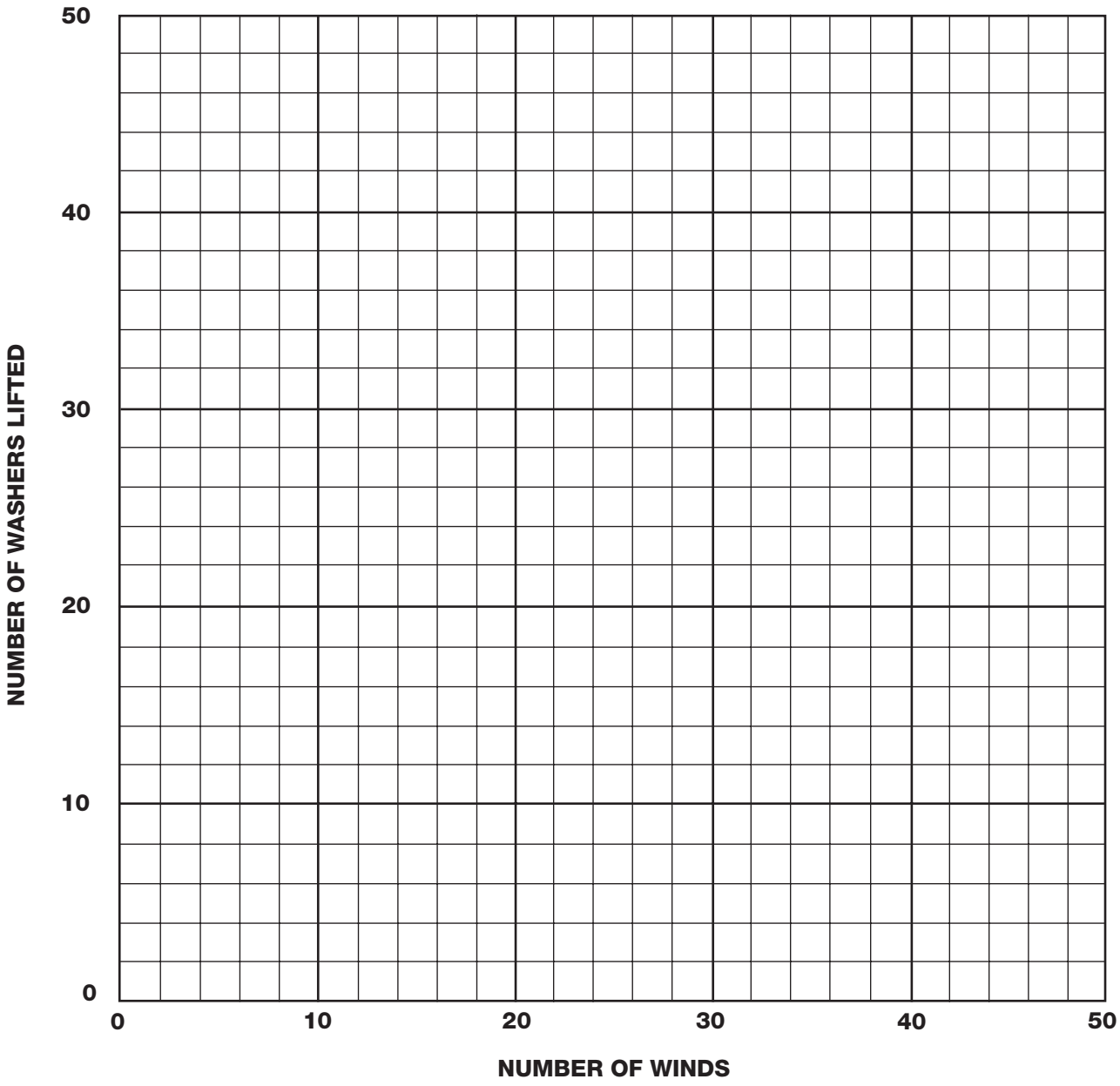
_____

Name _____

Date _____

WINDING ELECTROMAGNETS

NUMBER OF WINDS OF WIRE	NUMBER OF WASHERS LIFTED

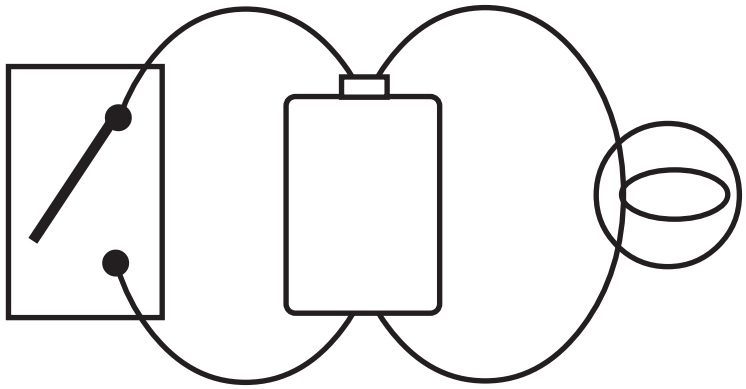


Name _____

Date _____

RESPONSE SHEET—REVERSE SWITCH

A student drew a plan for a circuit she thought would be interesting to build. She drew a picture to show how she would set it up (see below).



She wrote a note to her teacher:

I think this circuit will work in an unusual way. When the circuit is built and the switch is open, the light will shine. When the switch is closed, the light will go off.

Do you agree or disagree with this student? What do you think will happen when the switch is open and when it is closed? Explain why you think the circuit will work the way you described.

Name _____

Date _____

ELECTROMAGNET INVESTIGATION

1. What question about electromagnets did your group work on?

2. Describe what you did to answer your question.

3. What did you find out (answer to the question you wrote for #1)?

Name _____

Date _____

S-T-R-E-A-M CODE

S	T	R	E	A	M
1	2	3	4	5	6

Use the code above to send messages on the telegraph.

Write your messages here.

GRID CODE

Here's another code to try. When you use this code, you have to send two sets of clicks for each letter.

What conventions (or rules) do you need to set so everyone understands how the message is being sent?

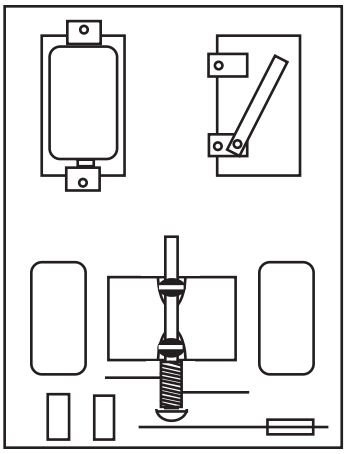
Can you set up the alphabet grid in a more efficient way? (HINT: What letters are used the most in words?)

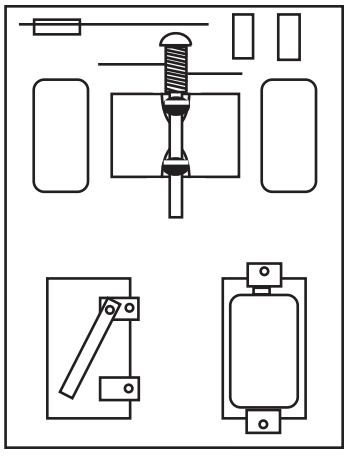
	1	2	3	4	5
1	A	B	C	D	E
2	F	G	H	I	J
3	K	L	M	N	O
4	P	R	S	T	U
5	V	W	X	Y	Z

Name _____

Date _____

LONG-DISTANCE TELEGRAPH





Name _____

Date _____

PROJECT IDEAS

- Can you design a new investigation using the balance and magnets (like you did in Investigation 1)? For example, use washers in place of spacers, more magnets, or different magnets.
- Can you find a set of insulators and conductors at home? How would you prove that they are conductors or insulators?
- Can you make a conductor/insulator tester using a lightbulb as an indicator instead of the motor?
- Does a D-cell last longer in a series circuit or in a parallel circuit?
- Can you use iron filings to show the magnetic field around a wire carrying current?
- Can you think of more variables to test to change the strength of an electromagnet?
- What happens if you wind the wire half one way and half the opposite way to make an electromagnet?
- Look in the *FOSS Science Stories* or books in the library for ideas about projects you might like to present to the class.
- Can you make one of the toys you read about in the *Magnificent Magnetic Models?*
- Can you make a water compass?
- Can you design some magnetic art using magnets and iron filings?
- Can you design a magnetic message board?
- Can you write an instruction booklet to show someone how to set up five different circuits?
- Can you make a quiz board that lights up when someone has chosen the right answer?
- Can you build a model motor?
- Can you hook up more than two telegraphs to send and receive messages?
- Can you build a cardboard telegraph?
- Can you build a lunchbox alarm? Another kind of alarm?
- Can you create a new kind of electric message sender? Can you create a new code?

Name _____

Date _____

PROJECT PROPOSAL

1. What is the question or the project that you are proposing?

2. What materials or references will you need to complete the project?

3. What steps will you follow to complete the project?

Name _____

Date _____

PRESENTATION GUIDELINES

You will have exactly 3 minutes to present your project to the class. In those 3 minutes you should answer these questions.

- What were you trying to find out (your question)?
- What materials or references did you need to do your project?
- What procedure did you follow to complete your project?
- What did you learn from doing your project?

When you begin speaking, you will see the *green card* held up for 2 1/2 minutes. When you see the *yellow card,* you have 30 seconds left. When you see the *red card,* it means you can finish your sentence, but you must stop within the next few seconds.

Practice your presentation so you will be sure it is at least 2 1/2 minutes long, but not more than 3 minutes long. Be sure you have included all of the information asked for above.

Name _____

Date _____

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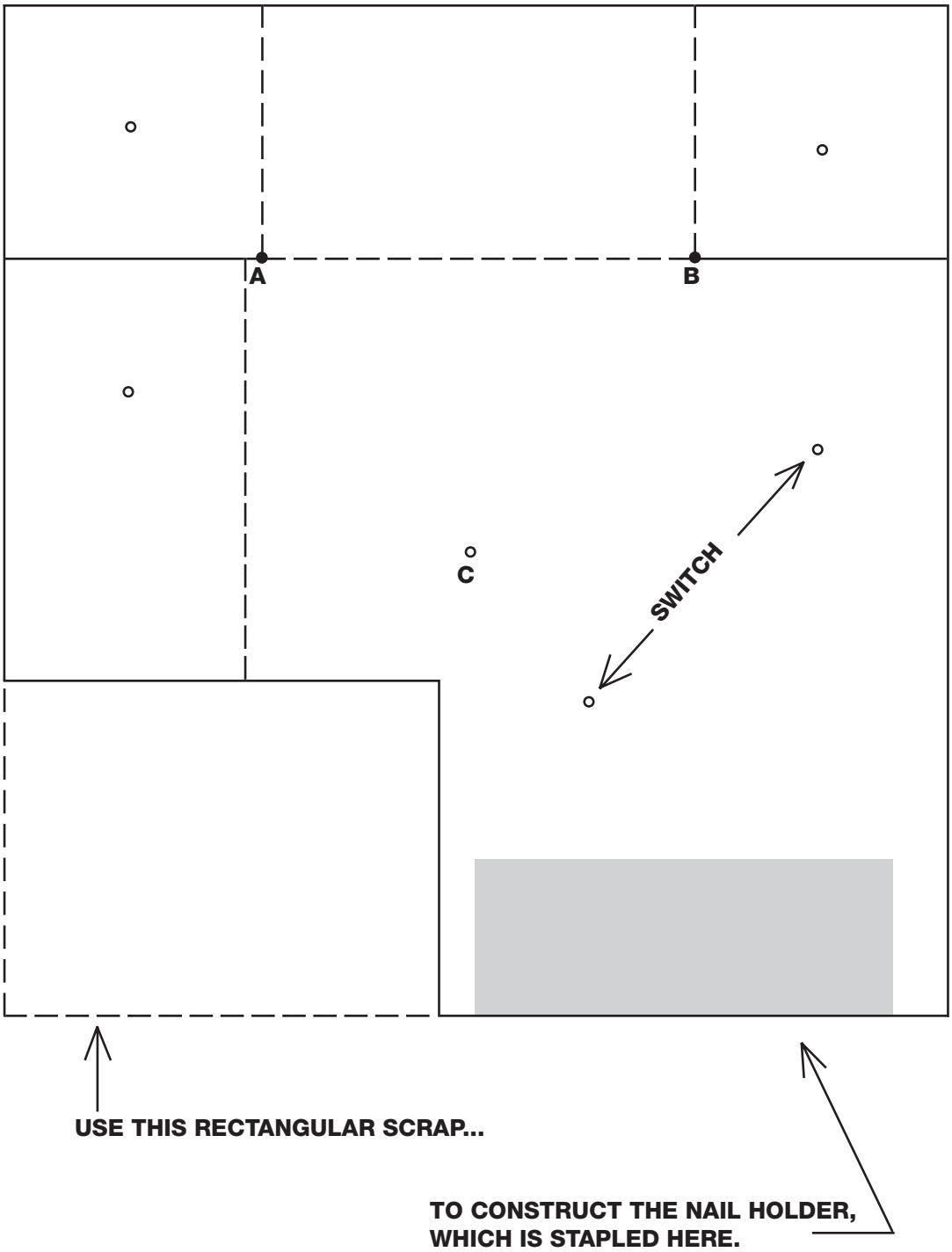
Practice your presentation so you will be sure it is at least 2 1/2 minutes long, but not more than 3 minutes long. Be sure you have included all of the information asked for above.

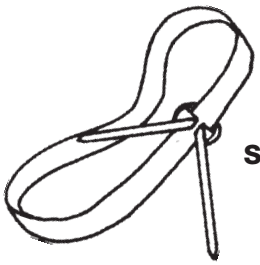
CARDBOARD TELEGRAPH PATTERN



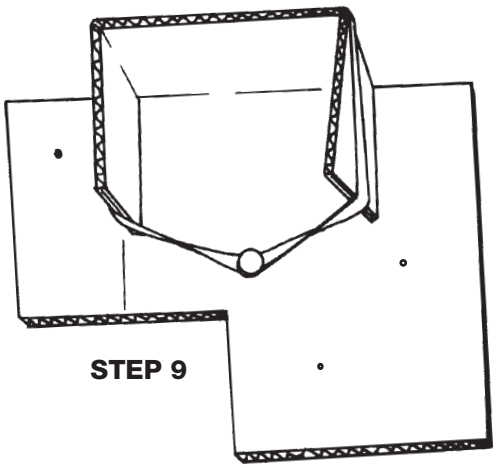
CARDBOARD TELEGRAPH ASSEMBLY

MATERIALS (FOR EACH TELEGRAPH)

1 Copy of the *Cardboard Telegraph Pattern*
1 Piece of cardboard, 15 cm × 15 cm
1 Rubber band, #62 (short and heavy)
5 Paper fasteners
1 Paper clip, regular
1 Paper clip, large
1 Nail, 16-penny
• Wire, 24-gauge, insulated, ~1.5 m
• Scissors
• Stapler
• Tape
1 Small nail (optional)
1 Craft stick (optional)



STEP 8



STEP 9

CONSTRUCTION

1. Cut the pattern along the solid lines, including the lines that extend to points *A* and *B.*

2. Tape the pattern to the piece of cardboard with a couple of small pieces of tape.

3. Trace around the pattern, including the lines that extend to points *A* and *B.*

4. With the pattern still taped to the cardboard, carefully poke a small nail or the point of a pencil through the six little circles, clear through the cardboard.

5. Use a craft stick or similar dull tool to score (crease lightly) the cardboard along all four dotted lines where the base will later fold.

6. Cut out the telegraph base. Save the rectangular scrap cut from the base.

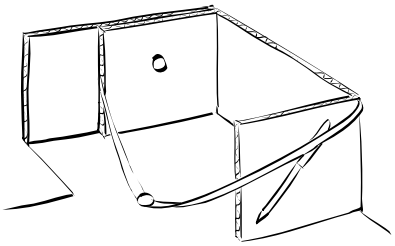
7. Fold the cardboard along line *A/B,* and fold in the ends to make a little box.

8. Trap a rubber band between the legs of a paper fastener, poke the fastener through hole *C* on the base, and secure it.

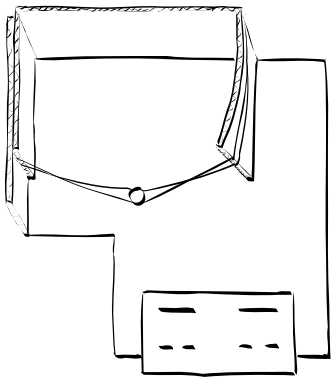
9. Loop the rubber band around the little box to hold it in place.

CARDBOARD TELEGRAPH ASSEMBLY

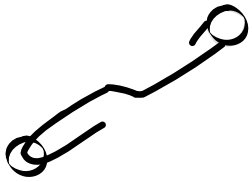
10. Fold up the last flap on the *A* side of the box, and stick a paper fastener through the two holes so that the *head* of the fastener is inside the box. Stick another fastener in the other end of the box.



11. Fold the rectangular scrap (about 7 cm by 6 cm) in half the long way over the edge of the base where the shading is on the pattern. Staple it in place with four or five staples. Make sure there is room to slide a nail into the fold.



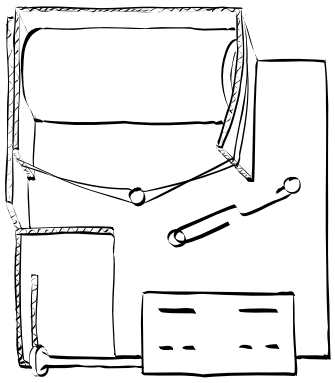
12. Unbend a regular paper clip as illustrated. Put a paper fastener in one switch hole, and secure the paper-clip switch in position with the other paper fastener.



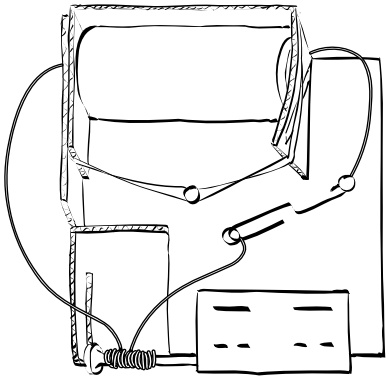
13. The little box is the cell holder—just snap a D-cell in. Connections can be made with plain wires, or wires equipped with alligator clips.

14. Wind the insulated wire around the 16-penny nail. Insert the nail point in the fold of cardboard stapled to the edge of the base.

15. Straighten half of a large paper clip and insert it into the end of the extended flap on the cell holder. It may be necessary to reinforce the end of this flap by taping or stapling it.



16. Connect all the wires to make a circuit. That's it! Some tinkering and adjusting may be necessary, but soon the messages will be on their way.



Name _____

Date _____

MATH EXTENSION—PROBLEM OF THE WEEK

INVESTIGATION 1: THE FORCE

BUYING MAGNETS

A teacher wants to set up a Magnet Exploration Center where students can find out more about magnets during their free time. She has $50.00 to spend. She looked in the magnet section of a science catalog and found these prices.

ITEM	QUANTITY	PRICE
Large bar magnets	Set of 2	$10.95
Small bar magnets	Each	$2.75
Large horseshoe magnets	Each	$7.95
Small horseshoe magnets	Each	$4.50
Disk magnets	Set of 4	$4.50
Lodestones	Set of 10	$7.95

1. What materials would you recommend she buy for the Magnet Exploration Center? (Remember, she has only $50.00 to spend.)

2. Write a paragraph about why you chose the items you did.

Name _____

Date _____

MATH EXTENSION—PROBLEM OF THE WEEK

INVESTIGATION 2: MAKING CONNECTIONS

TESTING C-CELLS

The students in Mrs. Ray's fourth-grade class had a question:

Do all brands of batteries last the same length of time, or do some kinds keep on going after the others have run out of energy?

The students decided to do an experiment. They agreed they should use brand new C-cells for their test. Here is a list of the C-cells they got.

3 **Charger** industrial-strength C-cells

3 **E-Z Volt** alkaline C-cells

3 **Amp-Champ** alkaline C-cells

The students connected each cell to a motor and let it run every day while they were in class. They disconnected the motors every night just before they went home. They kept track of the number of hours each motor ran. Here are the results they recorded.

KIND OF C-CELL	#1	#2	#3
Charger	30 hours	25 hours	20 hours
E-Z Volt	30 hours	40 hours	35 hours
Amp-Champ	25 hours	40 hours	40 hours

1. Based on these data, which brand of cell would you buy? _____

   (Show your math here.)

2. Explain why you chose that brand.

_____

_____

_____

_____

_____

Name _____

Date _____

MATH EXTENSION—PROBLEM OF THE WEEK

INVESTIGATION 3: ADVANCED CONNECTIONS

PREDICTING WIRES

A student wants to know how many wires she will need to set up some circuits with different numbers of lightbulbs. She knows she will need two wires to connect one lightbulb to a battery. So she thinks maybe she will need two additional wires for each additional lightbulb she adds to her circuit. But she isn't sure. Can you help her figure out a way to predict how many wires she will need?

1. What if she were building **series circuits** with only one battery and some lightbulbs?

2. What if she were building a **series circuit** with one battery, a switch, and some lightbulbs?

3. What if she were building a **series circuit** and adding one battery for every lightbulb she added?

4. What if she were building a **parallel circuit** with one battery and some light bulbs?

Name _____

Date _____

MATH EXTENSION—PROBLEM OF THE WEEK

INVESTIGATION 4: CURRENT ATTRACTIONS

COMPARING ELECTROMAGNETS

A fourth-grade class in Texas had just finished building electromagnets. The students wanted to know if electromagnets worked the same in Florida, so they contacted their FOSS website penpals in Florida with a plan. Each class lifted little washers with 20-wind electromagnets and 40-wind electromagnets. After counting the number of washers, they each sent their results to the other class. When the numbers were organized, this is what they saw.

TEXAS

GROUP	20 WINDS	40 WINDS
1	14 washers	30 washers
2	15 washers	35 washers
3	14 washers	28 washers
4	13 washers	38 washers
5	16 washers	41 washers
6	17 washers	33 washers
7	19 washers	29 washers
8	20 washers	30 washers

FLORIDA

GROUP	20 WINDS	40 WINDS
1	18 washers	23 washers
2	13 washers	30 washers
3	16 washers	31 washers
4	17 washers	27 washers
5	20 washers	42 washers
6	18 washers	33 washers

Do you think electromagnets work the same in Texas as in Florida? Why or why not?

Name _____

Date _____

MATH EXTENSION—PROBLEM OF THE WEEK

INVESTIGATION 5: CLICK IT

PRESENTATION TIME

A class was preparing to give project presentations. One student objected when the teacher told the class they would have only 3 minutes to present their project to the class. "I really need 8 minutes," the student told the teacher. The teacher decided to leave it up to the students, but first they would have to calculate how much time that would be. They had to decide if they were willing to listen as long as it would take for everyone to give an 8-minute presentation.

1. If there were 15 students in this class, and everyone presented a project for 8 minutes, how many minutes would they have to be a good audience? How many hours is that?

2. If the class had 30 students, how long would the presentations take?

3. How long would 8-minute presentations take in your class?

4. How many minutes do you think each presentation should be? How long will that be for your class to listen? Why do you think this is a good plan?

Name _____

Date _____

HOME/SCHOOL CONNECTION

INVESTIGATION 1: THE FORCE

MAGNETS AT HOME

How are permanent magnets used around your home?

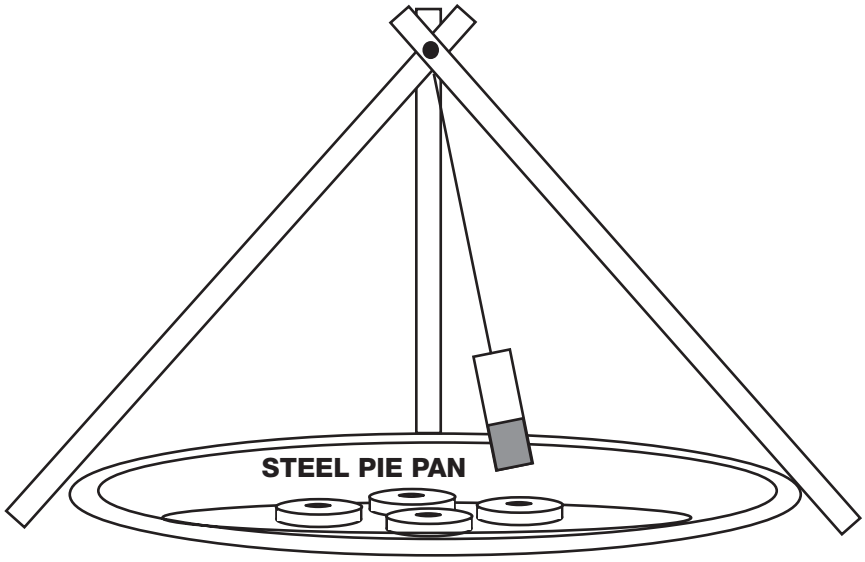
Places to check for magnets:

- Compasses
- Note holders on the refrigerator
- Cabinet and refrigerator door closers
- Toolboxes

Can you think of another way to use magnets around the house?

Can you invent a magnet game?

Talk over some ideas with your family and try some games out if you can. Draw a picture of your invention to share with the class, and write a paragraph explaining what it does.



Swinging Magnet Game

Name _____

Date _____

HOME/SCHOOL CONNECTION

INVESTIGATION 2: MAKING CONNECTIONS

WHERE'S THE ELECTRICITY?

Where's the electricity in your home? Take a tour and count the number of:

- Lights.

- Appliances that use electricity.

- Wall outlets where you can plug things in.

- Wall switches for turning on lights.

Be sure to talk with your family about safety when using electric appliances. Write your family safety rules below.

Name _____

Date _____

HOME/SCHOOL CONNECTION

INVESTIGATION 3: ADVANCED CONNECTIONS

WHAT'S INSIDE AN ELECTRONIC APPLIANCE?

If you have an old, broken radio, portable tape player, calculator, cassette player, remote control, walkie-talkie, or just about anything else that works on electricity, take a look inside. Look for advanced circuits to see where your knowledge of electricity can lead you.

Rules of engagement:

- Get approval from a parent before taking a device apart.
- Make sure the device is unplugged and batteries are removed.
- Get help opening the case. Remember, safety first.
- NO televisions, please. They can be dangerous to explore.

Things to look for and do:

1. You may be surprised to find very few wires. What kind of conductors are used in modern circuits instead of wires? Can you draw an example?

2. Can you find any familiar components like motors and lights? What function do they serve in the device?

3. Make drawings of one or two of the most common components you find.

NOTE: If you don't have an old device to take apart, draw a schematic of **one circuit** with two lightbulbs in parallel **in series with** a third lightbulb. Think about it...it can be done.

Name _____

Date _____

HOME/SCHOOL CONNECTION

INVESTIGATION 4: CURRENT ATTRACTIONS

Safety Note:

- Ask an adult to help you with this activity. Be sure to follow safety rules about electricity. Just look, don't touch!

FUSES AND CIRCUIT BREAKERS

Home electricity is provided by the electric utility company in your community. One large wire brings the electricity into your home. The wire can come to your home from a power line strung on poles, or from a cable underground. Can you find where the main electricity wire comes to your home?

You may have several wires coming to your home. Which one is the electricity? The trick is to look for the electric meter. The main wire always comes to the electric meter first. Why is there a meter on the electric line?

The electricity next goes to a fuse box or circuit-breaker box. The electricity divides and goes to several locations in your home. Each fuse or circuit breaker is included in a different circuit. How many circuits are in your home?

Wires are hidden inside the walls of your home. We connect our electric lights and appliances to the electric power in the walls by plugging them into electric sockets. How do you think plugging a lamp into a socket completes a circuit to light the lamp? Draw a schematic to show how you think it might work.