Applied Science

Our Technological World

FOURTH GRADE

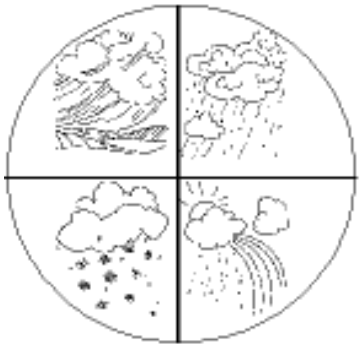
WORKBOOK

students _____

Applied Science

Life Cycle

Universe Cycle



Water Cycle

Rock Cycle

Plate Tectonic Cycle

APPLIED SCIENCE - SCIENCE AND MATH (4A)

PROBLEM: How does metric volume compare with the English volume of measurement?

PREDICTION:_____

PROCEDURE:
Exercise 1: Using the measuring devices on your lab table, determine the measurements for the following: (Use water to help you develop a way to find the correct number.)

_____ ML	1 CUP
_____ ML	2 CUPS
_____ ML	1/4 CUP
_____ ML	½ CUP
_____ ML	1 TABLESPOON
_____ ML	2 ½ CUPS
_____ ML	1 1/4 CUPS

EXERCISE 2:

You have 4 unlabeled containers. Try and figure out how many ml can fit into each container. Before you measure the volume, predict how much liquid each container can hold.

	PREDICTION	MEASURED AMOUNT
BOTTLE 1		
BOTTLE 2		
BOTTLE 3		
BOTTLE 4		

CONCLUSION: How many ml make 1 cup? _____ Since you figured out how many ml make 1 cup, how could you determine how many ml would fit into 3 1/2 cups?

_____

APPLIED SCIENCE - SCIENCE AND MATH (4A)

SKILL: Learning about measurements.

SCIENTISTS NEED TO KEEP CAREFUL TRACK OF THEIR WORK AND ALSO NEED TO TELL OTHERS EXACTLY WHAT THEY DID AND WHAT HAPPENED. TO DO THIS, SCIENTIST FREQUENTLY USE MEASUREMENTS TO DESCRIBE THINGS.

LINEAR MEASUREMENTS

EXERCISE 1. This is one centimeter (1 cm.). Look at your pencil and estimate (guess) how long it is, in centimeters. Now measure its actual length. Record your estimate and the actual length for each of the following:

	PREDICT LENGTH	ACTUAL LENGTH
pencil		
your partner's shoe		

EXERCISE 2. This is one inch (1 in. or 1"). Do you know your height in inches? Write down what you estimate your height to be and then (with your partner's help) measure your actual height. Do the same for your arm span (from finger tip to finger tip).

	PREDICT LENGTH	ACTUAL LENGTH
height		
arm span		

EXERCISE 3. A curved surface is often difficult to measure using a straight ruler. Mark a string and then measure the following:

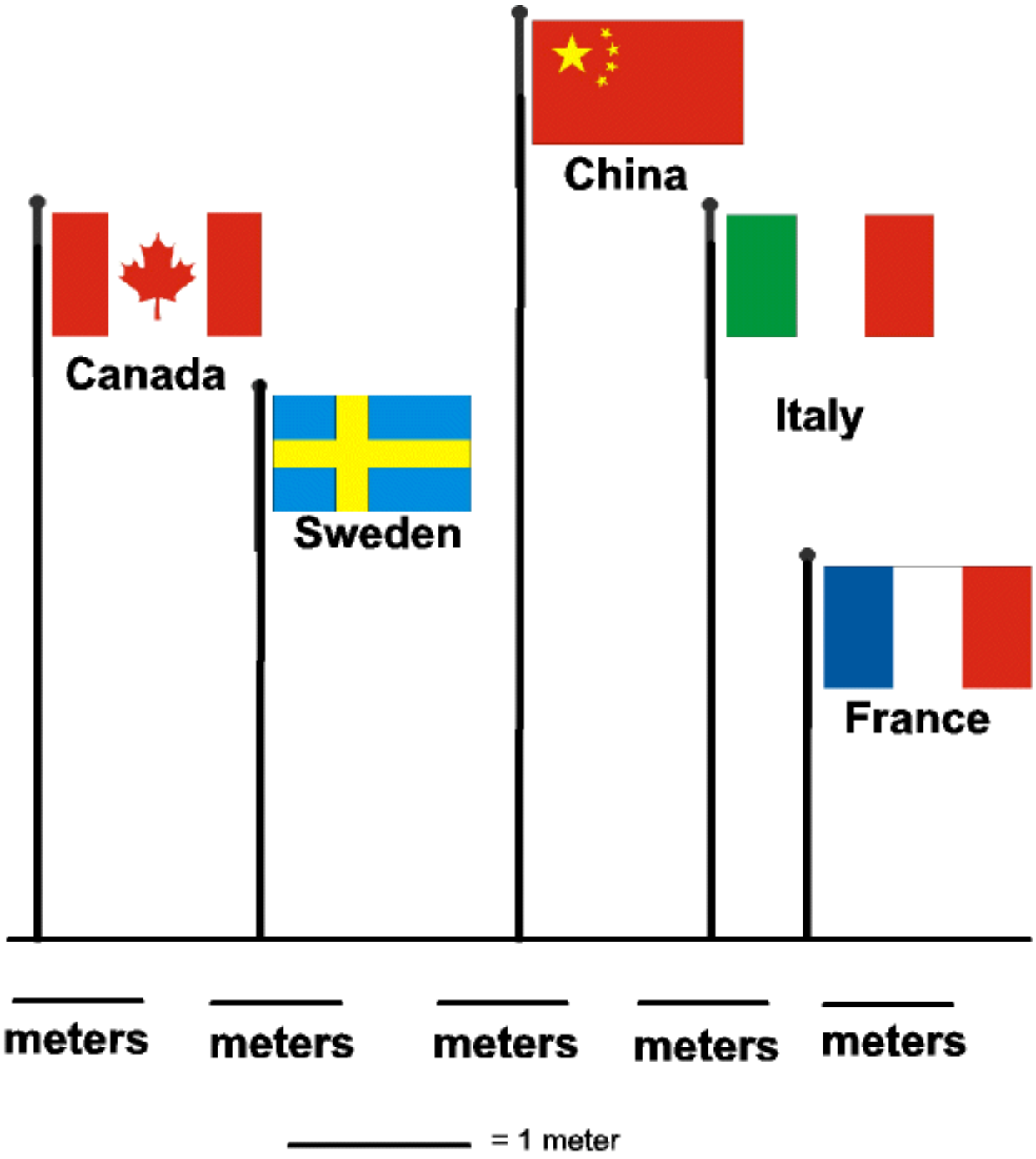
	PREDICT LENGTH	ACTUAL LENGTH
wrist		
head		

EXERCISE 4. Write the unit of measurement that each of the following abbreviations stand for:

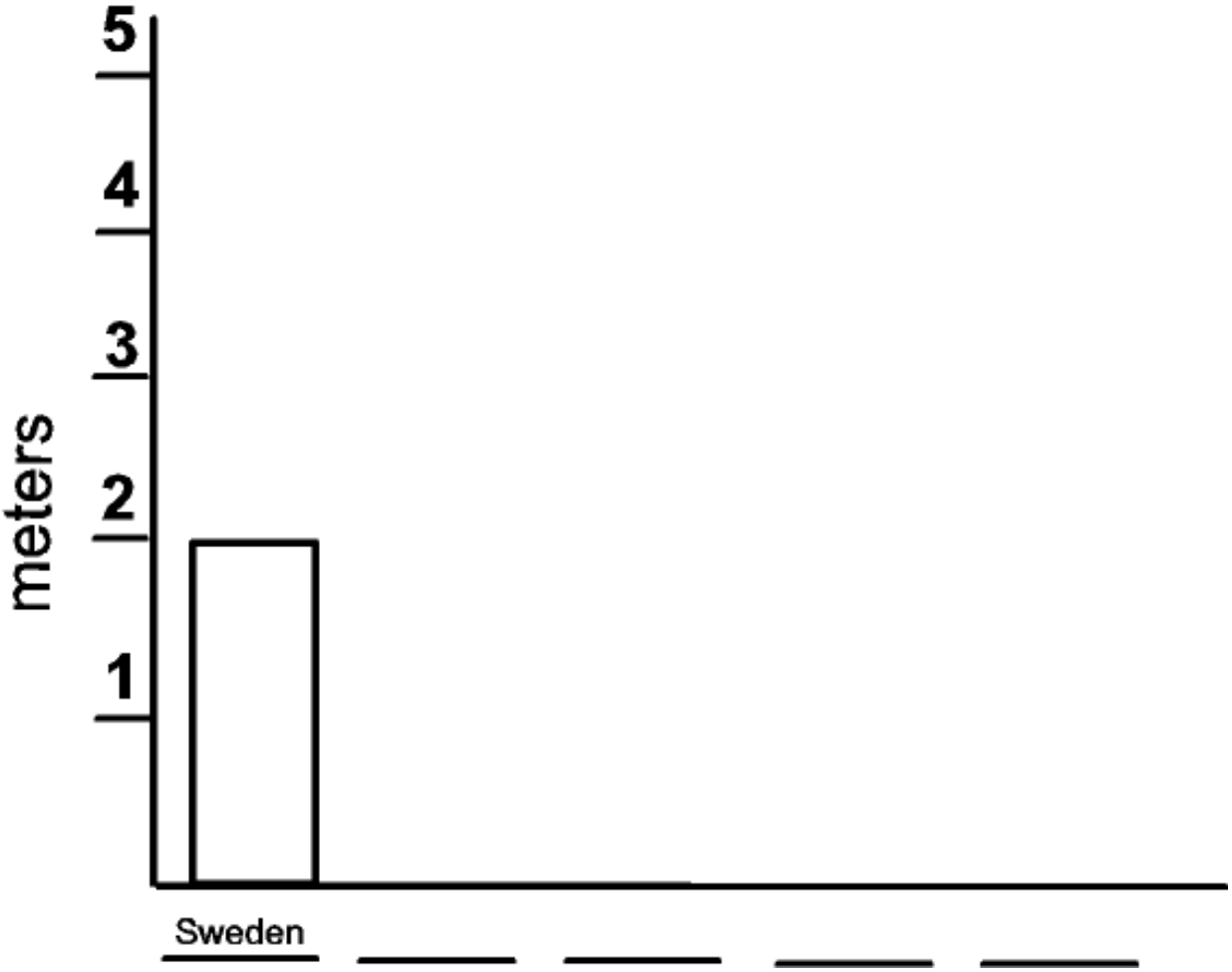
ft. =	in. =	cm. =	yd. =
mm. =	km.=	m. =	mi.=

Circle the units above that are in the metric system of units.

Measure the height of each flagpole. Record the height below each flag pole.



Write the names of the countries on the bottom lines. Draw bars showing the height of the flag poles of each country. Color each bar a different color. See the example.



How does a bar graph help you to look at data.

APPLIED SCIENCE - SCIENCE AND MATH (4B)

PROBLEM: How can a science experiment be both qualitative and quantitative?

PREDICTION: _____

MATERIALS: 25 ml graduated cylinders, baking soda, measuring spoons, vinegar

PROCEDURE: Follow the steps below. Record your data and then graph the results.

TRIAL 1. In one graduated cylinder put 1 ml of baking soda; slowly add 5 ml of vinegar. Students may stir the liquid gently. Record what happens (below). After it stops fizzing, add another 5 ml of vinegar. Record what happens. Continue adding 5 ml of vinegar until there is no more fizzing. How many milliliters did you use?

TRIAL 2. In one graduated cylinder, put 1 ½ ml of baking soda and repeat the experiment above. Record your data.

TRIAL 3. In one graduated cylinder, use 2 ml of baking soda and repeat the experiment above. Record your data.

DATA (State whether it fizzed or not, any odor, etc.)

	TRIAL 1	TRIAL 2	TRIAL 3

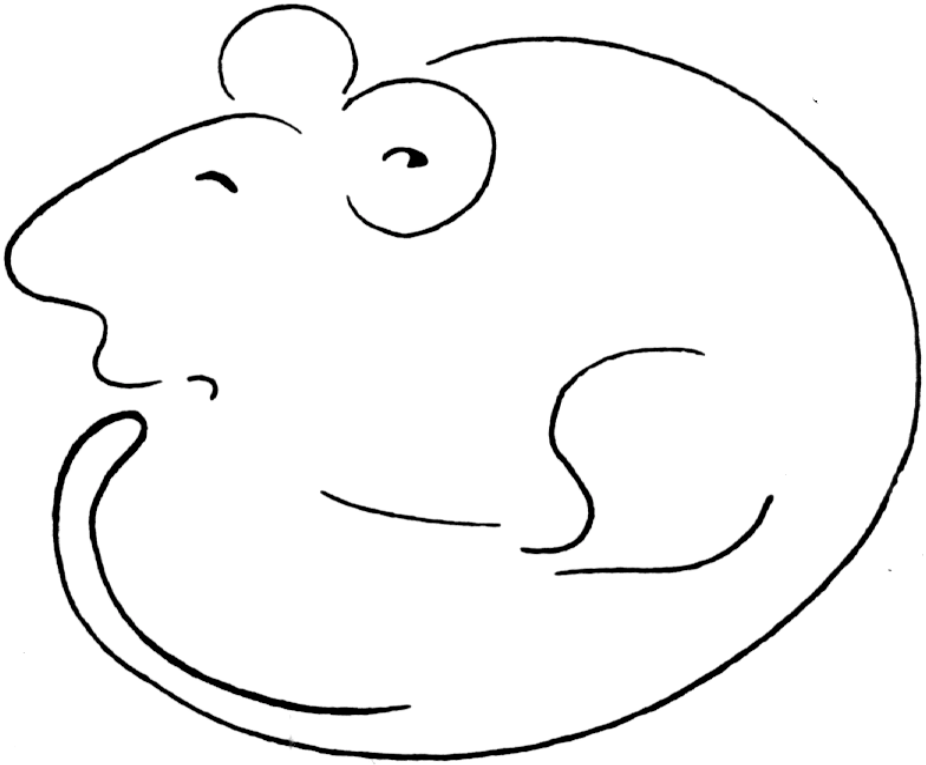
Make a bar graph of these results.

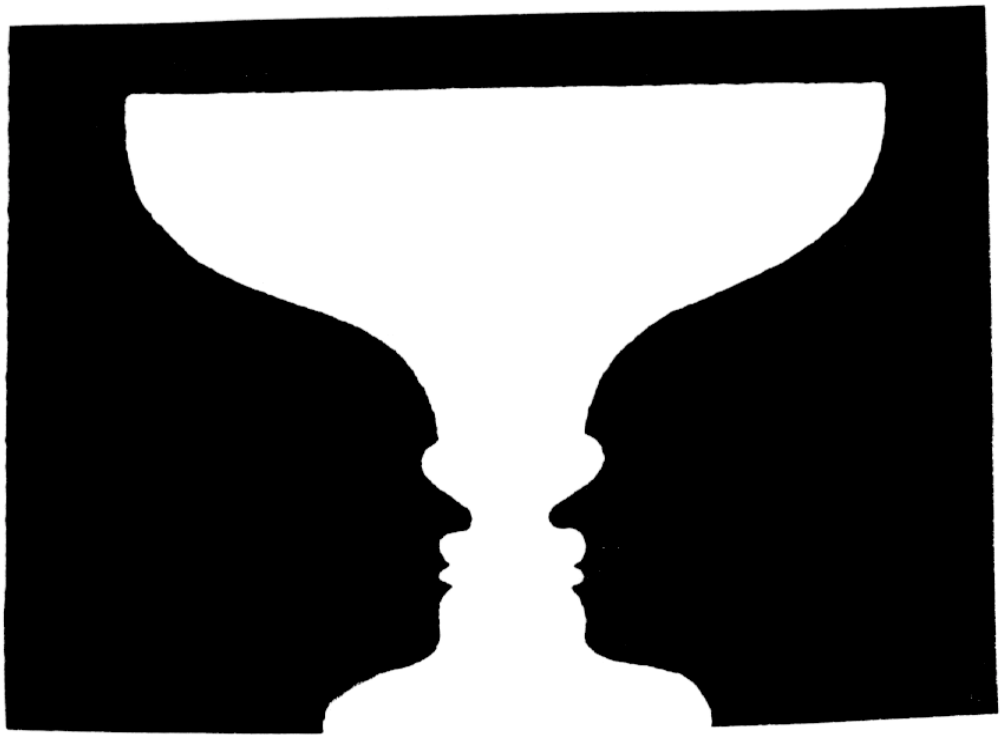
CONCLUSION:

Which portion of the experiment was qualitative?_____

Which was quantitative?_____

If you add more baking soda would you add more or less vinegar? _____





APPLIED SCIENCE - SCIENCE AND MATH (4C)

PROBLEM: How do people perceive things?

PREDICTION:_____

PROCEDURE: This experiment has 2 parts.

MATERIALS: 4 different shapes per group

1. You have 4 shapes. Have your partner close their eyes and put their palm out and rest it on the table. Choose one of the shapes and with "normal" pressure, imprint the shape on the palm of your partners hand. Record what they call it. Repeat the experiment 5 more times with different shapes. Your partner will repeat the experiment with you. Write down what they called it.

	YOUR RESULTS			PARTNERS RESULTS		
TRIALS	PALM	FINGER	ACTUAL	PALM	FINGER	ACTUAL
1						
2						
3						
4						
5						
6						

your result:_____ out of 6 were correct

partners result:_____ out of 6 were correct

CONCLUSION:

Look at your results. Describe the difference between putting the item on the palm and using your fingers? _____
_____

Why is there a difference? _____

Are the class results similar to your findings? _____
_____

JUST A FEW INVENTORS AND SCIENTISTS

Carolus Linnaeus	(1707-1778)	classification system
Marie Curie	(1867-1898)	radioactivity, discovered radium and polonium
Galileo Galilii	(1564-1642)	gravity, telescope allowed him to discover many unknown features
Isaac Newton	(1643-1727)	laws of motion, calculus, optics, celestial mechanics
Louis Pasteur	(1822-1895)	spread of disease, pasteurization
Charles Darwin	(1809-1882)	natural selection, coral reefs, evolution
Jonas Salk	(1914-)	vaccine for polio
Albert Einstein	(1879-1955)	relativity, photoelectric effect, quantum mechanics
George Washington Carver	(1861-1943)	agriculture, peanuts and sweet potato products
Robert Fulton	(1765-1815)	steamboat
Thomas Edison	(1847-1931)	incandescent lamp, electric power station, phonograph
Marconi Guglielmo	(1874-1937)	wireless telegraph
T'sai Lun	around 100 A.D.	paper
early North Africans		writing, numbers
early American Indians		agriculture

APPLIED SCIENCE - PHYSICS (4A)

PROBLEM: How can one determine if a substance conducts electricity?

PREDICTION: _____

MATERIALS: miniature light bulb, battery, battery holder

EXERCISE I. Look at one battery.

1. What size is it? _____
2. How many volts does it have? _____
3. What is in the battery? _____
4. Draw a picture of the battery, label + and -.

5. Put the ends of the miniature light bulb to the ends of the battery. Is your battery charged? How do you know? _____
6. Reverse the wires? Record what happens? _____
7. What have you completed? _____
8. Put two batteries in a battery holder. Draw how to arrange the cells. Why do you think they are put in this way? _____
9. Use the miniature light bulb on each of the ends of the holder. Is there a difference between 2 cells versus 1 cell? Describe.
10. How many volts does 2 batteries working together have?

EXERCISE II. Use the miniature light bulb, one battery, and various conductors and non-conductors. Try to determine if a material is a conductor. Record what you find below by listing the material and then stating if you think it conducts electricity or not.

MATERIAL	CONDUCTOR/NONCONDUCTOR	BRIGHTNESS OF BULB

CONCLUSION: _____

APPLIED SCIENCE - PHYSICS (4B)

PROBLEM: What type of items do magnets pick up?

PREDICTION:_____

EXPERIMENT 1: MAGNETS

1. Can you always stick a magnet to another magnet?_____ Locate the north and south poles of all your magnets. Clue: north on the bar magnet is where the notch is. State where north and south are on the other magnets.

_____

_____

2. Put the North poles of two magnets together. What happens?

_____

3. Put the South poles of two magnets together. What happens?

_____

4. Do like poles repel or attract?_____
5. What pole will the North pole attract?_____

EXPERIMENT 2: MAGNETIC FIELD

PROCEDURE: Put the bar magnet under a piece of paper. Sprinkle the filings on top of the paper. Move the magnet slowly. Draw the magnetic field configuration that appears.

EXPERIMENT 3 WHAT IS MAGNETIC? (use bar, logo or ring)

PROCEDURE: Test to see which items are magnetic and which are not. List them accordingly:

magnetic			
nonmagnetic			

What kinds of materials are magnetic?_____

EXPERIMENT 4: MAGNETIC FORCE (1 logo, bar, ring magnets)

1. Are all magnets of equal strength?_____
2. Can you make a stronger magnet by sticking several magnets together?_____
3. Will a magnet attract things through a sheet of paper?_____

several sheets? _____

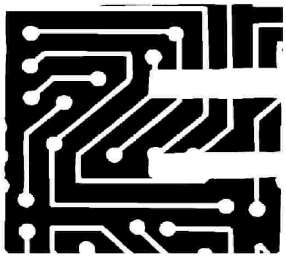
Find out whether these items will "block" the magnetic force. Answer yes or no, and comment on your findings.

paper _____ wood _____

glass _____ finger _____

CONCLUSION: Why do you think magnets pick up only certain substances?

_____



LECTRONICS INDUSTRY

APPLIED SCIENCE - TECHNOLOGY (4A)

PROBLEM: Can electrical circuits be used to gain information?

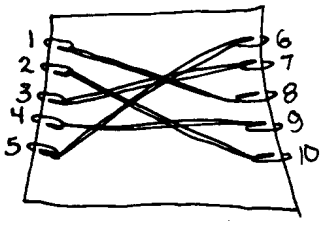
PREDICTION:_____

PROCEDURE:

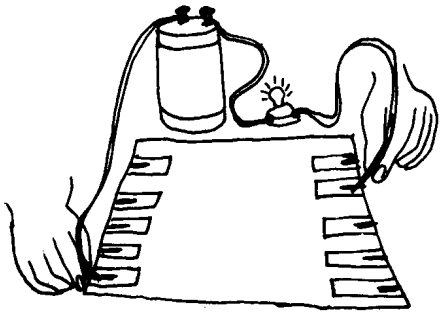
Holding the cardboard lengthwise, attach 5 paper clips about an inch apart along the left side. Then attach 5 paper clips to the right side in a direct line with the corresponding paper clips on the left. Number the clips 1-10, as in the diagram. Follow the "circuit" diagram below.

Using alligator clips, attach one clip to the paper clip on the question side and then one on the answer side. Devise 5 questions and their answers. Record them below. Put the questions and answers on the appropriate "circuit" so the bulb will light when the correct circuit is completed.

Circuit Diagram (example)



back



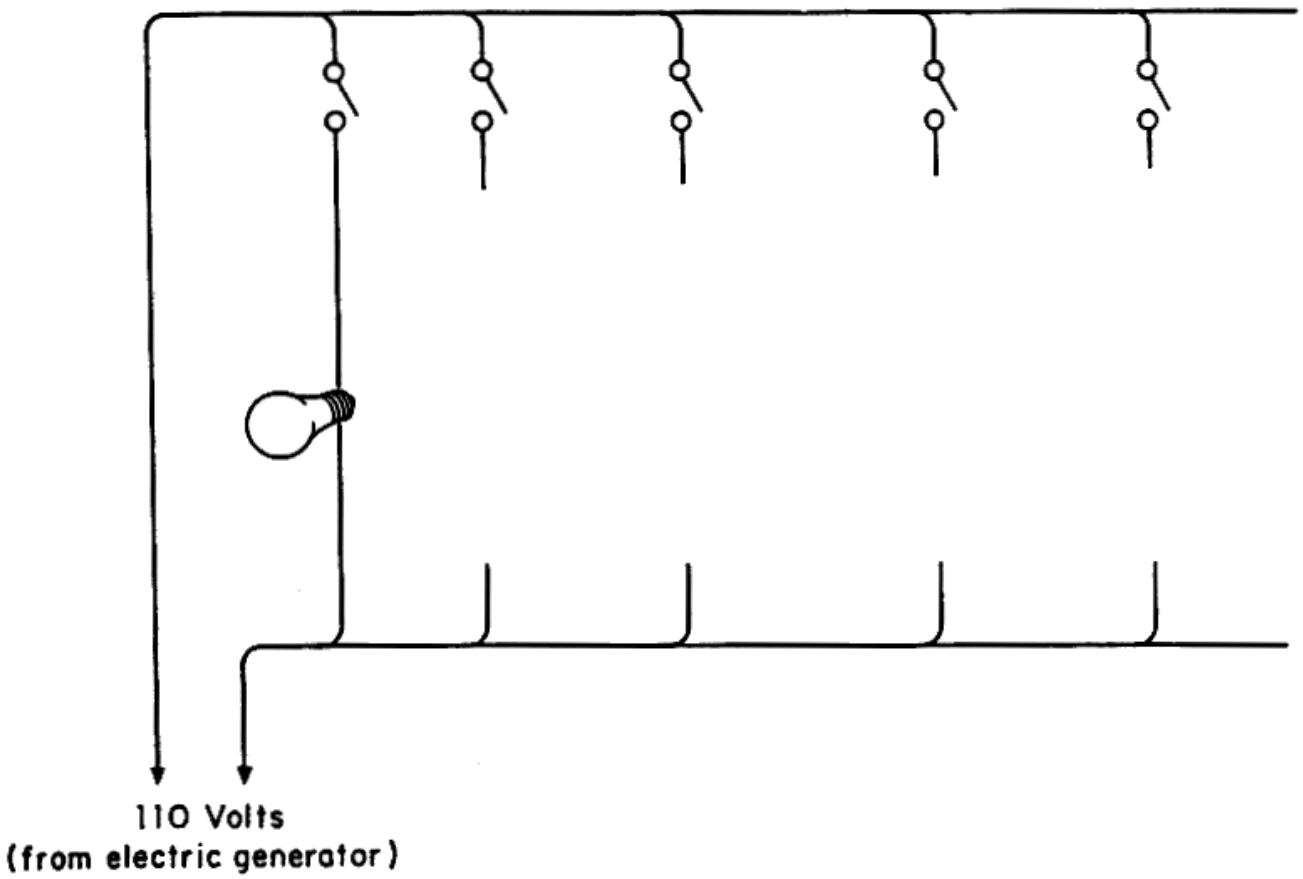
front

QUESTION	ANSWERS
1.	
2.	
3.	
4.	
5.	

Have another set of partners take a "quiz" on your circuit board.
What happens when they get the correct answer?_____
Why does this happen?_____
_____

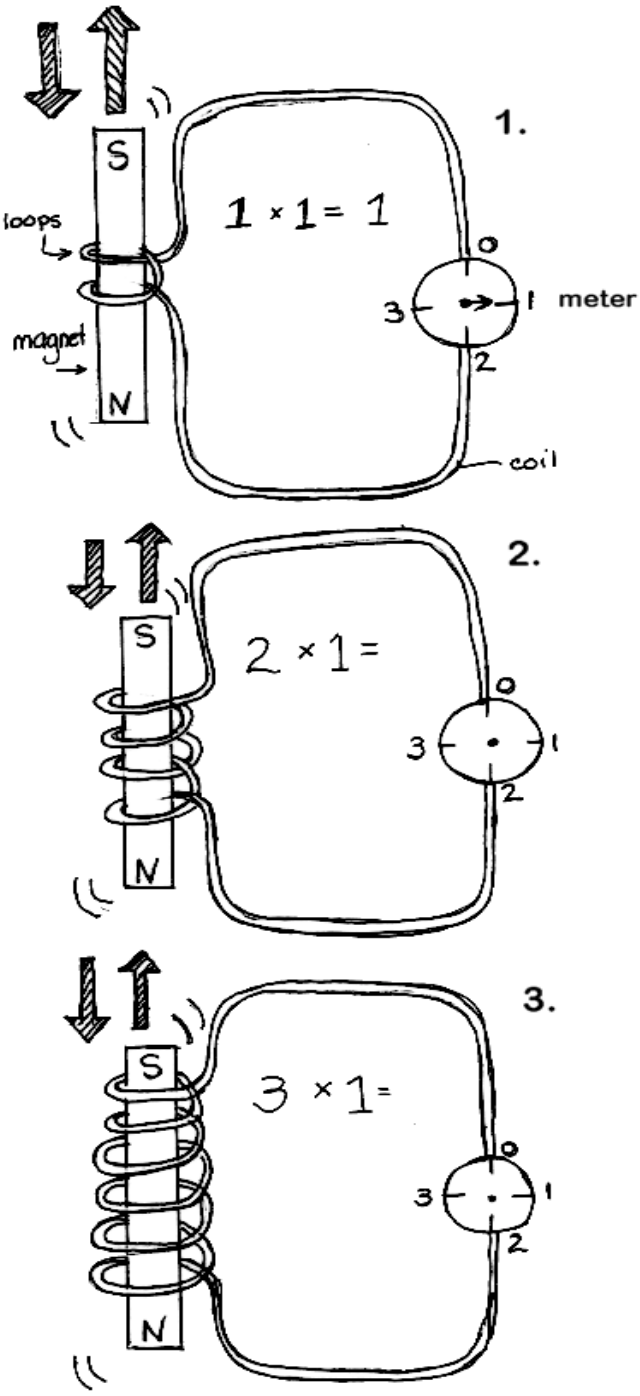
CONCLUSIONS: How does a quiz board illustrate how electricity can help gain knowledge?_____

DRAW THE APPLIANCES THAT REQUIRE ELECTRICITY IN YOUR HOUSE.



When a magnet is placed into a coil having twice the number of loops as in picture 1, twice as much energy is produced. Show this on the meter of picture 2.

If a magnet is place into a coil with three times as many loops, then three times as much energy is produced. Show this on the meter of picture 3. It is also three times harder to push the magnet into the loops.



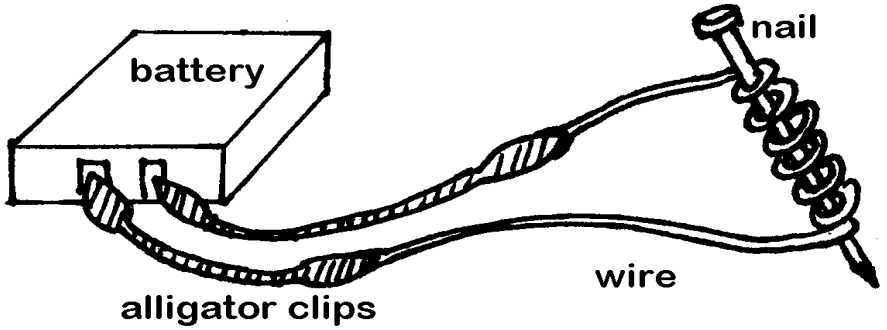
APPLIED SCIENCE - TECHNOLOGY (4B)

PROBLEM: Can you vary the strength of an electromagnet?

PREDICTION:_____
_____

MATERIALS: Two 1.2 volt batteries, battery holder, large nail, 2 pieces of insulated electrical wire, paperclips

PROCEDURE:
EXPERIMENT 1: Work in pairs to assemble your electromagnet.
A. Wrap about 10 coils of the wire tightly around the nail.
B. Attach each end (stripped of insulation) to the battery. (see diagram)
C. Test if the electromagnet works.



1. How many paperclips can you pick up?_____
(clips should be end to end so the test is the same)
2. Remove one of the wires from the battery, what happens?
_____

EXPERIMENT 2: MAKING A STRONGER ELECTROMAGNET
A. Double the number of coils around the nail to a total of 20 coils.
3. How many paperclips can you pick up now?_____
4. Is that double the above number? _____
5. If you triple the number of coils, how many paper clips can you lift?
_____
B. Remove the nail from the wire coil.
6. Does the coil of wire still act as an electromagnet?_____
7. How many paperclips can you pick up now?_____
8. Any other observation_____

CONCLUSIONS: What happens when you make more coils on the nail?

MORSE CODE

A . _	J . _ _ _	S . . .
B _ . . .	K _ . _	T _
C _ . _ .	L . _ . .	U . . _
D _ . .	M _ _	V . . . _
E .	N _ .	W . _ _
F . . _ .	O _ _ _	X _ . . _
G _ _ .	P . _ _ .	Y _ . _ _
H	Q _ _ . _	Z _ _ . .
I . .	R . _ .	

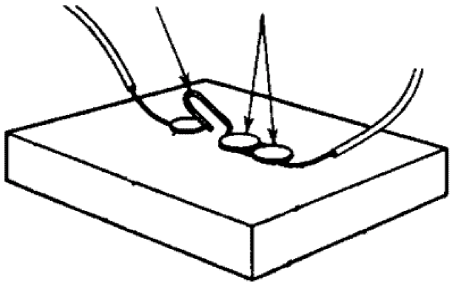
APPLIED SCIENCE - BUILT ENVIRONMENT (4)

PROBLEM: How can you transmit signals using a circuit?

PREDICTION:_____

EXERCISE I: MAKING A SWITCH

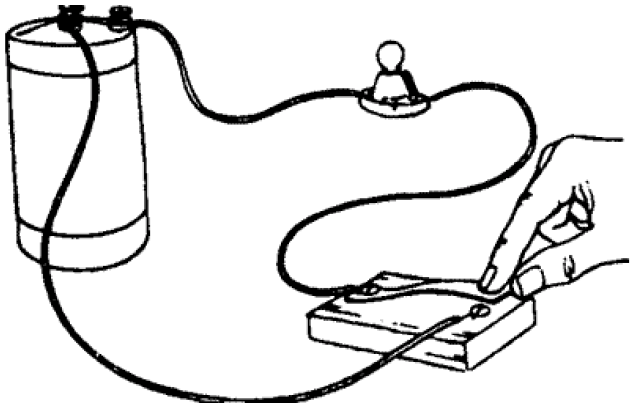
MATERIALS: 1 metal tack, 1 metal push pin, 3 paper clip, thick cardboard or piece of wood



PROCEDURE: Use a tack that is only metal. Put two paper clips and one push pin on one side of the base (wood or thick cardboard) as in diagram. Open up the paper clips before you attach them. Place the other paper clip down on the opposite side with the metal tack. Bend the paper clip that will make contact with the tack so that you have to force it down to make a connection (see diagram). You now have a switch.

EXERCISE II:

PROCEDURE: Set up equipment to make a light telegraph as in the diagram below. Make sure the circuit is complete. Note that this is not a "real" telegraph. A telegraph is made of an electromagnet so it can intensify the signals sent over long distances.



Practice the letters of the Morse Code so you can recognize a dot (quick pulse) and a dash (long pulse), Test your partner.

Practice sending the following words. Write it first in Morse Code.

H E L P	H E L L O

EXERCISE III. Write a message in Morse Code. Send it to your neighbor. Have your neighbor send you a message. The message is:

_____
_____

in Morse Code

_____

My neighbor's message is:_____

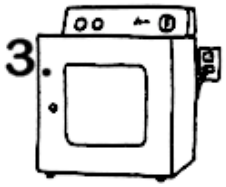
CONCLUSIONS: What is the principle of a telegraph?

_____

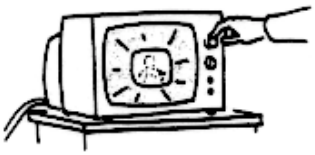
APPLIED SCIENCE - BUILT ENVIRONMENT (4) POST

1.

2.



3.



4.

5.

6.

7.

8.

9.

10.