Back

LINKS IN A CHAIN

OBJECTIVES

The student will do the following:

1. Describe the eight forms of energy (light, heat, sound, electrical, mechanical, magnetic, chemical, and nuclear).
2. Observe and describe energy transformations.

SUBJECTS:
Science

TIME:
120 minutes

MATERIALS:
red construction paper, scissors, transparent tape, posterboard, markers, student sheets (included)

BACKGROUND INFORMATION

There are many forms of energy. Light, heat, sound, and electrical energy are familiar to us in our everyday lives. Other forms, which may not be as familiar, are mechanical, magnetic, chemical, and nuclear energy.

Energy cannot be created or destroyed, but it can be changed from one form to another. Burning coal as fuel changes its chemical energy to heat energy. We can use the heat energy directly (for example, to warm us or heat materials like metals in industrial processes), or we can use the heat energy to produce some other kind of energy. Heat energy can be used to boil water. The steam can spin a turbine, producing mechanical energy. Turbines run generators to produce electricity. We then use the electricity to produce light, heat, sound energy, or power for mechanical energy. Our everyday lives are filled with examples of chains of energy transformations.

Terms

chemical energy: energy stored in matter because of its composition; energy that is released when compounds change; e.g., the energy stored in fuel.

electrical energy: energy produced by electrons pushing through wires.

energy: the ability to do work.

energy chain: a series of energy transformations from one form to another.

heat energy: the internal energy of a substance or object due to the movement of its particles.

kinetic energy: the energy of motion.

light energy: a form of energy that travels in waves and can be detected by the unaided human eye.

magnetic energy: the energy of attraction for iron and similar materials; such materials may have this energy naturally or it may be induced in them (as with an electromagnet).

mechanical energy: energy possessed by the moving parts of machines.

nuclear energy: the energy released when the nuclei of uranium atoms are split.

potential energy: stored energy, or the energy of position.

sound energy: the form of energy which travels in waves and causes the vibration of particles of air, water, or solids; detected by the ears.

PROCEDURE

I. Setting the stage

A. Tell the students that energy from the sun runs their television sets. Show evidence for this statement with the following presentation:

1. Prepare before class a blank bulletin board and the following construction paper cut-outs.

a. A circle labelled "sun."

b. A square labelled "TV."

c. Eight links (cut by the pattern on the student sheet "LINK PATTERN," included), labelled as follows:

(1) Potential energy, water (see illustration)

(2) Heat energy, water vapor

(3) Kinetic energy, rain

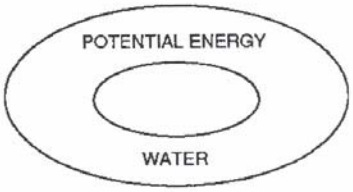
(4) Potential energy, reservoir

(5) Mechanical energy, turbine

(6) Electricial energy, generator

(7) Electrical energy, television

(8) Light energy, picture



2. Place the sun piece at one end of the board and the TV piece at the other. Give the eight links to eight students and tell them to post the links on the board as you talk through the chain of energy transformations.

3. Share with the students the following narrative:

Energy from the sun runs your television set. The energy is changed and transferred many times between the sun and the television screen. The sun's energy is stored on earth in three forms of matter—water, food, and fuel. The sun's energy heats water (for example, in oceans, lakes, and other bodies), evaporating it. The water rises into the atmosphere as water vapor. High in the atmosphere, the vapor cools, condensing and forming clouds from which fall rain, sleet, or snow. The rain falls to earth and some of it flows into rivers or lakes. Where rivers are dammed, the water is stored temporarily behind the dams. When the water is released through a hydroelectric dam, the force of the water can turn a turbine. As the turbine spins,

III. Follow-up

A. Give each student a copy of the student sheet "FORMS OF ENERGY," included. Have the students find and circle the listed energy terms in the word search puzzle. The answers are as follows:

B. Give each student a copy of the student sheet "ENERGY CROSSWORD," included. Have the students complete the puzzle. The answers are as follows: ACROSS—1. mechanical, 3. magnetic, 4. sound, 6. chemical, 7. heat, 8. light; DOWN—2. electrical, 5. nuclear.

C. Have each group give a three-minute presentation about its poster, summarizing the information about the form of energy it was assigned.

RESOURCE

Sund, R. B., D. K. Adams, J. K. Hackett, and R. H. Mayes. Accent on Science. Columbus, OH: Merrill, 1985.

ENERGY TERMS

chemical energy: energy stored in matter because of how it is made up; energy released when matter changes; examples of chemical energy include the energy stored in fuels and the energy stored in batteries.

electrical energy: energy produced by electrons pushing through wires.

energy: the ability to do work.

energy chain: a series of energy transformations from one form to another.

heat energy: the energy in matter because of the movement of the particles which make it up.

kinetic energy: the energy of motion.

light energy: a form of energy that travels in waves and can be detected by the eyes.

magnetic energy: the energy of attraction for iron and similar materials; such materials may have this energy naturally or may gain it, as an electromagnet does.

mechanical energy: the energy of the moving parts of machines.

nuclear energy: the energy released when the nuclei of uranium atoms are split.

potential energy: stored energy, or the energy of position.

sound energy: the form of energy which travels in waves and causes the vibration of particles of air, water, or solids; detected by the ears.

FORMS OF ENERGY

Can you find these words?

MECHANICAL	ELECTRICAL	MAGNETIC
CHEMICAL	NUCLEAR	ENERGY
CHAIN	SOUND	LIGHT
HEAT		

They may be spelled backwards, or they may go from corner-to-corner. When you find them, circle them and check them off the list.

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

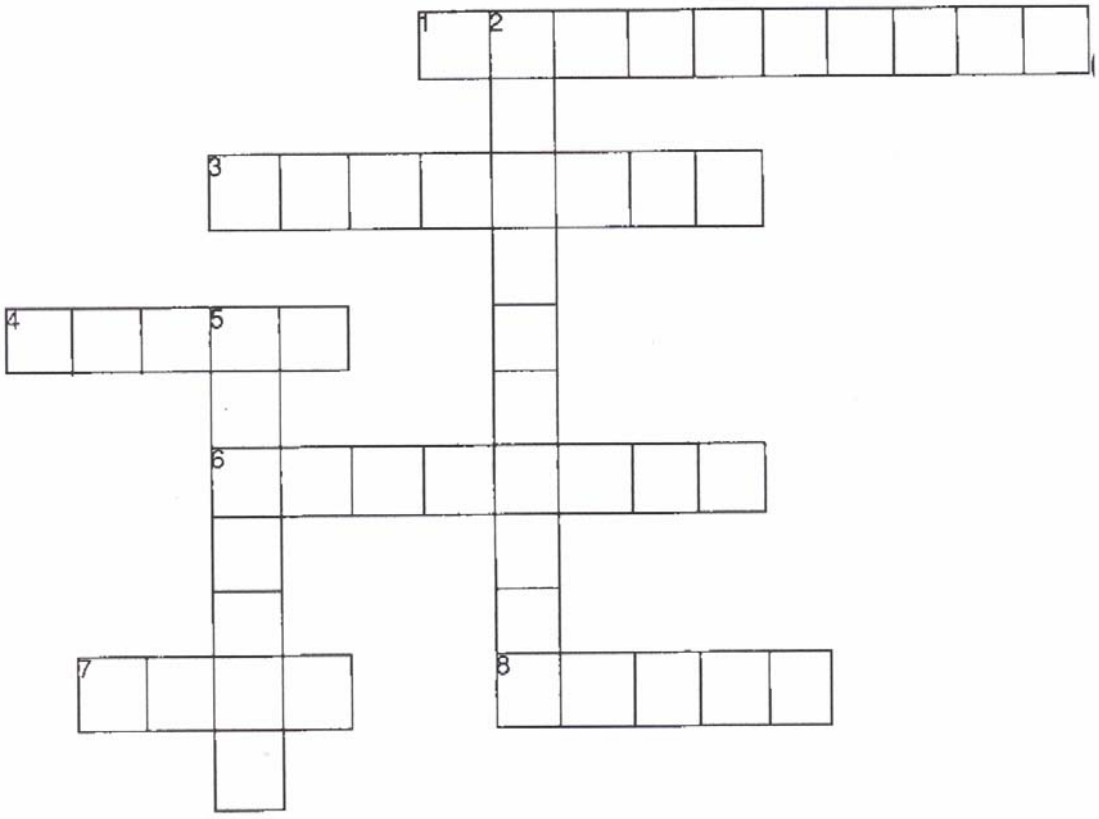
ENERGY CROSSWORD

ACROSS:

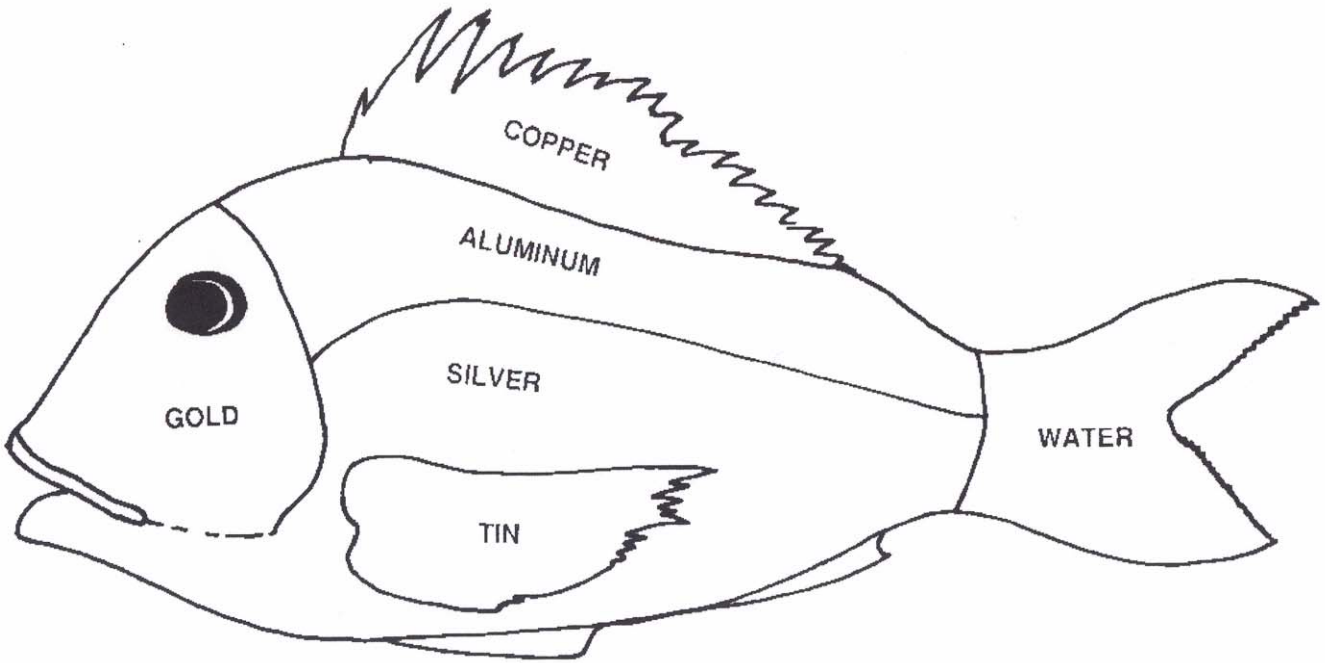
1. The energy possessed by the moving parts of machines.
3. The energy of attraction which iron may have naturally.
4. Energy form consisting of waves of vibration carried in the air, water, or solids.
6. The energy stored in matter; released by chemical change.
7. The energy of the movement of the particles making up a substance.
8. A form of energy that travels in waves and is detected by the eyes.

DOWN:

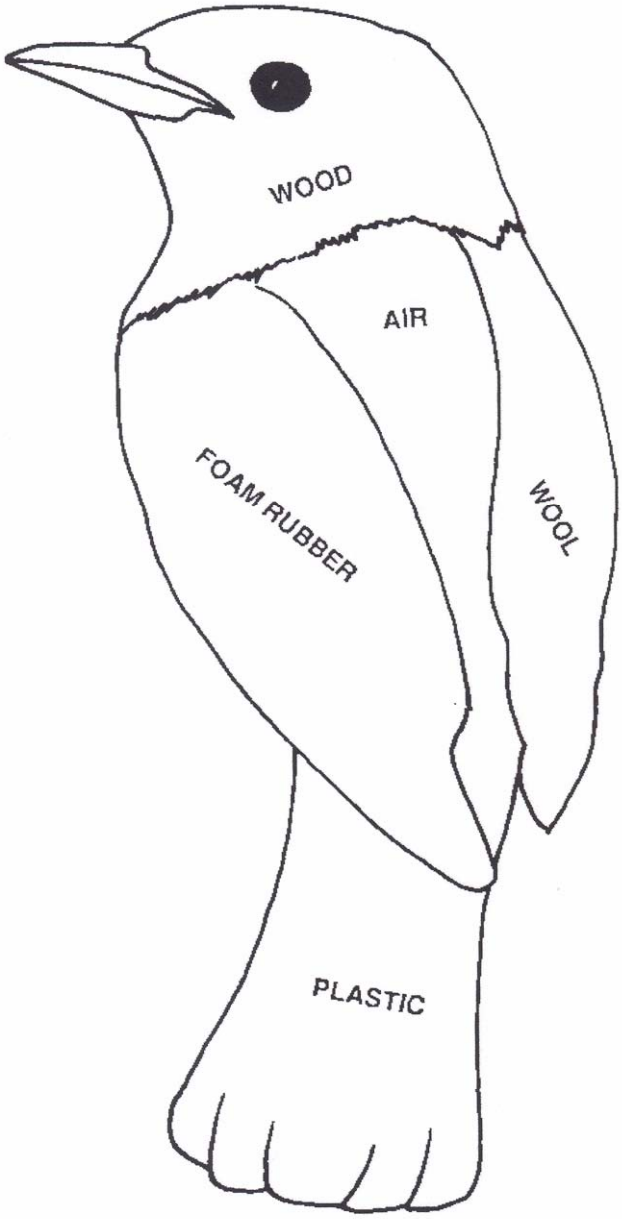
2. The energy of electrons pushing through wires.
5. The energy released when the nuclei of uranium atoms are split.



CONDUCTOR CRITTER PUZZLE



INSULATOR ANIMAL PUZZLE



YOU LIGHT UP MY LIFE

Materials: two batteries, masking tape, flashlight bulb, wire, nail and other objects

1. Make a simple electrical conductivity tester.

   a. Tape the batteries together. The bottom end of one should touch the top end of the other.

   b. Scrape about 2 inches of covering off each end of the piece of wire. Twist one of the bare ends around the metal part of the flashlight bulb. Tape the other end tightly to the bottom of the battery.

   c. Now touch the bottom tip of the bulb to the top post of the battery. The bulb should light up if all the connections are clean and tight.

2. Use the tester to find out if materials are conductors or insulators.

   a. Hold a clean nail between the top post of the battery and the tip of the flashlight bulb. The bulb will light up just as before. This shows that the iron nail is a conductor of electricity.

   b. Try other things, too. Here are some things that you can test—an eraser, a key, paper, glass, aluminum foil, a penny, a candle, a match stick, a paper clip, a pencil lead, cellophane, cork, a comb, a crayon.

3. Make a list of conductors and a list of insulators.

Conductors	Insulators

MR. CONDUCTOR—PLEASE!

Circle all the materials that are conductors. Put a ~~line~~ through all the materials that are insulators.

WATER

WOOD

SILVER

WOOL

ALUMINUM

PLASTIC

COPPER

GOLD

FOAM RUBBER

AIR

TIN

GOING AROUND IN CIRCUITS

OBJECTIVES

The student will do the following:

1. Define an electrical circuit.
2. Construct an electrical circuit.
3. Distinguish between parallel and series circuits.

SUBJECT:
Science

TIME:
120 minutes

MATERIALS:
flashlight bulbs, C or D batteries, noninsulated wire, masking tape, teacher and student sheets (included)

BACKGROUND INFORMATION

Current electricity is the movement of charged particles—electrons—along a conductor, such as a wire. Current electricity is generated from a source such as a battery or generator. Current electricity flows along a closed path called a circuit.

Electric circuits behave differently depending on how they are connected. A parallel circuit is a circuit that consists of more than one path through which electricity can flow. If one bulb burns out, the remaining bulbs are not affected. A series circuit is a circuit that consists of only one path. If one bulb burns out, all the bulbs in the circuit will go out.

Terms

current electricity: the flow of electricity; the movement of electrons through a circuit.

circuit: a path for the flow of electrical current; composed of elements such as a source of electricity, something that uses electricity, and the wires connecting them.

parallel circuit: a circuit in which the elements that use electricity are arranged so the same voltage is applied at each one; that is, a circuit that consists of more than one path through which electricity can flow.

series circuit: a circuit in which all the elements that use electricity are connected one after the other so that the current's voltage is divided among them; that is, a circuit that consists of only one path through which electricity can flow.

PROCEDURE

I. Setting the stage

A. Prepare by duplicating and cutting out the electrons on teacher sheet "ELECTRONS," included. (You need one electron for each student.)

B. Play the electron game. Have the students form a circle around the classroom. Tell the students the following rules:

1. Each student may hold only one electron at a time.

2. As students receive successive electrons, they must pass their electrons to the right.

C. Start passing out electrons and keep handing them out until each student has one. The electrons will be moving around the circle. Let the students do this for a few rounds to show that current electricity is flowing.

D. When the students have seen the electrons in motion, remove one electron. Tell the students that when the current is interrupted, the circuit is broken and electricity ceases to flow.

II. Activity

A. Divide the class into small groups. Give each group a flashlight bulb, a C or D battery, two pieces of noninsulated wire, and some masking tape. Tell the groups to light the bulbs. The masking tape is to be used to hold the wire in place, connecting the bulb and the battery. The groups are to draw pictures showing the circuit.

B. Duplicate for each student a copy of the student sheet "WHICH ONES WORK?," included. (In a simple circuit, one wire goes from the power source—the battery—to where the power is used—the light. The other wire goes back to the power source.)

1. Have the students look at the circuits shown and check the ones that are complete circuits. (Circuits 2, 3, and 4 are complete circuits and the bulb should light up. Circuits 1, 5, and 6 are incomplete circuits.)

2. Divide the class into the small groups. Return to each group a flashlight bulb, a C or D battery, and a piece of noninsulated wire. The students are to check the answers they gave on the student sheet by constructing each illustrated circuit to see if the bulb lights. **(CAUTION—BATTERIES MAY GET HOT.)**

C. Divide the class into small groups. Give each group two flashlight bulbs, two C or D batteries, four pieces of noninsulated wire and some masking tape. Give each group a copy of the student sheet "COMPARING CIRCUITS," included.

1. Before the students start to work, discuss with them series and parallel circuits. (Christmas tree lights make a good example.) Remind the students about the positive (+) and negative (-) terminals on the batteries. **(CAUTION—BATTERIES MAY GET HOT.)**

2. Have the students build and compare the illustrated circuits and their own circuits (as directed). (The following results should be observed: Circuit 3—each bulb gets only half the voltage of the battery, so they both glow dimly. Circuit 7—both get almost the whole voltage, so they glow brightly. Circuit 4—the two batteries together produce twice the voltage, so the bulb glows very brightly. Circuit 5—the two batteries give the voltage of a single battery.)

III. Follow-up

A. Have the students complete the student sheet "A-MAZE-ING CIRCUITS," included. (Correct completion of the maze will allow them to answer the questions with the word "electrons.")

B. Have the students fill in the blanks.

1._____ is the flow of electricity or the movement of electrons over a circuit.

2._____ A is a pathway for the passage of current.

C. Have the students draw a simple circuit consisting of a flashlight bulb, a battery, and a piece of noninsulated wire.

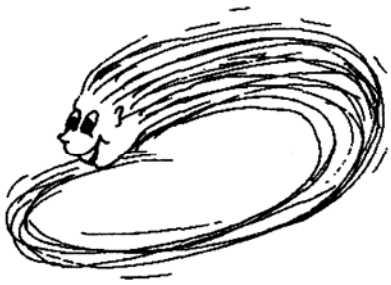
D. Have the students draw two series circuits and two parallel Circuits consisting of some (but perhaps not all) of the following-2 flashlight bulbs, 2 batteries, and 4 pieces of noninsulated wire.

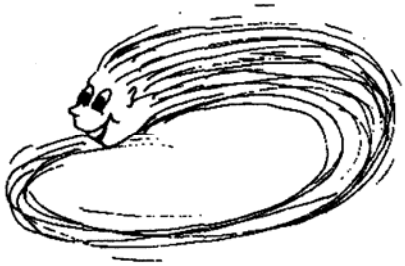
RESOURCES

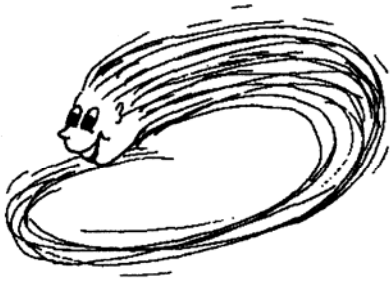
Ardley, N. Discovering Electrici1v. New York: Franklin Watts Std., 1984.

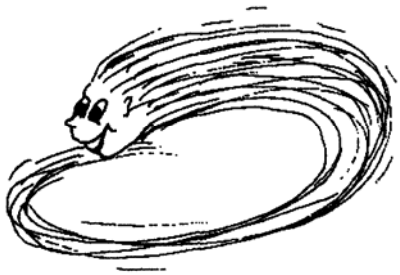
Sund, R. B., D. K. Adams, J. K. Hackett, and R. H. Mayes. Accent on Science. Columbus, OH: Merrill, 1985.

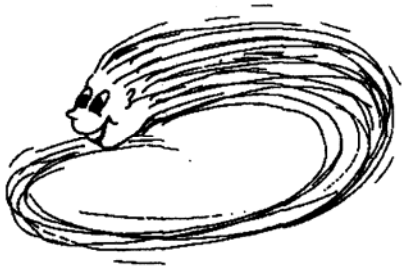
ELECTRONS

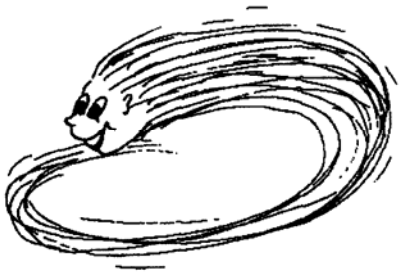












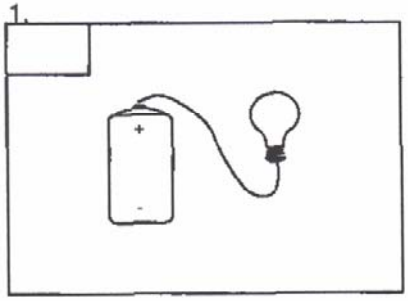
WHICH ONES WORK?

Look carefully at each circuit pictured below.

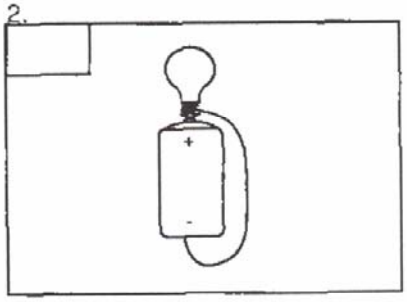
Decide which circuits are complete and would make the lights glow.

Check the boxes showing complete circuits.

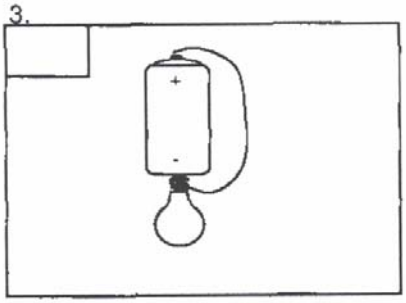
1.



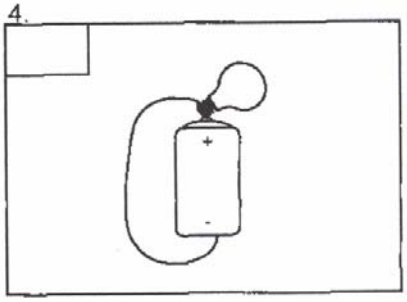
2.



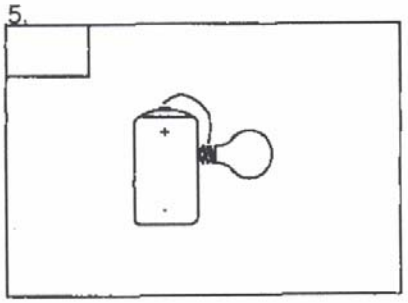
3.



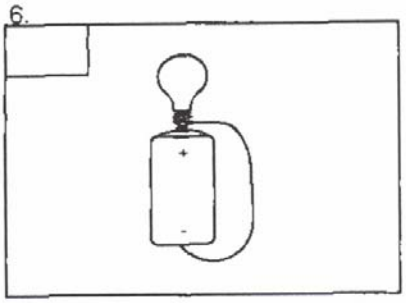
4.



5.



6.



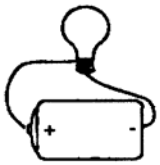
COMPARING CIRCUITS

Construct each of these circuits carefully. (Use masking tape to hold wires in place.)

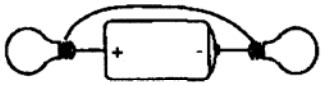
As you build each circuit, note the brightness of the bulb. Color the bulbs on this worksheet to match the bulb's brightness.

1. Simple

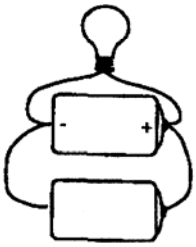
2. Simple



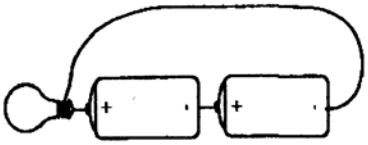
3. Series



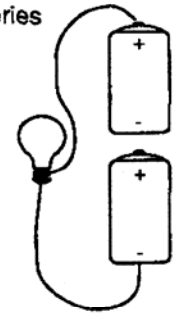
4. Parallel



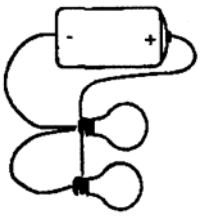
5. Series



6. Series



7. Parallel



8. Try a series circuit of your own. (Draw it here.)

9. Try a parallel circuit of your own. (Draw it here.)

A-MAZE-ING CIRCUITS

Complete the maze. The correct path through the maze will lead to letters which will spell the word needed to complete this sentence.

Current electricity is the flow of _____.