

LET'S EXPLORE

# ELECTRICITY



An Information & Activities Book

**GPU** Nuclear



What exactly is **ELECTRICITY**?

Isn't it the "**JUICE**" that makes **LIGHT BULBS SHINE**?

I don't know. I think we'd better ask the **PROFESSOR**!

**THE PROFESSOR**



**TAKING AN INSIDE LOOK AT ELECTRICITY**

Hey, Professor, what is electricity?

That's right!  
Huh?

You're right! You said a "**WATT** is electricity," didn't you? A watt is a unit used to measure electricity.



I'm still confused. Could you tell us more?

Sure! Electricity is a form of **ENERGY**.

Energy... I never seem to have enough of it for cleaning my room.

Good example! Scientists define energy as the ability to do work.



Work!?!  
What does electricity have to do with work?

It's quite simple.

The energy in electricity is caused by the movement of tiny particles called "**electrons**."

I've never seen any electrons.

That's because they're too small and moving too fast... but we can use their energy -- for example, by sending them through wires. Electricity used this way can do lots of work for us -- at the **FLICK OF A SWITCH**.





# ELECTRICITY

is an important part of our lives, because we use it in so many ways.



Below are some examples of how we use electricity. Read each explanation, then find and circle the word in the grid that correctly fits the blanks. Words may be read up and down, left to right or diagonally. (The first letter of each word has been given.)

- Electricity helps keep us comfortable. It provides **L**\_\_\_\_\_ to help us see and **H**\_\_\_\_\_ to keep us warm.
- We also use electricity to help us learn and solve problems. **C**\_\_\_\_\_ are electric-powered machines that can store lots of information and help solve problems.
- Electricity helps keep us healthy, too. **D**\_\_\_\_\_ examine and treat patients with **M**\_\_\_\_\_ powered by electricity.
- Electricity helps us communicate with other people. For example, we can talk with our friends by using the **T**\_\_\_\_\_.
- Without electricity, life would be different. We wouldn't be able to use a **R**\_\_\_\_\_ or **S**\_\_\_\_\_ to enjoy our favorite music, and we couldn't watch **T**\_\_\_\_\_.
- Electricity can make just about any **J**\_\_\_\_\_ easier. Thanks to electricity, **W**\_\_\_\_\_ are able to produce more and do a better job.
- Electricity even helps provide food. That's because modern **F**\_\_\_\_\_ and food processing depend on electric-powered machines.

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



# ELECTRICITY CAN BE WILD!



Electricity is all around us  
-- all the time!

Do you mean it's in  
wires, switches, toasters  
and stuff like that?

Well, sure, but it also occurs  
naturally, whenever those  
tiny electrons create a force  
called a "charge."



That scientific  
talk is pretty overpowering.  
How about some examples?

OK. You've seen  
lightning during  
a thunderstorm ...



... and "static cling"  
in clothes from the  
dryer, haven't you?

Gee, you  
mean that's  
electricity?



That's right! We  
call it "static"  
electricity, because  
it sits still while  
it builds up --  
then it may  
suddenly "jump."

How about the spark I feel  
when I touch a doorknob after  
walking around the house in  
my socks during cold weather?

That's static  
electricity,  
too. Now you've  
got the  
picture!



## EXPERIMENT:

Hey kids,  
**CHARGE IT!**

1. Blow up a balloon and tie a knot in the end of it (the end with the hole in it!).
2. Rub the balloon against your shirt for a few seconds.
3. Hold the balloon against the wall and let it go -- or hold it close to your hair and see what happens.

Try this experiment  
to see if you can  
generate your own  
static electricity.



It's a real "hair-  
raising" experience!



# TIME OUT!

Before going any further, find out how much you know about electricity already. Choose the correct answer for each item below. Bet you know more than you think!

## EASY

1. Which word below has nothing "wattsoever" to do with electricity?



- a) Volts  
b) Amps  
c) Current  
d) Toadstools

2. Electricity travels \_\_\_\_\_



- a) around the country giving free concerts  
b) at a speed of 186,000 miles per second (as fast as the speed of light!).  
c) with the rest of the team and coaches.

## HARDER

3. Which of these is powered by electricity?



- a) windmill  
b) bicycle  
c) washing machine  
d) hot-air balloon

4. Some objects conduct electricity (allow it to pass through) quite easily. These objects are called good \_\_\_\_\_



- a) resistors  
b) conductors  
c) transistors  
d) amplifiers

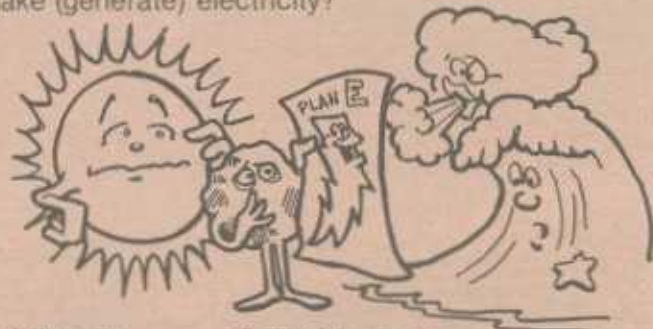
## GOOD LUCK!

5. In Ben Franklin's famous experiment, he showed that lightning is a form of electricity by flying a \_\_\_\_\_ in a thunderstorm. (Never try this experiment yourself - it's dangerous and can cause death!)



- a) generating plant  
b) kite  
c) paper airplane  
d) lightning rod

6. Which of these can be used to help make (generate) electricity?



- a) the sun  
b) the wind  
c) coal  
d) moving water  
e) all of the above  
f) none of the above

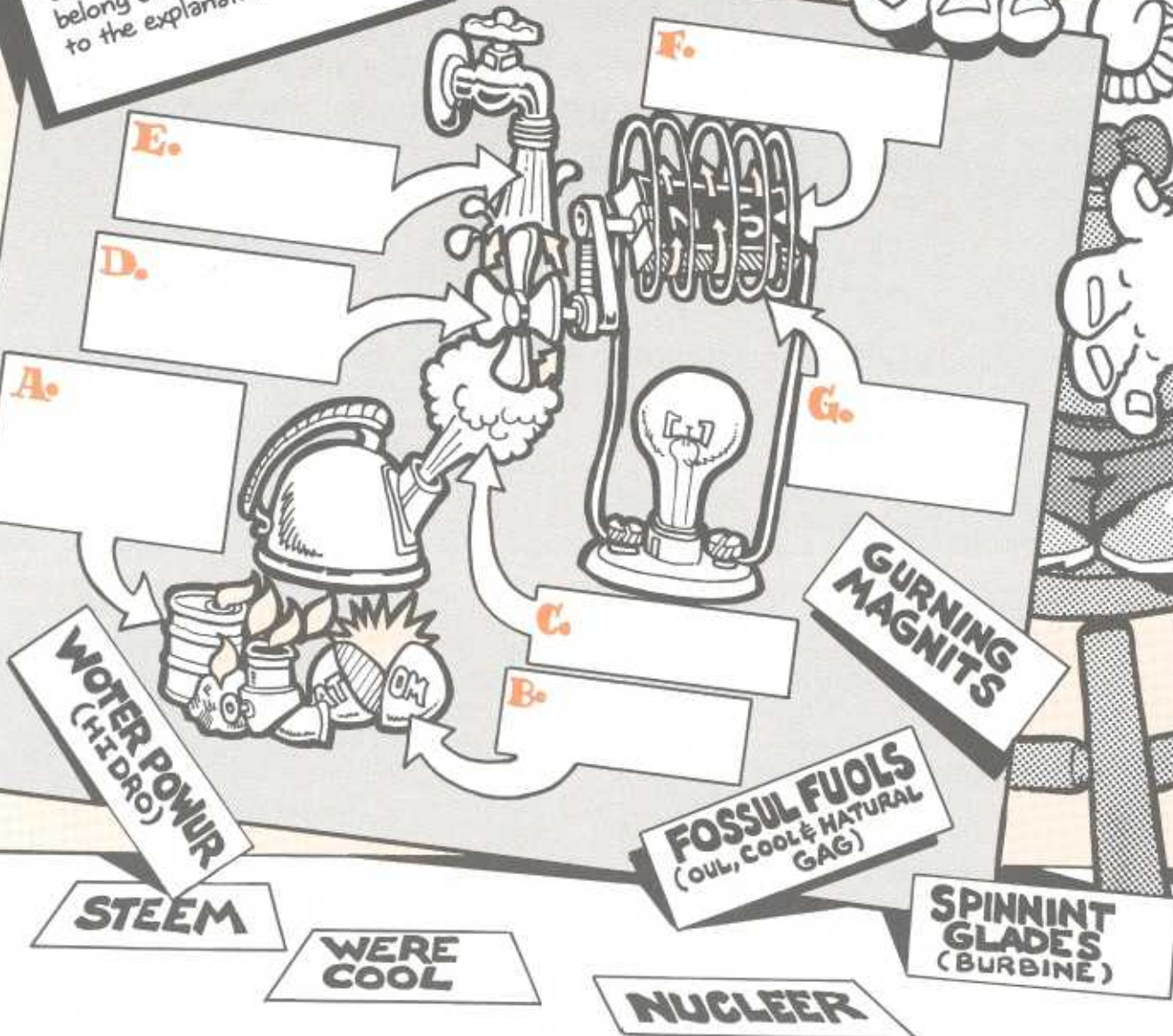


# HOW WE MAKE ELECTRICITY

The electricity we use in our homes, schools, stores and businesses is different from static electricity -- it's called "current" electricity because it moves (in a current) as it's made. It doesn't sit still. Most of our current electricity is made at generating plants, which work this way:

1. Fossil fuels (coal, oil and natural gas) are burned to heat water, which makes steam. Fossil fuels were formed inside the earth from the remains of plants and animals that lived long ago. A fuel called uranium may also be used. When uranium "atoms" (made of electrons spinning around a center called a "nucleus") are split, heat for making steam is released. This is called nuclear power.
2. The steam spins the blades of a turbine. In some generating plants, water passing through a dam spins the turbine (this is called "hydro" power).
3. The turbine turns a magnet inside a wire coil. The magnet causes electrons in the wire to move, starting an electric current (electricity).

The Professor wanted to use the poster below to show how electricity is generated. Unfortunately, he didn't spell the labels for the poster right. To make things worse, the labels fell off the poster. Correct the Professor's spelling and write the labels where they belong on the poster, according to the explanation.





# HOW ELECTRICITY IS DELIVERED TO YOUR HOME

The Professor prepared a lecture on how electricity gets from the power plant to people's homes. This time he spelled everything right, but he dropped his posters on the way to the lecture hall. Can you help the Professor by reading his lecture notes and then numbering the posters so that they're in the right order?

1. Electricity leaves the **GENERATING PLANT.**

2. The electricity passes through a **STEP-UP TRANSFORMER,** which raises the force behind it (the number of "volts"), so it can travel a long distance.

3. Electricity travels a long distance through **TRANSMISSION LINES,** before arriving at the substation.

4. Electricity passes through the **SUBSTATION,** where a transformer lowers the power so it can be shared by neighborhoods and businesses.

5. **DISTRIBUTION LINES** carry the electricity from substations to neighborhoods.

6. **POLE TRANSFORMERS** (step-down transformers) in neighborhoods lower the power once again, before the electricity enters your home.





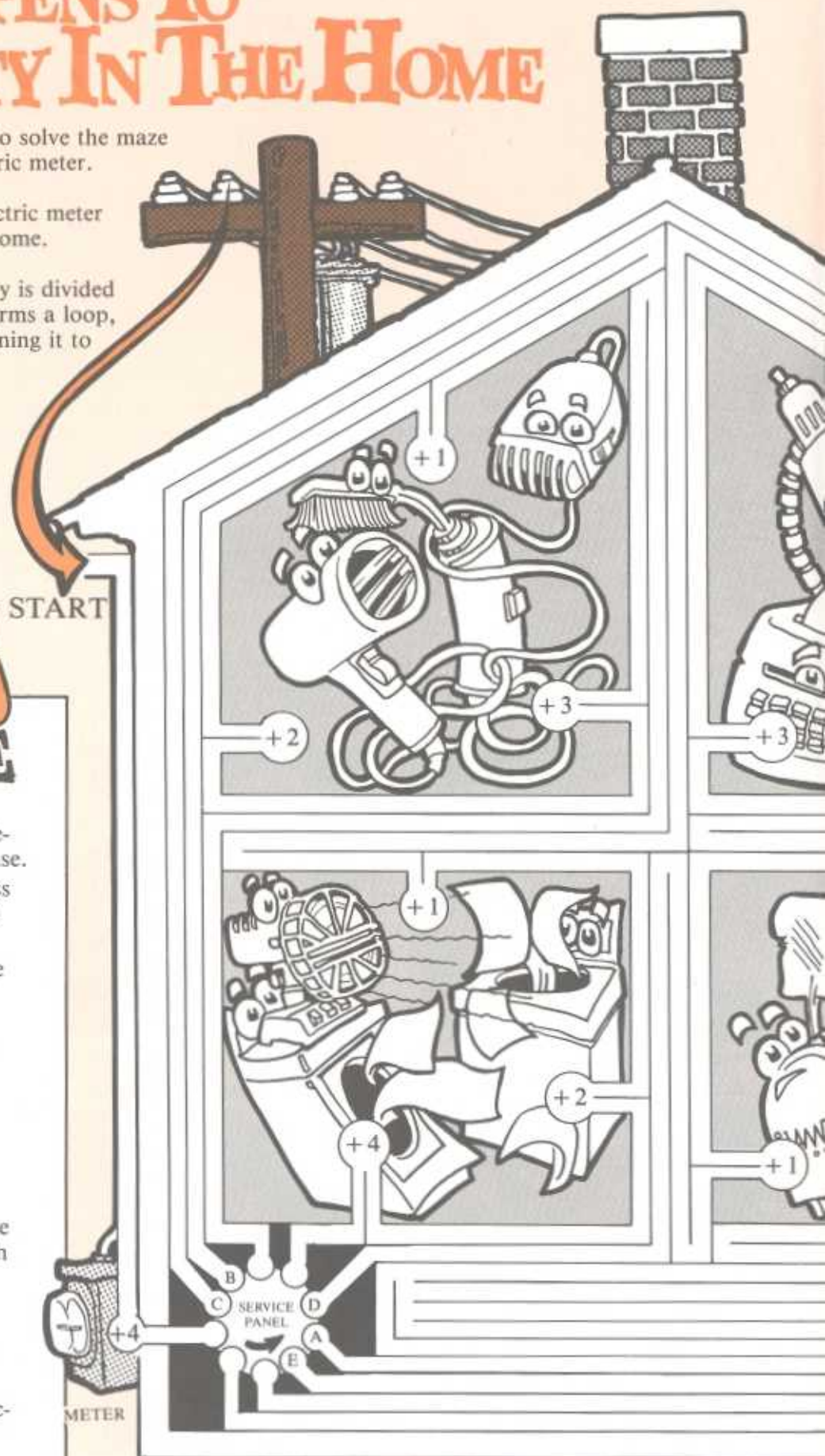
# WHAT HAPPENS TO ELECTRICITY IN THE HOME

Read the explanation below, then try to solve the maze by following the directions at the electric meter.

1. Electricity passes through the electric meter to the service panel inside your home.
2. In the service panel, the electricity is divided into **CIRCUITS**. Each circuit forms a loop, carrying electricity to outlets and returning it to the service panel.
3. The service panel uses a fuse or circuit breaker for each circuit. The fuse or circuit breaker shuts off the flow of electricity when too much electricity is being used. This helps to prevent fires.

## THE AMAZING ELECTRIC METER MAZE

1. Start where the wire from the telephone pole is attached to the house.
2. As you enter the maze, you'll pass through the electric meter and go into the service panel.
3. Begin with circuit A in the service panel. Follow its path through the house, adding the number shown at each light or appliance as you go. (Be sure to follow each circuit all the way back to the panel.)
4. Follow circuits B, C and D in alphabetical order, adding numbers, and returning to the service panel. After you complete circuit D, the only remaining path will lead you to the winner's circle.
5. If you've completed the maze and added correctly, you should have the answer shown on p.15. The numbers add up the way electricity use adds up!





# Create Your Own Circuit

For this experiment, you'll need a few simple items:

- ☐ a flashlight battery
- ☐ a flashlight bulb
- ☐ a piece of fine wire or tin foil
- ☐ some tape

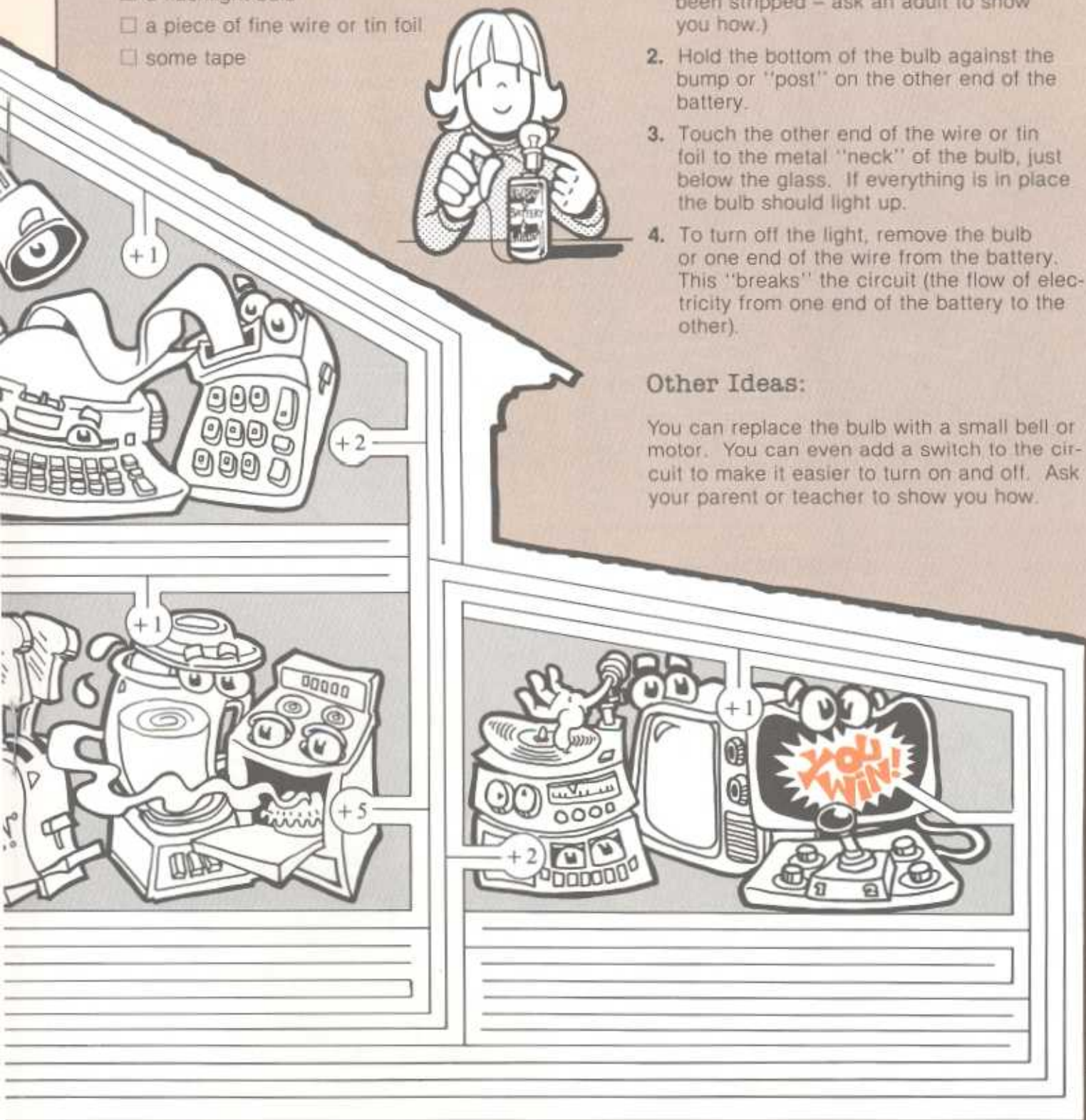


## What To Do:

1. Hold or tape one end of the wire or tin foil against the flat end of the battery. (Make sure the ends of the wire have been stripped – ask an adult to show you how.)
2. Hold the bottom of the bulb against the bump or "post" on the other end of the battery.
3. Touch the other end of the wire or tin foil to the metal "neck" of the bulb, just below the glass. If everything is in place the bulb should light up.
4. To turn off the light, remove the bulb or one end of the wire from the battery. This "breaks" the circuit (the flow of electricity from one end of the battery to the other).

## Other Ideas:

You can replace the bulb with a small bell or motor. You can even add a switch to the circuit to make it easier to turn on and off. Ask your parent or teacher to show you how.





# ELECTRICITY! A Precious Energy Source

The Professor has always been a concerned citizen. When he read the newspaper article at the left, he decided to write a letter to the editor. Unfortunately, the Professor's typewriter wasn't working right. A different key was sticking as he typed each paragraph. Can you figure out which key was sticking and read the Professor's message?

Dear Editor:

Lik many of your radrs, I, too, am concernd about th cost of letricity today. As th fuls w burn to mak letricity hav becom hardr to find, thy hav becom mor xpnsiv. W shar ths ful costs in our lettric bills.

ur electric bills als include mney spent n prtecting the environment, keeping wrkers safe and finding tmrrw's energy surces.

Whle these costs can add up n a hurry, there s a smple way to reduce our electrc blls and keep them as small as possible: use electrcity wsely!

Yours energetcally,  
The Professor

*The  
Professor*

## THE PROFESSOR'S ALTERNATIVE ENERGY MACHINE

The Professor invented a machine that uses 'alternative' forms of energy to generate electricity. These energy sources can help us save fuel and money.

WIND  
POWER

BIOMASS  
(energy from garbage  
and plants)

SOLAR  
HEAT  
(heat from  
the sun)

PHOTO-  
VOLTAICS  
(electricity  
from  
sunlight)

GEOTHERMAL ENERGY  
(from heat inside the earth)

BIOMASS  
CONVERTOR



# ARE YOU A GOOD METER READER?

The people who sell electricity use meters so they can tell how much electricity has been used in your home.

Gee, I've never tried to read an electric meter.

Then it's time to learn how.

First, learn some DEFINITIONS.

## DEFINITIONS

**A Watt** is a unit of electrical power (roughly equal to  $1/746$  "horsepower").

**Kilowatt-Hours** are what your electric meter measures. Each kilowatt-hour means that you used 1,000 watts of electricity for one hour. (The shortened form of kilowatt-hour is kwh.)

## TRY THIS METER-READING BRAIN TEASER (a challenge to math experts)

- Following the example on the right, use the space provided to fill in the readings shown on the meters below.  
To read a meter, write down the number indicated by the pointer in each dial from left to right. When the pointer is stopped between two numbers, choose the smaller number.
- Subtract the first reading from the second reading, to find out how many kilowatt-hours were used.
- Multiply your answer (from step 2) by the electric rate – given here as \$.08 per KWH – to see how much the cost of the electricity would be.

### EXAMPLE

FIRST READING



SECOND READING



SECOND READING				
8	5	1	6	5
MINUS FIRST READING				
8	4	8	1	3
kwh's USED				
	3	5	2	

KWHs USED	352
RATE (\$ per kwh)	.08
COST OF ELECTRICITY USED	\$28.16

### TEST YOURSELF

FIRST READING



SECOND READING



SECOND READING				
MINUS FIRST READING				
kwh's USED				

KWHs USED	
RATE (\$ per kwh)	.08
COST OF ELECTRICITY USED	\$ .

### READ YOUR METER AT HOME!

FIRST READING



SECOND READING



SECOND READING				
MINUS FIRST READING				
kwh's USED				

KWHs USED	
RATE (\$ per kwh)	
COST OF ELECTRICITY USED	\$ .



How much  
**ELECTRICITY**  
is used in  
**YOUR HOME**  
?

**ENOUGH**  
to make all the  
lights and appliances  
**WORK!**

Let's be  
serious!

# THE INCREDIBLE ROBOT-MACHINE!

Imagine your home  
as a giant robot-machine  
powered by electricity.

It cooks!  
It cools!

It even plays music  
and makes coffee!

**DID YOU REALIZE?**  
The average American robot-  
machine . . . er, I mean  
household . . . uses more  
than 8,000 kilowatt-hours  
of electrical energy each year.

- Directions:** 1. In the list below, put a check mark next to the electric-powered appliances you find in the robot-machine.  
2. Then, circle any items (on the list) that you have in your home.

APPLIANCE	HOW MUCH ELECTRICITY IT USES (WHEN TURNED ON)
<input type="checkbox"/> Air conditioner (one room unit)	1,000 watts
<input type="checkbox"/> Automatic toaster	1,100 watts
<input type="checkbox"/> Automatic washer	700 watts
<input type="checkbox"/> Blender	300 watts
<input type="checkbox"/> Coffee maker	600 watts
<input type="checkbox"/> Dehumidifier	350 watts
<input type="checkbox"/> Dishwasher	1,500 watts
<input type="checkbox"/> Dry iron or steam iron	1,000 watts
<input type="checkbox"/> Electric blanket	200 watts
<input type="checkbox"/> Electric clock	2.5 watts
<input type="checkbox"/> Electric clothes dryer	4,500 watts
<input type="checkbox"/> Electric fry pan	1,200 watts
<input type="checkbox"/> Electric water heater	4,500 watts
<input type="checkbox"/> Freezer (frostless 15 cu. ft.)	440 watts

APPLIANCE	HOW MUCH ELECTRICITY IT USES (WHEN TURNED ON)
<input type="checkbox"/> Fluorescent lights (each tube)	15-40 watts
<input type="checkbox"/> Garbage disposal	900 watts
<input type="checkbox"/> Hair dryer	1,250 watts
<input type="checkbox"/> Hot plate	1,500 watts
<input type="checkbox"/> Lamps (each bulb)	40-150 watts
<input type="checkbox"/> Oil burner	250 watts
<input type="checkbox"/> Portable fan	100 watts
<input type="checkbox"/> Radio	71 watts
<input type="checkbox"/> Range, electric	8,000 watts
<input type="checkbox"/> Refrigerator (frostless 14 cu. ft.)	600 watts
<input type="checkbox"/> Sewing machine	75 watts
<input type="checkbox"/> Stereo, hi-fi	300 watts
<input type="checkbox"/> TV, color (no tubes)	200 watts
<input type="checkbox"/> Vacuum cleaner	630 watts

**It's easy to see how energy costs can add up!**



I didn't  
know we used  
**SO MUCH**  
electricity!

We use a lot,  
but sometimes  
**IT'S WASTED.**

**WHAT**  
**CAN WE DO**  
to keep from  
wasting it  
?

# ELECTRIC CONSERVATION CODE

Below are some coded messages that will give you some ideas for saving electricity.

**CODE 1** See if you can figure out how this one works.

Y·T·P·M·E S·i M·O·O·R  
E·H·T N·E·H·W S·T·H·G·I·L  
E·H·T F·F·O N·R·U·T

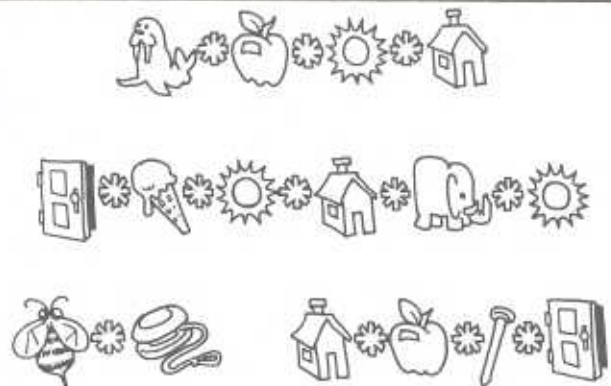
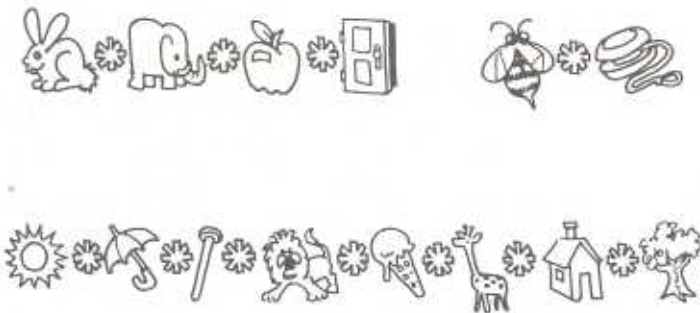
N·E·P·O R·O·O·D  
R·O·T·A·R·E·G·I·R·F·E·R  
E·H·T E·V·A·E·L T·N·O·D

**CODE 2** This one uses a numbered alphabet.  
(CLUE: A = 1, C = 3, F = 6 -- see if you can figure out what's going on.)

20-21-18-14 15-6-6 20-8-5  
20-22 23-8-5-14 14-15-2-15-4-25  
9-19 23-1-20-3-8-9-14-7

4-18-25 25-15-21-18  
8-1-9-18 23-9-20-8 1  
20-15-23-5-12

**CODE 3** Good luck with this one!  
(If you can spell the name of each pictured object, you're on your way.)



Record the number of times and different ways you use electricity. Use your diary to think of other energy-conservation ideas.



# THE PROFESSOR PRESENTS:

## WATT'S MY NAME?

Below are actual events and accomplishments in a famous person's life. The famous person had a lot to do with how we use electricity today.

### DIRECTIONS

Using the list at the bottom of the page, choose the word that correctly completes each fill-in-the-blank. Then, take the letters that appear in boxes and use them to spell our mystery person's name in the spaces provided after item 9.

## WHO...???



1. once wired two cats'  together to generate electricity. (Never try this experiment - it may injure the cats.)



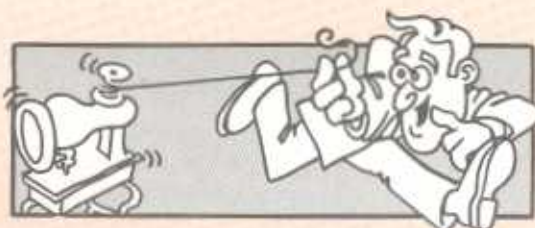
2. tried to hatch an egg by sitting on it when he was a young .



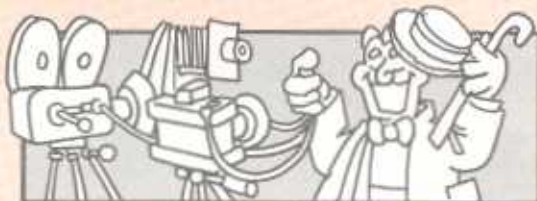
3. wired an  clock to a telegraph key so he could sleep while messages were sent.



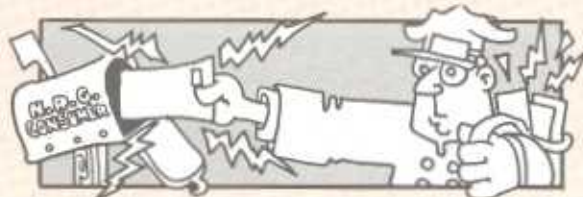
4. invented the phonograph (record player) in 1877 and  it by recording and playing back "Mary Had a Little Lamb."



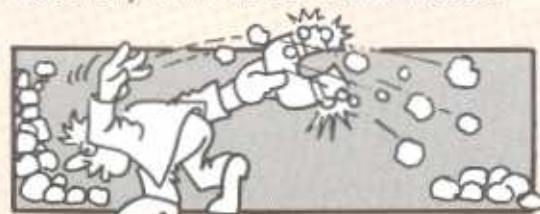
5. invented the first light bulb, which used pieces of  inside a glass container.



6. experimented with machines, cameras and films, giving birth to the  picture industry.



7. developed the first power , which delivered electricity to homes and businesses.



8. developed a process which used a magnet to separate fine particles of  ore from other rocks.



9. once said that genius is 99% perspiration and 1% .

1. 2. 3.

4. 5. 6. 7. 8. 9.

ALARM  
TESTED

ELECTRIC  
MOTION

THREAD  
STRING

STATION  
INSPIRATION

BOY  
TAILS

IRON  
STEEL



# CROSSWIRED PUZZLE



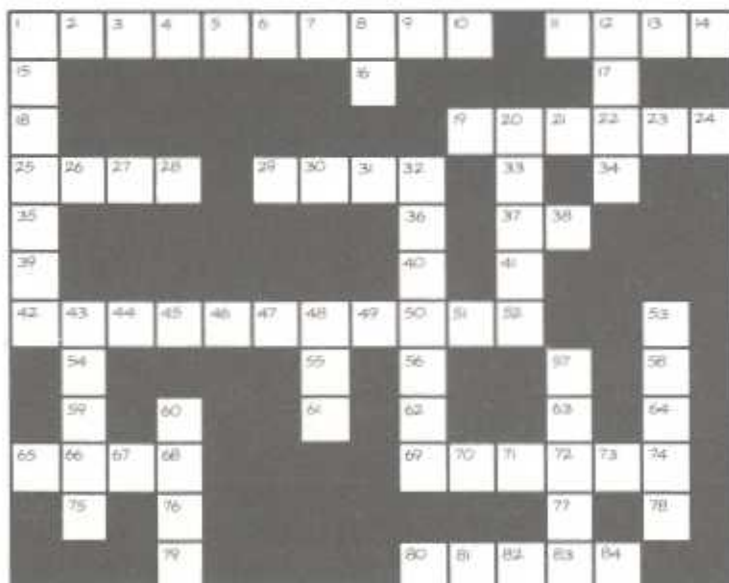
Complete the crossword puzzle below with some of the "electrifying" words that have been used in this book.

## ACROSS

1. Electricity passes easily through materials called \_\_\_\_\_.
11. Short for kilowatt-hours.
19. It's used to turn something on or off.
25. A fuel burned to make electricity.
29. A light \_\_\_\_\_ shines when electricity passes through it.
37. The short name for television.
42. It's used to increase or decrease the force of the electricity flowing through a wire.
65. We used fine \_\_\_\_\_ to carry electricity from the battery to the light socket in our experiment on p. 9.
69. Lightning is this type of electricity.
80. Water power.

## DOWN

1. The path of electricity from the power source through the wires and back.
8. The opposite of to turn off is to turn \_\_\_\_\_.
12. A unit of electric power.
20. When it's boiled, it makes steam to power a generator.
32. Burning garbage and plants to produce energy.
43. It uses electricity to let you listen to music, news, etc.
48. Another fuel burned to generate electricity.
53. It uses electricity to help us tell time.
57. It's used to measure how much electricity you use.
60. What electricity can produce to help keep us warm.



## BONUS MESSAGE:

After you complete the crossword puzzle, find the box with the number shown below each blank. Fill in the blank with the letter from that box.

41 58 77 9 34 67 12 46 55 27 18  
34 30 38 3 46 05 99 92 57 !

## ANSWERS



1. Talk 2. Boy 3. Thread 4. Tested 5. Motion 6. Iron 7. Station 8. Inspiration
- P. 14 TOM EDISON

1. Turn off the lights when the room is empty  
2. Turn off the TV when nobody is watching  
3. Don't leave the refrigerator door open  
4. Dry your hair with a towel  
5. Wash dishes by hand  
6. Read by sunlight  
7. Turn off the lights when the room is empty  
8. Turn off the TV when nobody is watching  
9. Don't leave the refrigerator door open  
10. Dry your hair with a towel  
11. Wash dishes by hand  
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74. Turn off the TV when nobody is watching  
75. Don't leave the refrigerator door open  
76. Dry your hair with a towel  
77. Wash dishes by hand  
78. Read by sunlight  
79. Turn off the lights when the room is empty  
80. Turn off the TV when nobody is watching

1. Light, Heat  
2. Computers  
3. Doctors, Machines  
4. Telephones  
5. Radio, Stereo, TV  
6. Job, Workers  
7. Farming  
8. Radio, Stereo, TV  
9. Job, Workers  
10. Computers  
11. Doctors, Machines  
12. Telephones  
13. Light, Heat  
14. Computers  
15. Doctors, Machines  
16. Telephones  
17. Light, Heat  
18. Computers  
19. Doctors, Machines  
20. Telephones  
21. Light, Heat  
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49. Light, Heat  
50. Computers  
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53. Light, Heat  
54. Computers  
55. Doctors, Machines  
56. Telephones  
57. Light, Heat  
58. Computers  
59. Doctors, Machines  
60. Telephones  
61. Light, Heat  
62. Computers  
63. Doctors, Machines  
64. Telephones  
65. Light, Heat  
66. Computers  
67. Doctors, Machines  
68. Telephones  
69. Light, Heat  
70. Computers  
71. Doctors, Machines  
72. Telephones  
73. Light, Heat  
74. Computers  
75. Doctors, Machines  
76. Telephones  
77. Light, Heat  
78. Computers  
79. Doctors, Machines  
80. Telephones



Soo---

# **ELECTRICITY PLAYS AN IMPORTANT ROLE IN OUR LIVES TODAY!**



- ✓ **LEARN** all you can about electricity.
- ✓ **UNDERSTAND** how it's made and used.
- ✓ **USE** it wisely.