What's the Big Idea?

You will learn:

- how circuits are used in the home.
- how electricity is measured.

Lesson 2

How Is Electricity Used in the Home?

You're late! **A storm has knocked out the power. Your alarm clock didn't go off, the bathroom's dark, and the toaster's not working. You'll miss electricity because you use it all over your home in important ways.**

Circuits in the Home

Throughout your home, wires in the walls and ceilings form circuits. Electricity flows through these circuits to your alarm clock, toaster, refrigerator, TV, and other electric devices.

You recall that a circuit always leads back to where it started. Imagine the path you would take if you followed an entire circuit. You begin at the power plant, move through a variety of wires and equipment, and finally arrive at your home. The circuit enters your home at your circuit box and continues through a wire to your toaster. Inside your toaster, you follow the circuit through a special wire that heats up and toasts your bread. Then the circuit leaves the toaster, moves through a return wire to the circuit box, exits your home, and continues back to the power plant. Every time you use a plug-in device, you use a very long circuit!

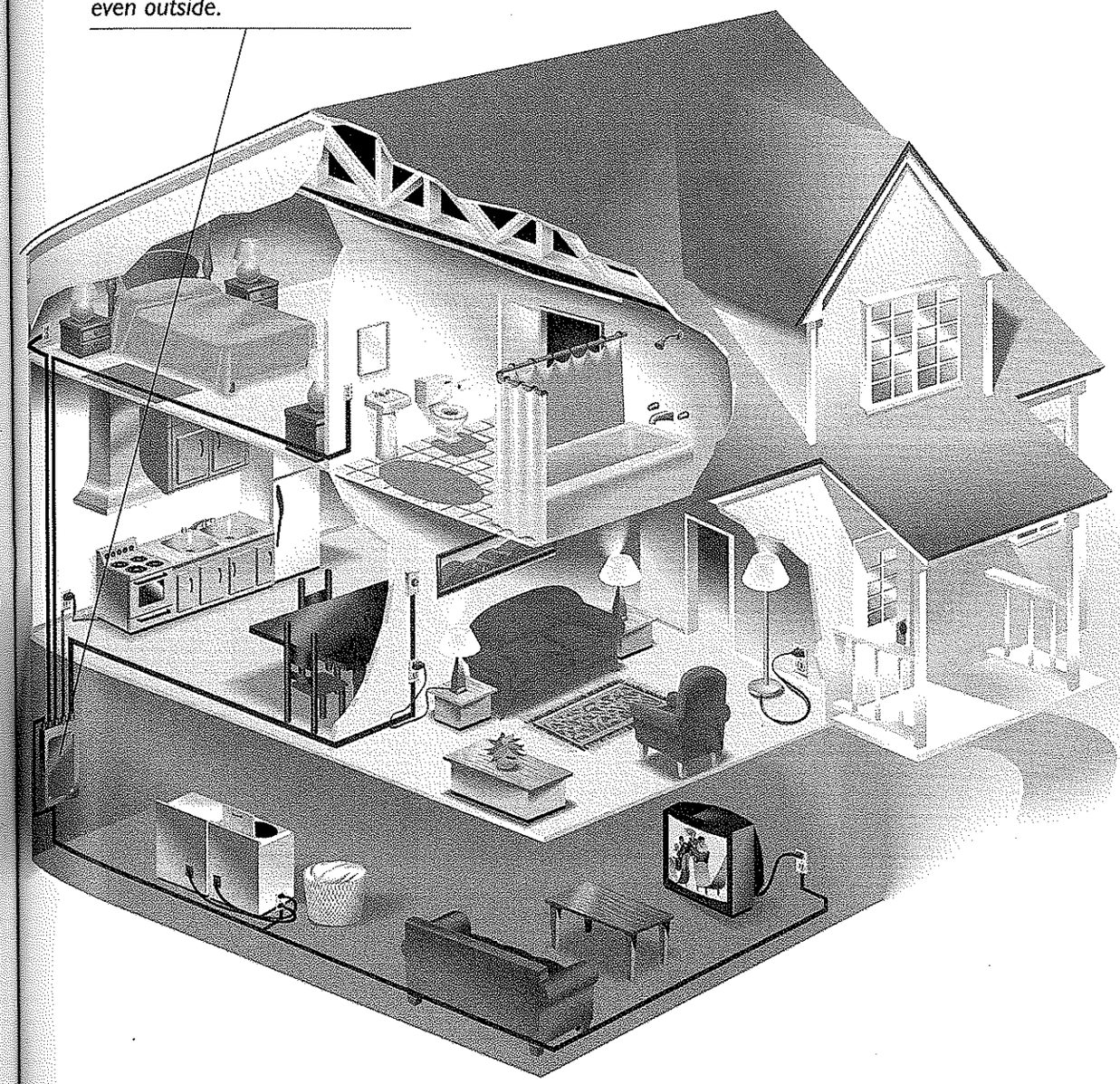
Your home has many circuits. Find the five circuits shown on the next page. Notice that they all pass through the circuit box on their way to and from the power plant. Because of this, electricians usually say that a circuit in the home begins and ends at the circuit box.

Circuit Box

Electricity from a power plant enters your circuit box and provides electricity to each circuit. All circuits pass through your circuit box. Where in your home is your circuit box? Sometimes it is in a kitchen, a basement, a garage, or even outside.

Follow a Circuit

The picture shows some of the circuits in this home. Begin at the circuit box and follow each circuit shown. Each colored path contains a wire to bring electricity to the device and one to bring it back to the circuit box. ▼



Glossary

switch, the part of a circuit that closes the circuit and allows electricity to flow or opens the circuit and prevents the flow of electricity

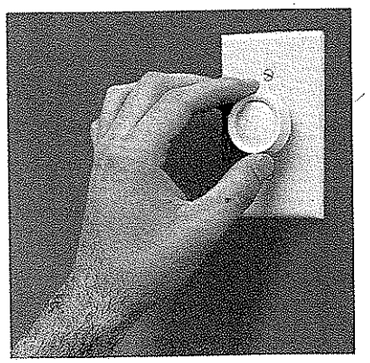
The circuits in your home are useful because you can control them. Imagine if your TV was always on full blast and your bedroom light shone all the time.

You use a **switch,** a part of a circuit, to control the flow of electricity. You flip a switch and your radio plays. The circuit in your radio is complex, but one part is simple. One wire has a gap in it. Electricity cannot move past this gap. When you move the switch, you close the gap and your radio plays. A switch opens or closes a gap in a circuit.

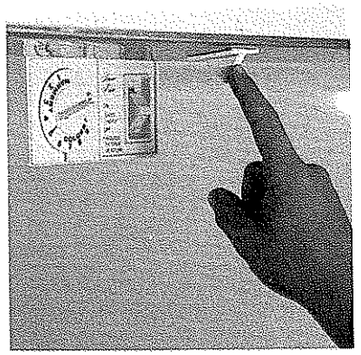
In your home, you may use a dimmer switch to dim the lights. Your dimmer switch does more than a regular switch. It lets you control how much electricity moves through the circuit. This way, you can control a light's brightness.

You may control other circuits around your home with switches you don't even notice. Open your refrigerator, and the light inside comes on. Your family may use a thermostat to keep your home comfortable. Study the switches shown on this page to learn what each does.

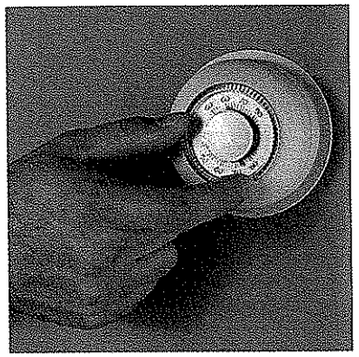
▲ *When you turn the volume knob on this radio, you complete a circuit and the radio plays.*



▲ *When you turn a dimmer switch like this one, you change a lamp's brightness.*



▲ *Look around where your refrigerator door touches when it's closed, and you'll probably find a switch that looks like a lever or a button. Push it and the light will go off. When you shut the door, the door pushes the switch and turns off the light.*



▲ *Your family may use a thermostat, a switch with a built-in thermometer. The switch turns on the heat when your home gets too cold. Some families also use a thermostat to control air conditioning.*

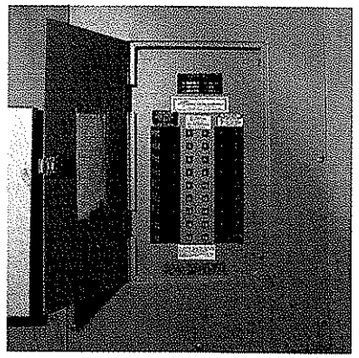
Special switches in your home protect you and your family. If too much electricity flows through a circuit, the wires could get hot and cause a fire. To help prevent this, a circuit box has protective switches called circuit breakers. When too much electricity flows, a circuit breaker automatically flips to the off position. It leaves a gap in the circuit that stops electricity from flowing and helps prevent fires. An adult can close this gap and start electricity flowing again by flipping the circuit breaker to the on position.

Perhaps you live in an older home that uses fuses rather than circuit breakers. Fuses also make a break in a circuit. If too much electricity flows in a circuit, a special wire inside the fuse melts. This leaves a gap in the circuit. A fuse cannot be turned back on. An adult must replace it with a new fuse.

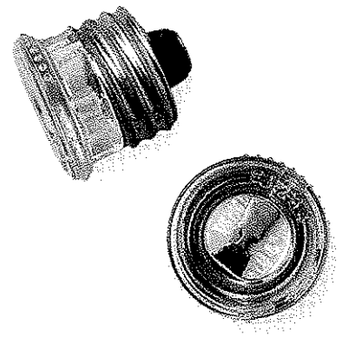
Do you have an outlet with two small buttons in your bathroom or near the sink in your kitchen? You may use one of these **GFCI outlets** (ground fault circuit interrupter outlets) every day without being aware of how it protects you. Except for those two small buttons, GFCI outlets look like regular outlets. They help prevent shocks by instantly switching off the outlet in certain situations. Hair dryers sold today have built-in GFCI plugs that work the same way.

Glossary

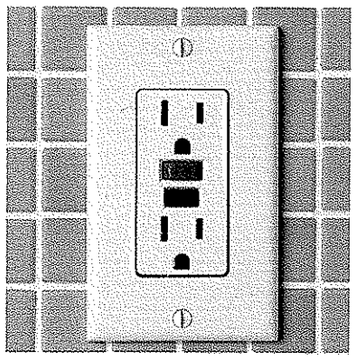
GFCI outlet, a special outlet with a safety switch that instantly switches off in some dangerous situations to help prevent a shock



▲ *This circuit box holds circuit breakers. Circuit breakers switch off when too much current flows through a circuit.*



▲ *If too much current flows through the special wire in a fuse, the wire melts. This leaves a gap that stops the flow of electricity.*



▲ *GFCI outlets help prevent shocks by instantly switching off in some dangerous situations.*

Glossary

Glossary

volt (vōlt), a unit used to measure how strongly the electrons in a wire are pushed

Measuring Electricity

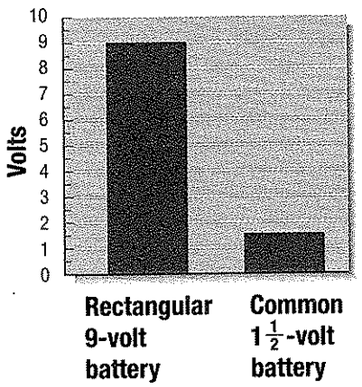
If it would fit, why couldn't you use a rectangular battery in your flashlight instead of the round kind? How is the electric current used by your toaster different from the current used by an electric stove? Which uses electrical energy more quickly—your toaster or a computer? To answer these questions and to really understand electricity, you need to know how it is measured.

Volts measure how strongly the electrons in a wire are pushed. The graph shows that a rectangular 9-volt battery pushes electricity through a wire 6 times harder than a round $1\frac{1}{2}$-volt battery. Compare the batteries used in the electric devices below. Using a battery with the wrong number of volts could damage an electric device.

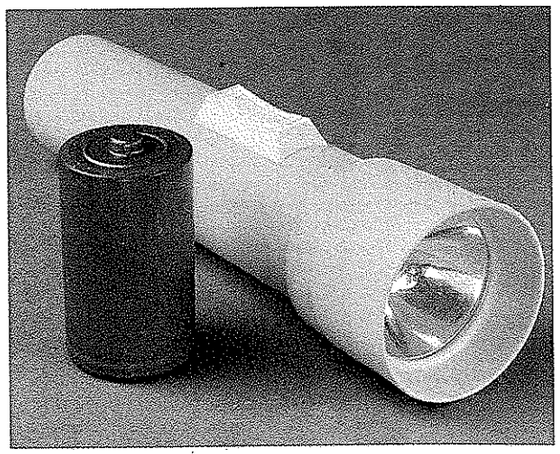
Electric stoves and a few other devices use 220-volt electric current. Your toaster and everything else in your home that plugs in uses 110-volt electric current. For safety, 220-volt devices use special outlets and plugs that won't work with regular 110-volt ones.

The electric company makes sure the electric current it sends to your home stays at the right number of volts. This protects you and your electric equipment.

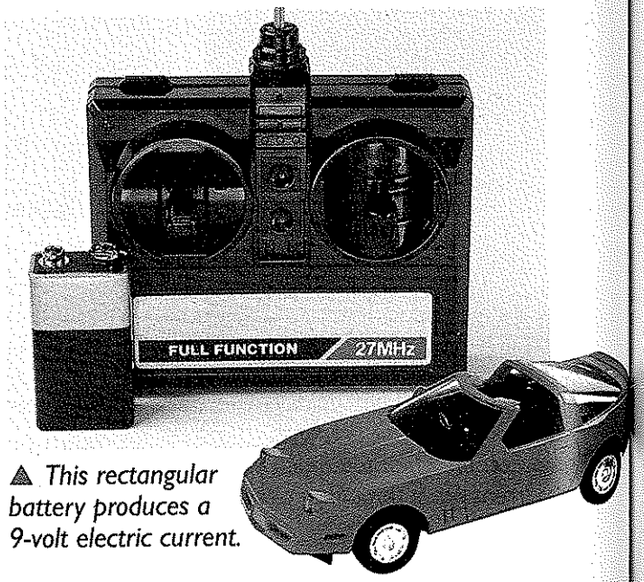
Comparison of Two Batteries



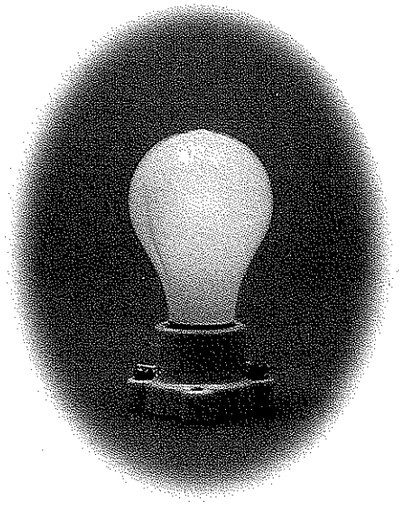
▲ *A 9-volt battery pushes electricity through a wire 6 times harder than a $1\frac{1}{2}$-volt battery ($6 \times 1\frac{1}{2}$ volts = 9 volts).*



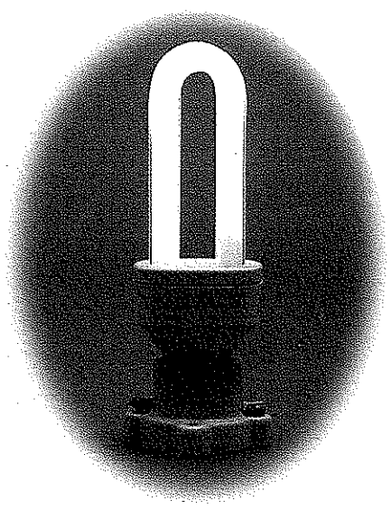
▲ *Common batteries with this shape produce a $1\frac{1}{2}$-volt electric current.*



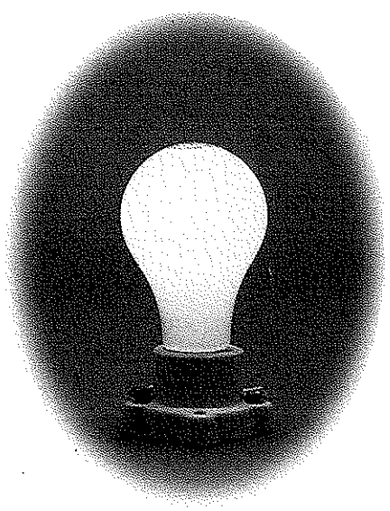
▲ *This rectangular battery produces a 9-volt electric current.*



25-watt traditional bulb



25-watt energy-saving bulb



100-watt traditional bulb

The electric company also measures the electricity you use. How fast you use electrical energy is measured using a unit called a **watt.** A 1,000-watt toaster uses electrical energy ten times as fast as a 100-watt TV. The 100-watt light bulb above uses electrical energy four times as fast as the 25-watt bulbs. Notice below that the 25-watt energy-saving bulb shines as brightly as the 100-watt traditional bulb.

Because the electric company measures how fast your whole family uses electrical energy, it needs a bigger unit, the **kilowatt.** A kilowatt is 1,000 watts. This is how fast ten 100-watt light bulbs use electricity (10×100 watts = 1,000 watts = 1 kilowatt). In the United States, a typical home is using a little more than 1 kilowatt at any moment.

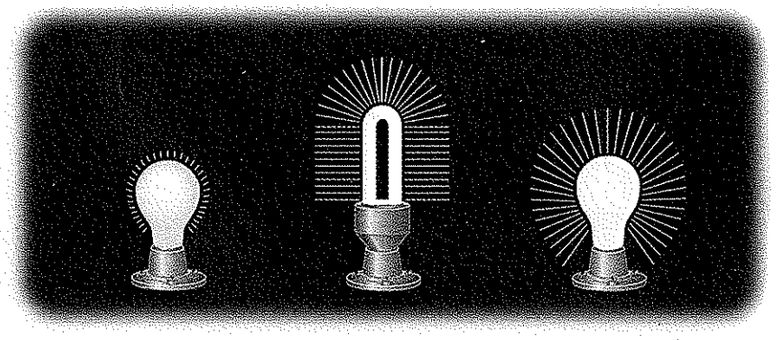
▲ *Perhaps you use one of the newer, energy-saving light bulbs. They use electrical energy more slowly (fewer watts) but shine as brightly as traditional light bulbs.*

Glossary

watt (wot), a unit used to measure how fast electrical energy is used

kilowatt (kil′ə wot′), 1,000 watts

Glossary



▲ *The 25-watt energy-saving bulb in the center shines as brightly as the 100-watt traditional bulb on the right but uses electrical energy only one-fourth as fast.*

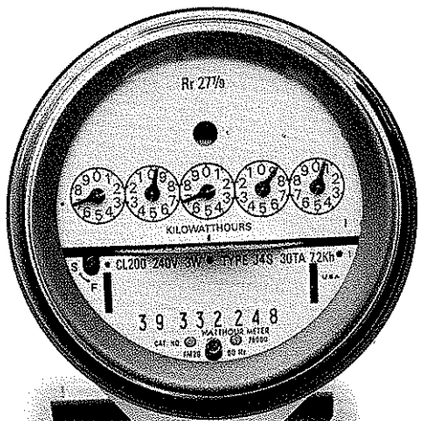
Glossary

kilowatt-hour, a unit used to measure the amount of electrical energy

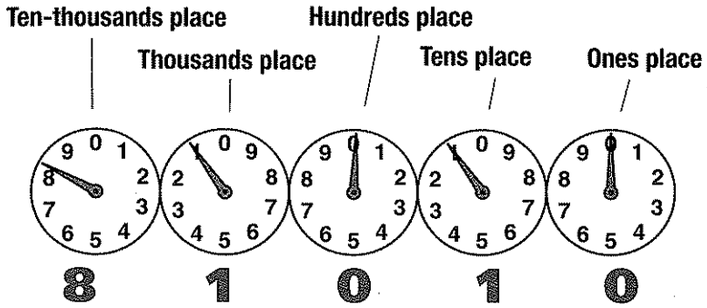
To measure the total amount of electrical energy you use, you need to take into account not just how fast you use electrical energy, but how long you use it. If left on for a long time, an energy-saving light bulb will use more energy than a traditional one left on for a short time.

Electric companies measure the amount of electrical energy you use in **kilowatt-hours**. If you measure the amount of electrical energy a 1-kilowatt heater uses in 2 hours, you will discover that it uses 2 kilowatt-hours (1 kilowatt × 2 hours = 2 kilowatt-hours). The electric company uses kilowatt-hours to figure out the electric bill for your home. In the United States, a typical home uses about 825 kilowatt-hours of electrical energy each month.

This electrical meter measures the amount of electrical energy in units called kilowatt-hours. ▼



The number of kilowatt-hours you use in your home is probably measured by an electric meter like the one shown on the previous page. You might have one like the one shown at the bottom right of this page. Most meters have five dials arranged by place value. The "ones" place is on the right and the "tens" place is to the left of it. The "hundreds" place is next, and so on. To read these meters, you look at the pointer on each dial and write down the numbers. Try this using the following example. Hint: When a pointer is between two numbers, use the lower number.

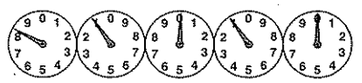


▲ *This meter reads 81,010 kilowatt-hours.*

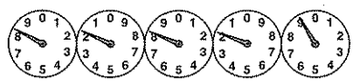
To figure out how much electricity your family uses in a month, compare two readings taken one month apart and then subtract. The difference tells you how much electricity you used in one month. In the example at the top right of this page, how much electricity did the family use from November 10 to December 10? In the next lesson, you will learn how the electric company produces the electricity your family uses.

Lesson 2 Review

1. What do the electric circuits in your home do?
2. How do watts differ from kilowatts?
3. **Scales and Bar Graphs**
   How could you change the scale on the bar graph on page B124 to show a 12-volt car battery?



▲ *On November 10 this meter showed 81,010.*



▲ *On December 10 this meter showed 81,819.*

To compute how many kilowatt-hours of electricity this family used from November 10 to December 10, subtract the first reading from the second reading. ▼

December 10 reading	81,819
November 10 reading	− 81,010
Kilowatt-hours of electricity used	809

Some newer electric meters have a digital display that makes reading a meter easier. ▼