LEARN ABOUT

Electric Currents

FIND OUT

- how electric charges can move
- ways different materials control electric current
- differences between series and parallel circuits

VOCABULARY

electric current
circuit
electric cell
conductor
insulator
resistor
series circuit
parallel circuit

Moving Charges

You know that a static charge stays on an object. But even a static charge will move if it has a path to follow. The snap and crackle of a static electric shock are the result of a moving charge.

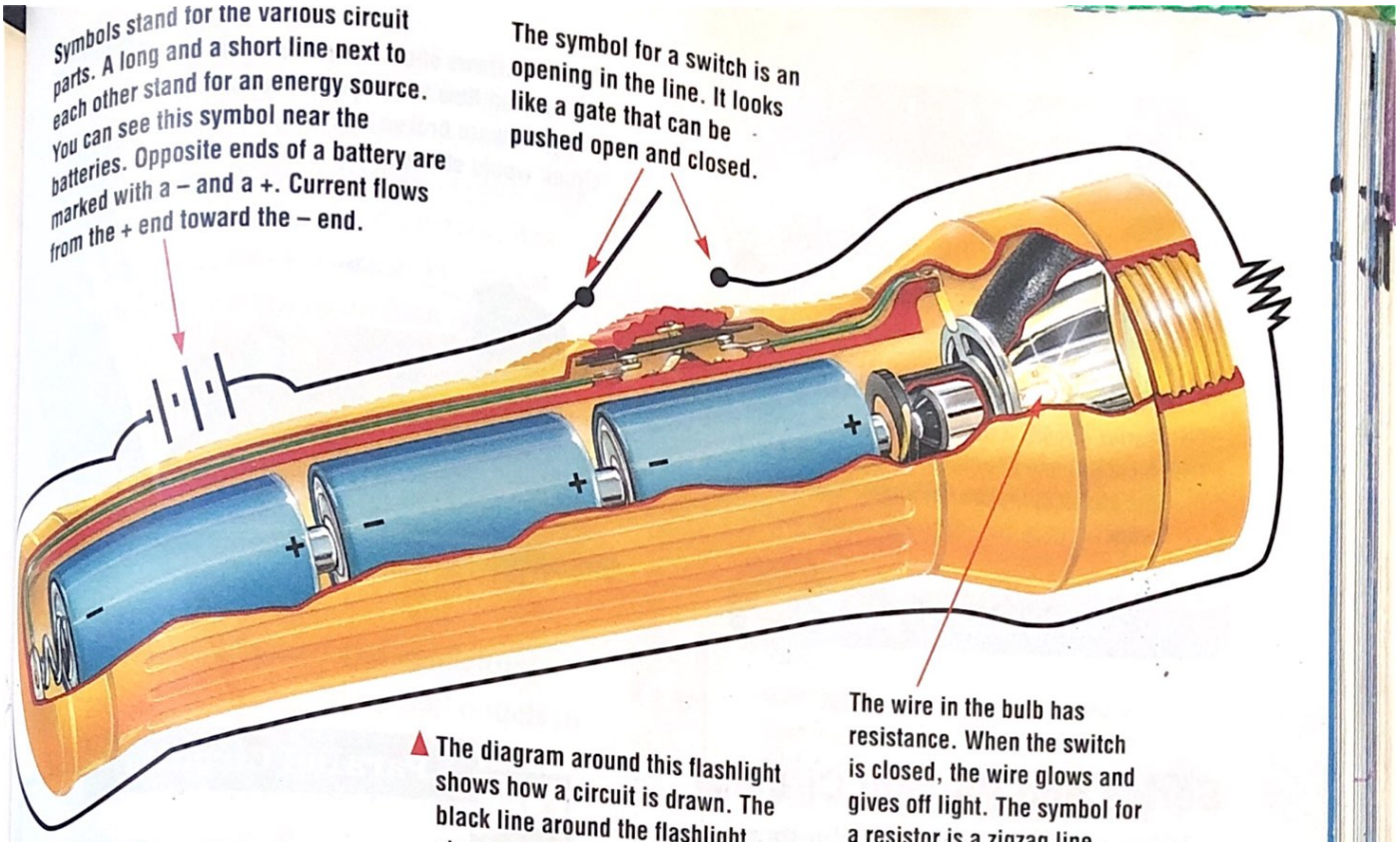
Have you ever gotten a small electric shock from touching a doorknob? Here's how it happens. Walking on a carpet rubs negative charges off the carpet and onto your feet. The charges spread out on your body. Your whole body becomes negatively charged. When you touch the doorknob, all the extra negative charges move at once from your hand to the doorknob. You get a small "zap." The static, or unmoving charge, has become a *current*, or moving charge. A flow of electric charges is called an **electric current**.

In the investigation you arranged a wire, a bulb, and a battery to make a path in which negative charges could flow. A path that is made for an electric current is called a **circuit** (SER•kit). The battery was an important part of the circuit you made. A battery is an **electric cell**, which supplies energy to move charges through a circuit.

✓ **What does an electric current need in order to flow?**

◀ An electric current in a circuit moves like a bike wheel. When you pedal, you give energy of motion to the whole wheel at once. When you connect a circuit, a battery moves energy to all parts of the circuit at the same time.

◀ Use your finger to trace the path of the current through each part of the circuit. What do you notice?



▲ The diagram around this flashlight shows how a circuit is drawn. The black line around the flashlight stands for the conductor that connects all the circuit parts.

Controlling Current

A circuit with a battery, bulb, and wires contains different materials such as copper and plastic. You can classify these materials by the way they control the flow of charges through them.

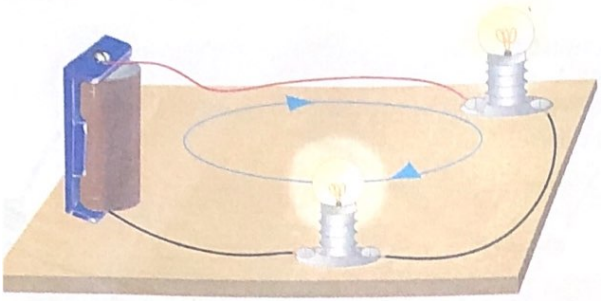
A **conductor** is a material that current can pass through easily. Most metals are good conductors of electric current. Electric wires are made of metal, often copper. The base of a light bulb is made of metal because it must conduct an electric current.

A material that current cannot pass through easily is called an **insulator** (IN•suh•layt•er). The black band between the metal tip and the screw-in part of a light bulb is an insulator. A plastic covering insulated the wire you used in the investigation. Plastic keeps the metal of the wire from touching other metal.

A flashlight has a switch to turn it on and off. A *switch* uses conductors and insulators to make and break a circuit. When the switch is on, two conductors touch. When they touch, the path is complete. Current flows through the circuit. When the switch is off, air separates the two conductors, breaking the path. No current can flow.

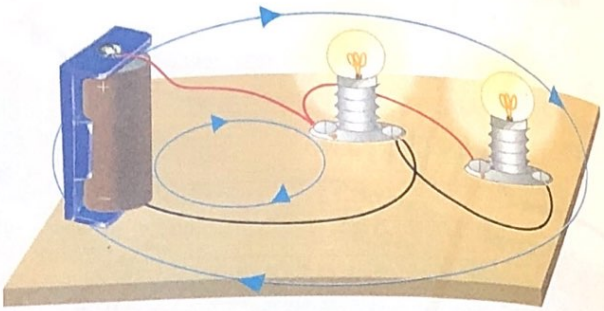
Some materials cut down, or resist, the flow of charges. A material that resists but doesn't stop the flow of current is called a **resistor** (rih•ZIS•ter). A flashlight bulb contains a tiny coil of metal. The coil is a resistor. As charges move through the resistor, they transfer thermal energy to it. The metal becomes hot. The glowing coil transfers some of its thermal energy to the air as radiation. It gives off light.

✓ **What does a switch do in a circuit?**



▲ The arrow shows how current flows in a series circuit. It flows through each circuit element, one after the other, or in *series*. If the circuit is broken anywhere, it will not work.

The two arrows show two paths where current can flow in this parallel circuit. If one path were broken, the other part of the circuit would still work. ▼



Series and Parallel Circuits

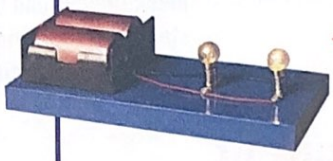
When you turn on a flashlight, there is one path for the current to follow through the circuit. A circuit that has only one path for the current is called a **series circuit**. The pictures below show a series circuit. Note that the current runs from the battery to one bulb, then to the next bulb, and then back to the battery. What happens if you remove one bulb or a bulb burns out? The single path is broken. No current moves through the circuit. The second bulb will go out.

Series Circuits

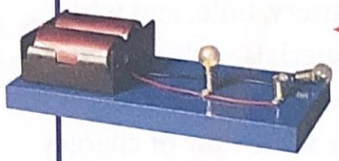
◀ There is one path for the current in a series circuit.

◀ If one bulb is removed, the path is broken. No bulbs on the circuit will light.

Parallel Circuits



◀ There is more than one path for the current in a parallel circuit.



◀ If one bulb is removed, one path is closed. But the other path is still open. The second bulb still lights.

A **parallel** (PAIR•uh•lel) **circuit** has more than one path for current to travel. With your finger, trace the path of the current in the parallel circuit shown above. Part of the current moves through each path of the circuit. What happens when a bulb is removed from this circuit? The current still moves through the other path. The second bulb stays lit. If one bulb in a parallel circuit burns out, the other bulbs will stay on.

✓ **Which type of circuit has more than one path for current?**

Summary

Electric current is a flow of charges through a path called a circuit. A material in a circuit can be classified as a conductor, an insulator, or a resistor. If a circuit has one path for current, it is a series circuit. A parallel circuit has more than one path for current.

Review

1. What is an electric current?
2. Describe what has to be in place for a circuit to work.
3. Contrast conductors and insulators.
4. **Critical Thinking** Most wall outlets in your home have places for two plugs. Infer which type of circuit an outlet is part of. How do you know?
5. **Test Prep** What supplies energy in an electric circuit?
   - A conductors
   - B electric cells
   - C resistors
   - D switches

LINKS

MATH LINK

Current Costs Electric energy is measured in a unit called a kilowatt-hour, or kWh. Suppose a utility company charges 10 cents for each kWh of energy. A family uses 900 kWh of energy a month. How much does the energy cost?

WRITING LINK

Informative Writing—Compare and Contrast Write a paragraph for a younger student explaining why it would be easier to decorate a home with strings of lights in a parallel circuit instead of strings of lights in a series circuit.

SOCIAL STUDIES LINK

Inventing the Light Bulb The invention of the first practical electric light bulb is a good example of not giving up. Research the story of the light bulb's invention. When was it invented? Who invented it? How many materials were tried and set aside before a light bulb that worked well was made?

TECHNOLOGY LINK

Learn more about controlling large circuits by viewing *L.A. Traffic Control* on the **Harcourt Science Newsroom Video** in your classroom video library.