Electrical Safety

Reading Preview

Key Concepts

- What measures help protect people from electrical shocks and short circuits?

Key Terms

- short circuit
- grounded
- third prong
- fuse
- circuit breaker

Target Reading Skill

Using Prior Knowledge Before you read, write what you know about electrical safety in a graphic organizer like the one below. As you read, write what you learn.

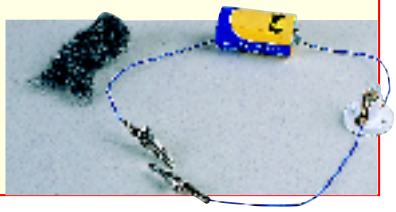
What You Know
1. An electric shock can be dangerous. 2.

What You Learned
1. 2.

Lab zone Discover Activity

How Can You Blow a Fuse?

1. Begin by constructing the circuit shown using a D-cell, a light bulb, and two alligator clips.
2. Pull a steel fiber out of a piece of steel wool. Wrap the ends of the steel fiber around the alligator clips.
3. Complete the circuit and observe the steel fiber and the bulb.



Think It Over

Developing Hypotheses

Write a hypothesis to explain your observations.

The ice storm has ended, but it has left a great deal of destruction in its wake. Trees have been stripped of their branches, and a thick coating of ice covers the countryside. Perhaps the greatest danger is from the downed high-voltage electric wires. Residents are being warned to stay far away from them. What makes these high-voltage wires so dangerous?

Personal Safety

You may have noticed high-voltage wires hanging from poles beside the highway. These wires form a circuit to and from the electric plant. The wires carry electric current from the electric plant to the customer. If these wires are damaged, they can cause serious injury. Potential dangers include short circuits, electric shocks, and ungrounded wires.

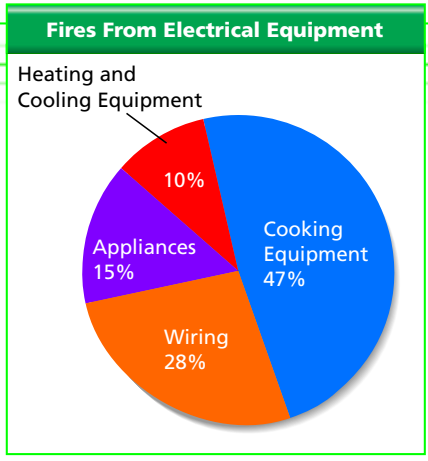
Short Circuits If someone touches a downed electric wire, the person's body can form a short circuit between the wire and the ground. A short circuit can also occur in your home if you touch frayed wires. A **short circuit** is a connection that allows current to take the path of least resistance. For example, the electric charge can flow through the person rather than through the wire to the power plant. The unintended path usually has less resistance than the intended path. Therefore, the current can be very high. The shock that the person receives may be fatal.

Math Analyzing Data

Electrical Equipment and Fires

If electrical equipment is not properly used and maintained, it can cause fires. The circle graph shows the percentage of fires caused by different types of electrical equipment.

1. **Reading Graphs** What determines the size of each wedge in the graph?
2. **Reading Graphs** What percentage of fires are caused by appliances?
3. **Interpreting Data** Which category of equipment is responsible for most fires? Which category is responsible for the fewest fires?



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Electric Shocks Electrical signals in the human body control breathing, heartbeat, and muscle movement. If your body receives an electric current from an outside source, it can result in a shock that interferes with your body's electrical signals.

The shock you feel from static discharge after walking across a carpet is very different from the shock that could come from touching a fallen high-voltage wire. The severity of an electric shock depends on the current. A current of less than 0.01 A is almost unnoticeable. But a current greater than 0.2 A can be dangerous, causing burns or even stopping your heart.

Grounding Earth plays an important role in electrical safety. **One way to protect people from electric shock and other electrical danger is to provide an alternate path for electric current.** Most buildings have a wire that connects all the electric circuits to the ground, or Earth. A circuit is electrically **grounded** when charges are able to flow directly from the circuit into Earth in the event of a short circuit.

One method of grounding is to use a third prong on a plug. Two flat prongs of a plug connect an appliance to the household circuit. The **third prong,** which is round, connects any metal pieces of the appliance to the ground wire of the building. If a short circuit occurs in the appliance, the electric charge will flow directly into Earth. Any person who touches the device will be protected.

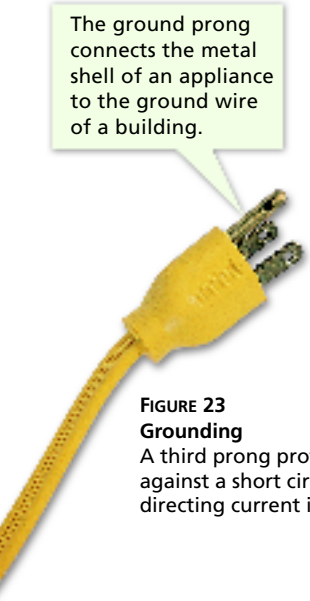


FIGURE 23
Grounding
A third prong protects against a short circuit by directing current into Earth.

Reading Checkpoint **What is the function of a third prong?**

Breaking a Circuit

If you use too many appliances at once, a circuit's current can become dangerously high and heat the wires that carry it. Overloading a circuit can result in a fire. **In order to prevent circuits from overheating, devices called fuses and circuit breakers are added to circuits.**

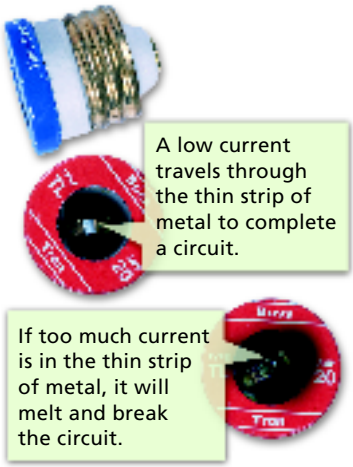
A **fuse** is a device that contains a thin strip of metal that will melt if there is too much current through it. When the strip of metal "blows," or melts, it breaks the circuit. The breaking of the circuit stops the current. Fuses are commonly found in cars and older buildings. Figure 24 shows how a fuse works.

A disadvantage of using a fuse is that once it burns out, it must be replaced. To avoid the task of replacing fuses, circuits in new buildings are protected by devices called circuit breakers. A **circuit breaker** is a reusable safety switch that breaks the circuit when the current gets too high. In some circuit breakers, a high current causes a small metal band to heat up. As the band heats up it bends away from wires in the circuit, disrupting the current.

It's easy to reset the circuit breaker. By pulling the switch back, you reconnect the metal band to the wires. However, the appliances that are causing the high current in the circuit need to be turned off first.

Reading Checkpoint **What is the difference between a fuse and a circuit breaker?**

FIGURE 24
A Fuse
When a circuit becomes overloaded, a fuse stops the current. **Interpreting Diagrams** *How does a fuse work?*



Section 6 Assessment

Target Reading Skill **Using Prior Knowledge** Review your graphic organizer about electrical safety and revise it based on what you have just learned in the section.

Reviewing Key Concepts

1. **a. Defining** What are grounded electric circuits? What are fuses and circuit breakers?
   b. Explaining Explain how grounding, fuses, and circuit breakers protect people from electrical shocks and short circuits.
   c. Predicting Without a fuse or circuit breaker, what might happen in a house with an overloaded electric circuit? Explain your answer.

Lab zone **At-Home Activity**

Checking Circuits Along with members of your family, find out whether the circuits in your home are protected by fuses or circuit breakers. **CAUTION:** *Be careful not to touch the wiring during your inspection.* How many circuits are there in your home? Make a diagram showing the outlets and appliances on each circuit. Explain the role of fuses and circuit breakers. Ask your family members if they are aware of these devices in other circuits, such as in a car.