The SHOCKING Truth

About Electrical Safety

FORTIS ALBERTA

We Use Electricity Every Day...

...without knowing much about it!

Many of our daily activities require electricity. Without it, our lives would come to a standstill. Think of all the ways you use electricity at home and at school, and list them on a piece of paper.

Electricity is a form of energy that results from the flow of electrons moving from atom to atom through a wire. It is typically produced at power plants where various energy sources are used to turn turbines. The turbines turn electromagnets surrounded by heavy coils of copper wire, and the moving magnets cause the electrons in the wire to move, generating electricity.

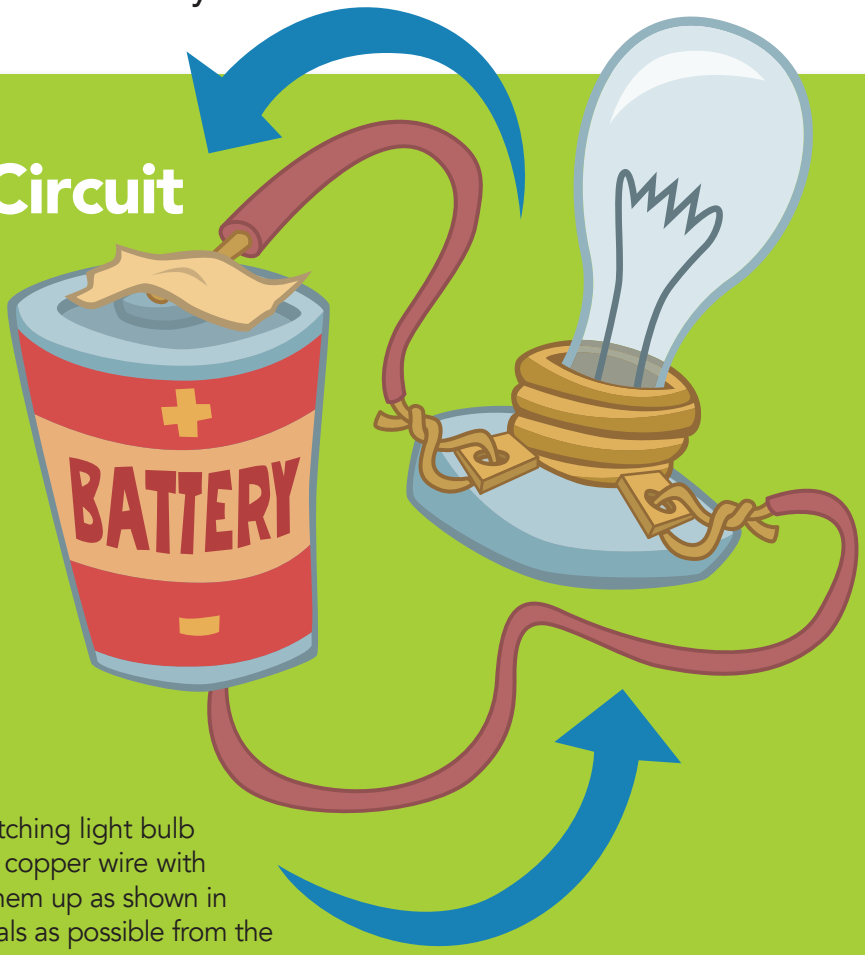
Electricity travels in a path called a circuit. Your house is part of a circuit that begins at a power plant. Electricity travels through a grid of wires to the utility pole or underground lines outside your home. From the pole it travels to your home and through the inside wires—to the lights, wall switches, and outlets.

When you switch on an electrical device—such as a desktop computer, TV, or microwave, or plug in a laptop, cell phone, or portable video game system to charge it—**you complete the circuit**. Electricity flows through the power cord to the device, then back through the cord to the outlet and out to the wires and into the grid again.

Electricity Flows Easily Through Conductors...But Not Through Insulators!

- A conductor is a material that electricity can flow through easily.
- An insulator is a material that electricity cannot flow through easily.
- Just as a pot holder insulates you from heat, electrical insulators slow down or resist the flow of electricity.

Make Your Own Circuit



1. **Make your prediction.** From the following list, circle one item that you think will conduct electricity well. Underline one item that you think will be a good insulator (will not conduct electricity). Then put a rectangle around one item you're not sure about.

aluminum foil	glass
metal paper clip	plastic lid
wooden toothpick	tin can lid
paper	eraser
leather	dry dirt
penny	rubber band

2. **Materials.** Get a 1.2-volt light bulb, a matching light bulb base, a D-cell battery, and two pieces of copper wire with the insulation stripped off the ends. Set them up as shown in the picture. Gather as many of the materials as possible from the list of 12 items above.
3. **Test the materials.** Under adult supervision, place each item between the battery and one of the wires, and tape it there. Use a separate sheet of paper to record what happens in each trial.
4. **Draw your setup and write the results on the page.** Post your results where everyone can see.
5. **Compare your results with your original prediction.** Then compare with other students. Were the results the same? If not, what might have happened to make the results different? Do the items that were good conductors have anything in common? If so, what?

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Electricity Always Takes the Easiest Path to the Ground

Electricity will stay in a circuit unless it can find a path to the ground. If you touch a circuit and the ground (or something that is "grounded") at the same time, you become the easiest path.

Something is considered grounded if it is touching the earth or something touching the earth, like the steps of a ladder or even a roof.

The amount of electric current (measured in amperes or "amps") is what hurts or kills people. The force of the current (measured in volts) and the length of time you are in contact with it determine the way in which you are hurt. Low-voltage current causes muscle spasms that can lock you to a circuit and cause death. High-voltage current often blasts a person clear of the circuit, but the shock or fall can be fatal.

What happens to the body?

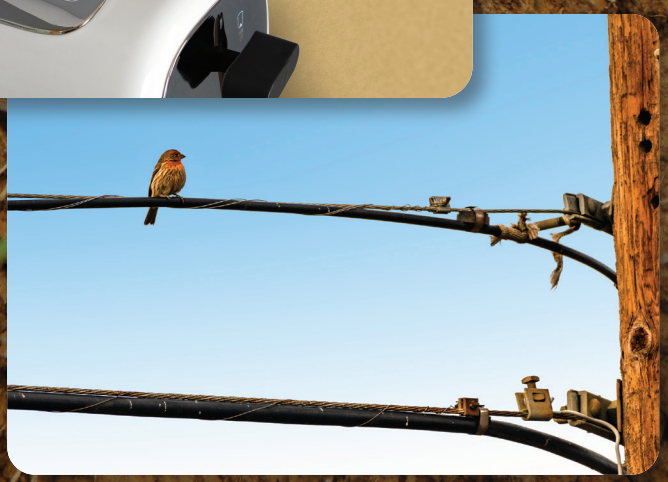
1. **Chest muscles contract.** This causes difficulty breathing and unconsciousness.
2. **The heart cannot pump blood** because it flutters and the veins that enter it are constricted. This happens most often at low voltages.
3. **Burns show at the entrance and exit points** of electric current. These are not like burns from the stove—electricity burns from the inside out. This happens at high voltages.
4. **Muscle spasms make you unable to free yourself** from the current and can cause bone fractures. This happens at low voltages.

TEST YOUR EQ (Electricity Quotient)

1. The path electricity travels is called a _____.
2. The amount of electricity flowing through a conductor is measured in _____.
3. The force with which electricity flows is called _____.
4. The place where electricity is always trying to go is _____.

Electricity, You, and the Ground

If you come between electricity and the ground, you become the easiest path. Work with a partner to explore what you know about where you might find dangerous situations with electricity.



ANSWER THESE QUESTIONS

1. You could be shocked or electrocuted by contacting two things. What are they?

   _____

   _____

2. Think about how the person in each picture could become the easiest path to the ground. Share your answers with your partner.

3. Draw the path electricity would take to the ground in each human example.

4. Can you draw the path to the ground through the bird on the wire? Why is this example different from the others?

Electricity, Water, and You

Water is a great conductor. You could become part of electricity's path to the ground if you are touching water that touches electricity.

Electricity would travel through the water and through you to the ground—and you could get hurt.

Even insulators can conduct electricity when they get wet.

Why should you NEVER squirt water at power lines?

CROSS OUT the activities in which you could get hurt by electricity.

Pick one of the activities you crossed out. Create a short radio ad in which you explain why this activity is dangerous, and how to prevent an accident.

Ground Fault Circuit Interrupters

A GFCI monitors the flow of electricity. If there is more electricity going out of a cord than coming back, it means that some electricity is traveling to the ground instead of back through the circuit. The GFCI interrupts power automatically to prevent shock.

RESEARCH PROJECT

Call your local building department or do some Internet research to answer these questions:

1. GFCIs are required in new homes in certain rooms. Which ones?
2. Why do you think they are required in these locations?

Your Body Can Conduct Electricity

You handle electricity safely every day. You know how to switch on the TV, the stereo, and the lights. But if handled carelessly, electricity can be dangerous for two reasons:

1. Electricity is always looking for the easiest path to the ground.
2. It can flow through water, and your body is made mostly of water. Water is a very good conductor of electricity.

SAFETY TIP

Because metal is a conductor, metallic balloons conduct electricity. They can cause outages and fires if they float into electric power lines or equipment. Always keep them indoors, tied to a heavy weight. If you see one caught in a power line or substation, stay away and tell an adult to report it to the local electric utility.

Look at this picture.
Predict what will happen.
Explain why you predict these events.
Discuss your ideas with a partner, with a small group, or as a class.

PREDICTION

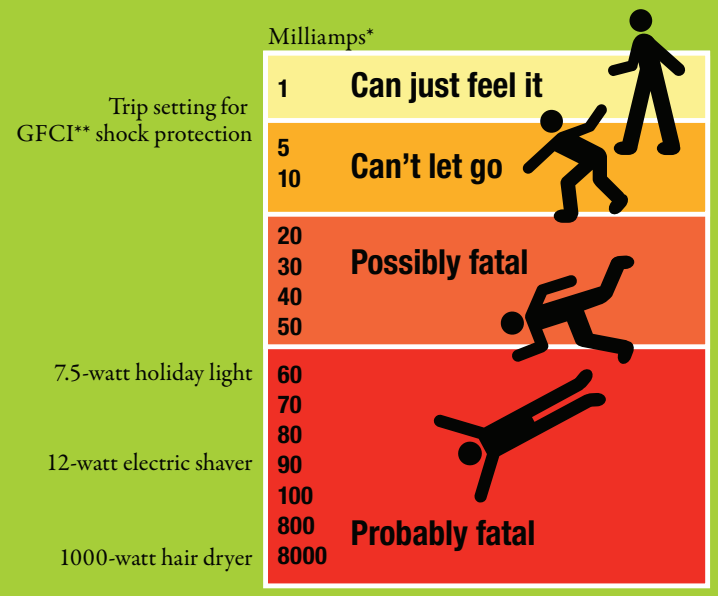
EXPLANATION

Electricity can Shock...Burn... or Kill You!

How much of your body is composed of water?

Electricity flows through water almost as easily as it travels through the wire that brings electricity to your house. Your body is 60-70% water. So if you touch electricity, electricity will flow through you, and you will be badly hurt.

JUST A LITTLE CURRENT CAN KILL



* A milliamp is 1/1000th of an ampere, a measure of electrical current.

** A GFCI is a ground fault circuit interrupter, a device that protects against serious shock.

What's a Watt?

A watt measures the amount of work done by electrical power. It takes more power to run a hair dryer on high (1500 W) than on low (800 W).

ANSWER THESE QUESTIONS

1. Why do you think GFCIs are set to trip (stop the flow of electricity) at 5 milliamps?

_____

2. Use the chart to figure out how many milliamps are used to run a 1000-watt hair dryer.

_____

3. After looking at the chart, what do you think would happen to a person who contacted 1 amp of electricity in their home by accident?

_____

_____

_____

Sometimes the Dangers of Electricity Are Not Obvious

Signs and adults warn you of danger. But sometimes you have to use what you know about electricity, your body, and the ground to figure out what is dangerous.

Match the picture with its description by writing the letter in the white box. Discuss with a partner how you can tell there is possible danger from electricity in each picture. Share your ideas as a class.

A Transmission towers carry high-voltage electricity over long distances.

B Substations lower the voltage for local distribution.

C Service lines to your house may look insulated, but it's usually just weatherproofing.

D Electricity goes to pole-mounted transformers so the voltage can be lowered once more before it goes into your home.

E If distribution wires are underground, electricity goes to a pad-mounted transformer before it enters your house.

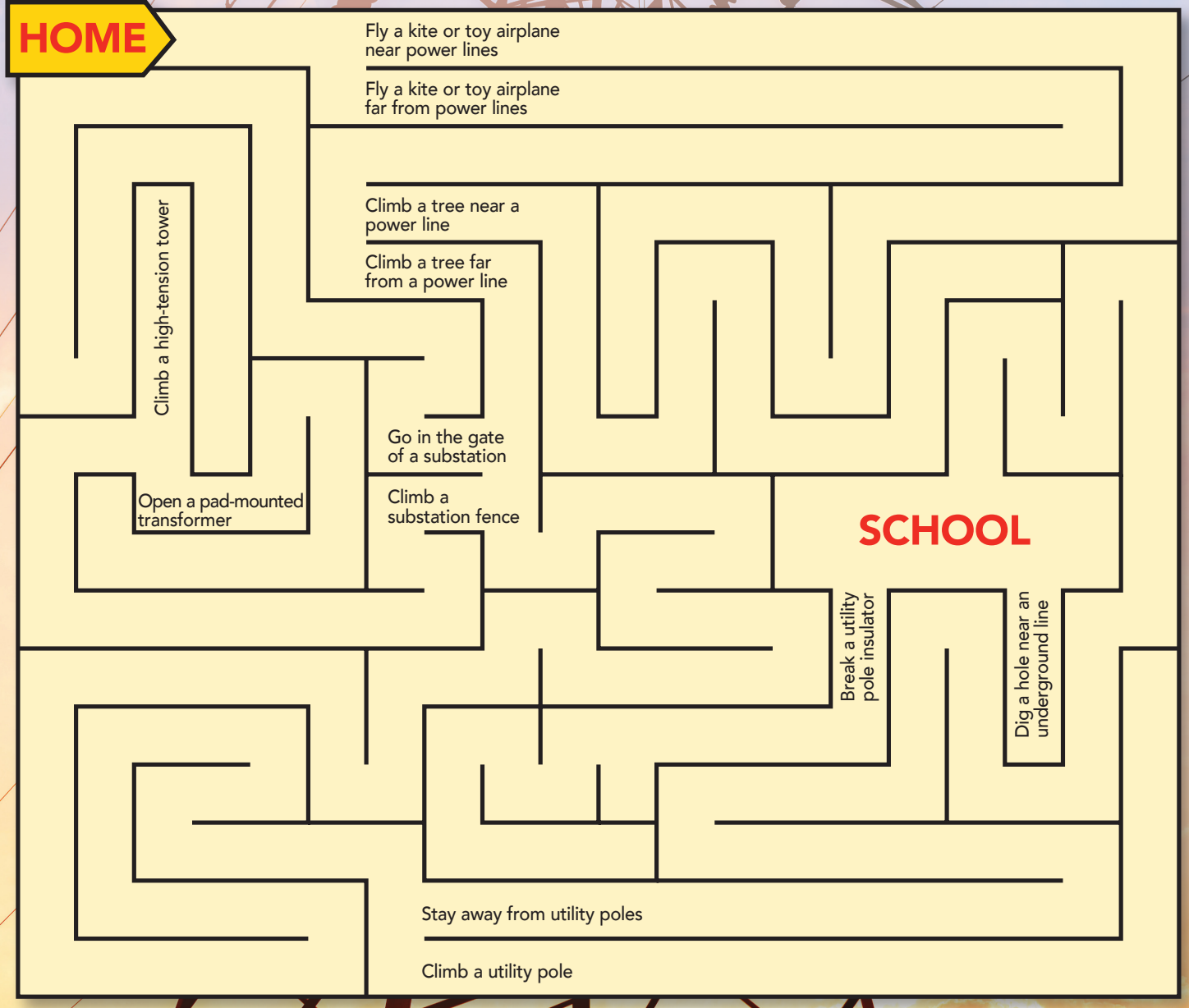
F If you plug too many things into an outlet or power strip, the circuit could overheat and cause a fire.

Light Up the Moon!

If you had a light on the moon connected to a switch in your bedroom, it would take only 1.26 seconds for it to light up, 238,859 miles away.

Stay Away from Electric Lines and Utility Equipment!

Stay out of danger on your way to school by making the right choices in the maze below!



People Who Work with Electricity Use Special Protective Gear

WHAT DO YOU THINK?

Circle the item in each pair that you think electrical workers use. Explain why you think so. The first one is done for you.

Why?

Why?

Why?

What to Do if You See Broken or Downed Wires

Always assume that downed wires are carrying electricity. If you come across a downed wire, here's what to do:

- **If you are in a car with a downed wire on or near it, stay there until rescue and utility workers arrive.** If people come near to see if they can help you, warn them to stay away. Then ask them to call for help. When you are in the car, you are not part of the path to ground. Why? _____

  _____

- **If you must leave because of fire, do not step out of the car.** Instead, jump away from the car and land with both feet together. Do NOT touch the car and the ground at the same time. Shuffle away as far as possible with small steps, keeping your feet close together and on the ground at all times. Why? _____

  _____

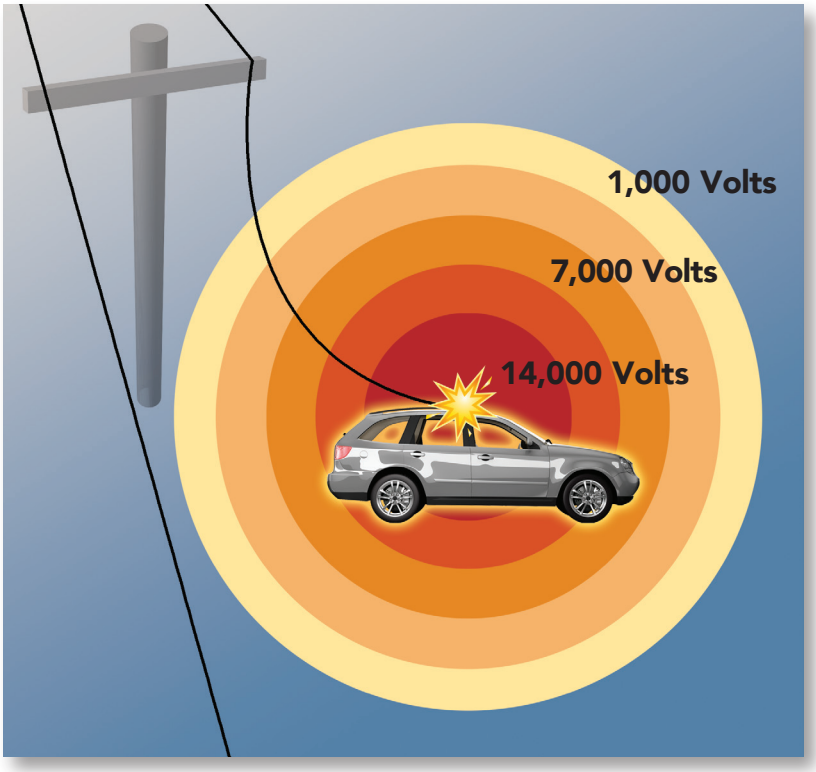
- **Don't try to help someone else from a car with a downed wire on or near it.** Why not? _____

  _____

Once you jump from a car with an electric wire on or near it, is the danger over?

It depends on the situation.

Electricity can spread out through the ground in a circle from any downed line. The voltage drops as you move away from the point of contact. You should shuffle away from the line with your feet close together, because if one foot lands in a higher voltage zone than the other, you will become a conductor for electricity.



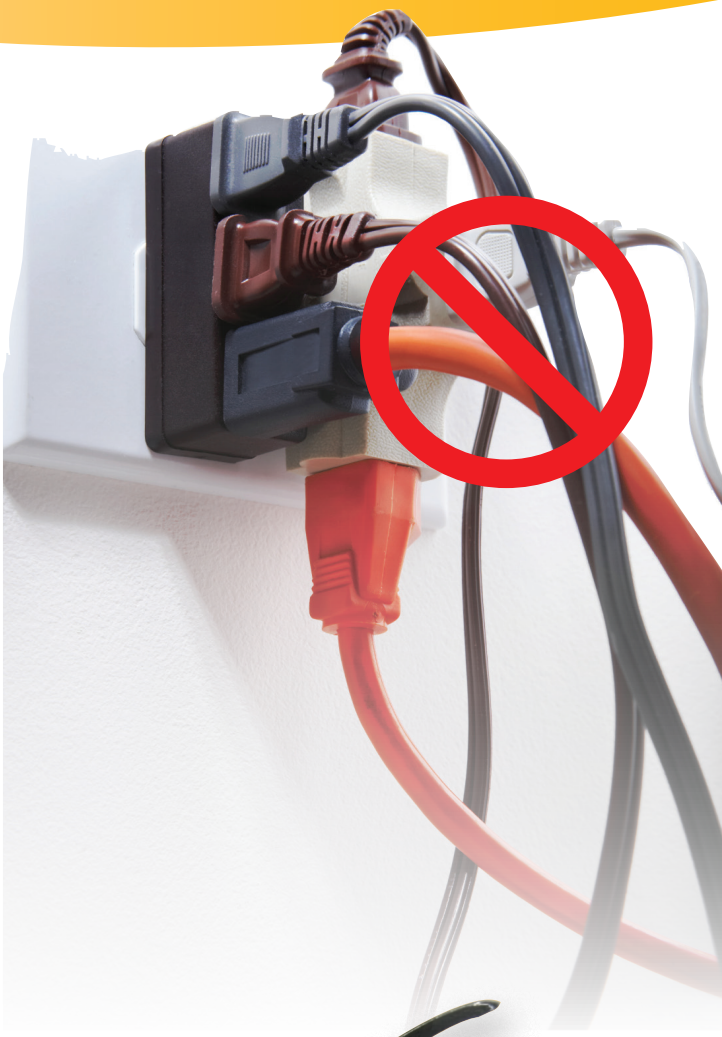
What to Do in an Electrical Fire

Electricity is hot!

It can cause fires in these ways:

- A hot electrical device, such as a light bulb or heater, contacts paper, clothing, or other flammable items.
- The insulation on an overloaded extension cord may burn or melt, exposing live wires. Live wires can spark and cause a fire.

Electrical fires are different from other fires because they have a source of electricity that is still conducting electric current.



In case of an electrical fire:

- Leave the area.
- Call 911 from a safe location.
- Tell an adult about the fire.

Only proper chemical fire extinguishers should be used on electrical fires. What would happen if someone tried to put out an electrical fire with water?

_____

_____

_____

PLAN AN EMERGENCY ESCAPE ROUTE WITH YOUR FAMILY.

What to Do if Someone Has Been Shocked or Burned by Electricity

You can help people who are in trouble. But in an electrical emergency, the hardest thing to remember is that **the best help may be to stay away.**

Just like in an electrical fire, call for help. Stay far away from a person who has been shocked or a vehicle with an electric line on it.

Think: Could you safely touch a person who was shocked if the person were still in contact with the source of electricity? Why or why not?

HELP!

What to do

1. **Do not touch the victim.** Tell an adult to turn off the power at the fuse box or circuit breaker.
2. **Call 911 for help.** Tell them it is an electrical accident.
3. **When the victim is NOT in contact with the source of electricity,** and you're SURE there is no danger, tell an adult to give first aid:
   - **If the victim is not breathing, give mouth-to-mouth resuscitation or CPR** if you are trained to administer it.
   - **Loosen the victim's clothing.** Keep the victim warm and lying down until help arrives.
   - **Don't touch the burns, break blisters, or remove burned clothing.** You cannot tell if there are electrical burns inside the body, so be sure the person is taken to a doctor.

Electricity Can Be Dangerous!

My name is Ellen Weiss, and I work for a construction company. Because I work with power lines, I have been trained to know the dangers of electricity. At work, I am cautious because I work on a team and my good sense ensures the safety of those around me. I got hurt by electricity at home, when I wasn't respecting electricity the same way I do at work.

It was a Saturday afternoon and I decided to do some yard work. I pruned my rose bushes, pulled some weeds, and then I decided to take my electric lawn mower out. That was where I made two mistakes. For one thing, my grass was very wet from all of the watering. And for another, I didn't notice that the insulation rubber around my power cord had frayed during storage in my shed. Needless to say, I experienced quite a SHOCK. Before I knew what was happening to me, the electricity was flowing from the exposed wires, down around the wet ground, and up through me. Luckily a friend was in the yard with me. She acted instantly, pulling the plug from the electrical outlet, and saving my life. The shock had knocked me unconscious, but had not stopped my heart. This event changed my life! I will never take electrical safety for granted again!

People just like you get hurt by electricity every day. Some people don't know how to be safe around electricity. Sometimes they know the rules, but they are careless. Sometimes something happens just by accident. Sometimes a person might ask you to do something around electricity that you are not comfortable doing.

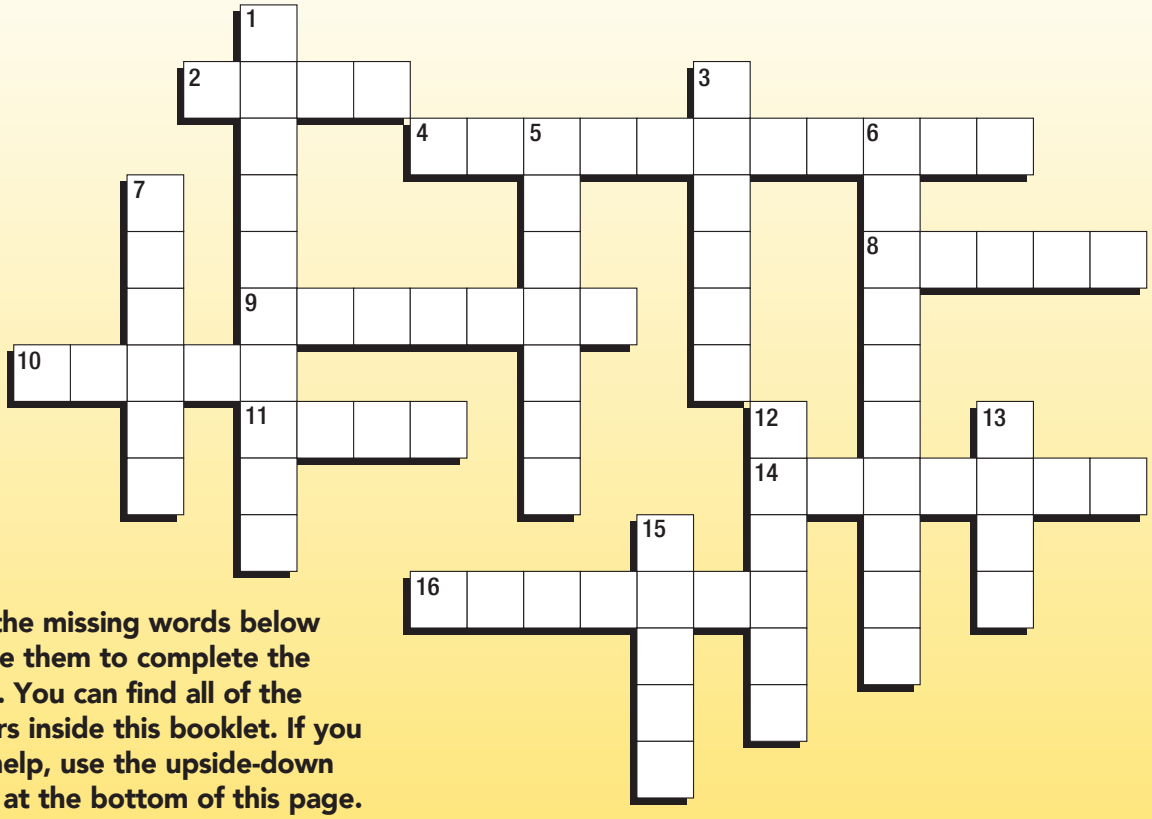
Find someone who has a story to tell, or find an article in the media, about an accident or a near miss involving electrical appliances. Answer these questions: Who told you the story or what was the headline of the article? Who was involved? What was the damage done (or almost done) by the accident? Did the person or the article describe safety precautions to prevent accidents like this? Can you think of any precautions that should have been taken?

PUTTING IT ALL TOGETHER

On a piece of paper, write down the three most important concepts that you've learned in this booklet for staying safe around electricity. Share them with a friend!

Water + Electricity = Danger

Stay Safe Around Electricity



Fill in the missing words below and use them to complete the puzzle. You can find all of the answers inside this booklet. If you need help, use the upside-down words at the bottom of this page.

Across Clues

2 If you put your _____ between electricity and the ground, electricity will flow through you.

4 You can be safe around _____ if you take the right precautions.

8 Coming in contact with electricity can cause _____, burns, or death.

9 The path electricity travels in is called a _____.

10 GFCIs are ground _____ circuit interrupters.

11 Fly kites in _____ areas away from overhead power lines.

14 Overloaded _____ can cause electrical fires.

16 Obey warning signs like Danger High _____.

Down Clues

1 Electricity flows through _____ easily. Metals, water, and humans are examples of them.

3 _____ electric cords can cause shock and fire.

5 Electricity always seeks the _____ path to the ground.

6 _____ prevent the passage of electricity. They keep the electricity flowing through wires.

7 If, due to fire, you must get out of a car with a downed wire on it, never touch the car and the _____ at the same time.

12 Don't climb transmission _____, utility poles, or substation fences.

13 The safest thing to do in an electrical emergency is to call for _____.

15 The human body is 60-70% _____.

Body Conductors Electricity Fault Frayed Ground Insulators Help Open Outlets Shock Towers Voltage Water

Circuit Easiest