



## **Introduction**

*Zap! Magazine* gives your students potentially life-saving information about electrical safety. Activities and readings go beyond warnings to help students understand how electricity works, and why it can be dangerous. Each page is a self-contained teaching unit and may be taught in sequence with the other pages, or independently.

This presentation guide provides answers to questions and puzzles in the booklet, as well as extension and discussion tips.

### **Page 2: Table of Contents (Overview)**

Objective: To give students an overview of booklet contents.

Extension: Ask students to select the story that is most interesting to them and to read that one first. Invite them to write their own articles about electrical safety. Article may focus on a dangerous experience someone has had with electricity, and/or how to be safe around electricity.

### **Page 3: Keeping the Beat (Biomedical Science)**

Objective: For students to understand that electricity plays a role in our heartbeat, and that while electricity can be dangerous to contact, it also has many beneficial uses.

Answers to *Think About It!*

Students should have little trouble coming up with obvious ways they are helped by electricity (lights, TV, appliances, calculators, etc.) Offer extra credit to the most imaginative.

### **Pages 4 & 5: Electrical Safety at the Circus (Power Line and Equipment Safety)**

Objective: For students to understand that electricity travels on wires, that these wires are covered with insulation for protection, and that it's important to stay away from power lines and other electrical equipment.

Answers to *Think About It!*

In your neighborhood, overhead and underground power lines carry electricity from where it is produced (power plant) to where it is used. At the circus, power lines carry electricity from a generator to where it is used.

In your neighborhood, overhead power lines are not insulated but at the circus they are insulated. And unlike in your neighborhood, at the circus specially insulated cables are sometimes laid right on the ground.

Answers to *What do You Know About Power Line Safety?*

1. Transmission lines can be dangerous if people climb the towers, fly a kite into them, or if storms knock power lines loose. Don't climb on or play near these towers.
2. Substations house high-voltage transformers and other equipment. If a person climbs over the fence and touches this equipment, he or she could be killed. Keep out of substations.
3. Service drops deliver electricity from power lines to buildings. These can be as high as 220 volts, and can be dangerous if touched or contacted with ladders or other equipment. Stay away from service drops.
4. Pad-mounted transformers are enclosed in steel boxes. People may be hurt or killed if they touch the equipment inside. Don't climb or play on pad-mounted transformers. If you see one open, call your electric utility.

**Page 6: Say What?! (Fascinating Facts)**

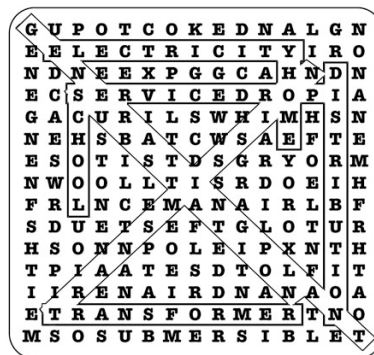
Objective: For students to learn some interesting facts about how electricity travels, how electrons behave, and other topics.

Extension/Discussion: Ask students to come up with their own fascinating facts about electricity. Sources might include encyclopedias, the Internet, or the library. Students can share their facts in small discussion groups.

**Page 7: Don't Try This At Home (Media Bloop)**

Objective: To counteract a misleading movie scene, teach children not to enter an electric substation, and to explain what to do if students see someone being shocked by electricity.

Extension: Ask students if they have seen other examples of people doing unsafe things around electricity in movies or TV programs. Encourage students to write up their examples and submit them to *Zap! Magazine*.



**Pages 8 & 9: Electric Fish Tales (Electricity in Nature)**

Objective: For students to understand that water is a good conductor of electricity, especially if it contains dissolved ions such as salt.

Answer to *Think About It!*

600 volts (eel) divided by 2 volts (battery) equals 300 batteries.

Will the Bulb Light?

Experiment Tips: Teachers should strip the wires ahead of time and make sure the

batteries are fresh. Though the illustration does not show it, use tape to stick the wires to the ends of the battery. The key in the conduction of electricity is the movement of electrons. In liquids, dissolved ions can carry a charge as well. That is why water helps in the conduction of electricity. Salty water, loaded with Sodium and Chloride ions, helps even more.

### **Pages 10 & 11: Lighting Treasure Hunts (Guarding Against Shock)**

Objective: For students to understand how we protect ourselves from shock by the use of Ground Fault Circuit Interrupters (GFCIs).

Answers to *Think About It!*

Ways treasure hunters protect themselves from shock include the following: a GFCI at the generator, heavy duty insulation around the cables that carry electricity to divers' equipment, special cases filled with compressed gas to insulate dive lights, and special rubber gloves divers wear when handling electrical equipment.

Answers to *How Shock Happens*

1. They would feel a small shock.
2. They would probably die.
3. 5 milliamps is the level at which a shock begins to become dangerous.

### **Page 12: Is Your Home Safe? /Shock Patrol (Home Inspection)**

Objective: To get students to take responsibility for checking the safety of their electrical outlets, cords and appliances at home.

Discussion: Ask students if they have ever seen an outlet as badly overloaded as the one in the photograph. What could be done to fix this situation?

### **Page 13: Find the Hidden Hazards (Review of Outdoor Electrical Safety)**

Objective: For students to identify hazards and explain how to prevent them.

The eight hazards are:

1. Someone climbing the substation fence.
2. A fallen wire from the utility pole on the sidewalk.
3. A child flying a kite near power lines.
4. A sprinkler near an electric lawn mower.
5. A boom box being used near water.
6. A ladder about to hit a service drop.
7. A fallen power line on top of a crashed car.
8. A child climbing a tree near power lines.

Encourage students to answer the questions at the bottom of the page with a partner or in a small group. Students' answers will vary, but in all cases should include an action the person can take to make the situation safe. (Note: The people trapped in the car with a power line in it should stay in the car and warn others away. Anyone who touches the car and the ground at the same time will be seriously hurt or killed. If students are ever in a car that contacts a power line and they need to get out of the car because of fire or other danger, they should do the following: jump clear without touching the car and ground at the same time and shuffle away taking small steps and keeping their feet close together.)

**Pages 14 & 15: Lightning and Storm Safety (Danger from Lightning)**

Objective: For students to understand that high voltage shock can come from lightning as well as wires, and to learn the many precautions they can take to avoid a lightning strike.

Answer to *Think About It!*

The electricity in both lightning and power lines is very high voltage. It can travel through a person's body on its way to the ground.

Extension: Have students do skits showing various ways to respond should they be caught outdoors during a lightning storm.

**Page 16: Electrical Safety Poster Contest (Student Activity)**

Objective: To reinforce key outdoor electrical safety messages through drawing.

Tips: Encourage students to make their posters on white letter-sized paper, and to use bold lines and vivid colors. Put posters up at school and then submit them to *Zap! Magazine* for possible publication.