



Zap! Play It Safe Around Electricity & Natural Gas

Teacher's Guide

Introduction

Zap! gives your students potentially life-saving information about electrical and natural gas safety. Activities and readings go beyond warnings to help students understand how electricity and natural gas work in our lives, and why they 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 or natural gas safety. The article may focus on a dangerous experience someone has had, and/or how to be safe around electricity or natural gas.

Page 3: Keep 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 in which they are helped by electricity (lights, TV, appliances, calculators, and so on). Consider having students work in pairs or small groups.

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

Objective: For students to understand that electricity travels in 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 carried electricity from a generator to where it was used. In your neighborhood, overhead power lines are not insulated but at the circus they were insulated. And unlike in your neighborhood, at the circus specially insulated cables were 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 or 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: To help pique students' interest in the discovery and workings of electricity and natural gas, and to stress the importance of safety around buried gas pipelines.

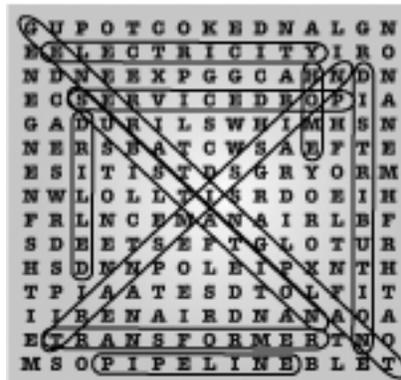
Extension/Discussion: Discuss with students the dangers of contacting underground gas and other utility lines when doing digging projects around their homes. An adult should call the underground locator service, accessible by dialing 811, several days before digging so buried utilities can be located and marked.

Ask students to come up with their own fascinating facts about electricity or natural gas. Sources might include encyclopedias, the Internet, or the library. Students can share their facts in small discussion groups or with the entire class.

Page 7: Really Cool Fossil Fuel (Formation and Distribution of Natural Gas)

Objective: For students to learn about how and when natural gas was formed, and how it is brought to the earth's surface and delivered for usage. This page teaches students how to recognize a gas pipeline leak: a smell of sulfur or rotten eggs; a hissing, whistling, or roaring sound; dirt spraying or blowing into the air; continuous bubbling in water; grass or plants dead or dying for no apparent reason. It also teaches them how to respond to a gas leak: don't use any fire or electricity as these could create a spark and ignite the gas; go far away from the area and do NOT return until safety officials say it is safe; get a trusted adult to call 911 and the utility company. Please reiterate these important pipeline safety tips! Also make sure students know that if they smell a gas leak inside their home they should avoid using a light switch, candle, flashlight, TV, radio, garage door opener, or phone; they should get everyone out of the house and go to a safe location; and they should have an adult report the leak to 911 and the local natural gas utility.

Word Search Solution:



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. Help students form a hypothesis that addresses whether the bulb will light and what will happen when salt is added to the water. 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. Encourage students to share and discuss the results of this experiment in groups or as a whole class.

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 in which 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 that divers wear when handling electrical equipment.

Answers to “Just a Little Current Can Kill You”

1. They would feel a small shock.
2. They would probably die.
3. 5 milliamps is the level at which a shock begins to be 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 gas and electric appliances at home.

Discussion: Ask students if they have ever seen an outlet as badly overloaded as the one in the photograph. Ask if they have ever seen books or magazines stored near a natural gas furnace or water heater. Discuss what could be done to fix each of these situations.

Page 13: Find the Hidden Hazards (Review of Outdoor Electrical and Natural Gas Safety)

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

The nine 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.
9. Children digging and about to contact a buried gas pipeline.

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 on 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 has very high voltage. It can travel through a person's body on its way to the ground. While power line electricity is generated and managed by people, lightning is a naturally occurring phenomenon.

Extension: Have students perform skits showing the right and wrong ways to respond should they be caught outdoors during a lightning storm.

Page 16: Electrical and Natural Gas Safety Poster Contest (Student Activity)

Objective: To reinforce key safety messages through drawing.

Tips: Encourage students to make their posters on white letter-sized paper, and to use bold lines and vivid colors.