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The Shocking Truth About Electrical Safety
Teacher's Guide

FOUR SIMPLE CONCEPTS ABOUT ELECTRICAL SAFETY

1. Electricity travels in a closed loop called a circuit.
2. Electricity flows easily through conductors, not through insulators.
3. Electricity always takes the easiest path to the ground.
4. Water is an excellent conductor of electricity. Because the human body is mostly water, it is also a good conductor of electricity.

The discovery guide introduces these principles and applies them to many different situations.

CONCEPT MATRIX

Use this matrix to find where basic and supplementary concepts are illustrated in the booklet.

MAIN CONCEPT	FOUND ON PAGE (I = Introduced; R = Reinforced)													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Electricity travels in a closed path called a circuit.	I	R	R											
2. Electricity flows easily through conductors, not through insulators.		I	R	R	R	R				R	R		R	R
3. Electricity always takes the easiest path to the ground. If you become part of that path, you will be injured.			I	R	R	R	R	R	R		R		R	R
4. Water is an excellent conductor of electricity. Because the human body is mostly water, we are also good conductors of electricity.				I		R	R				R			R
5. Effects of contact with electricity.			I				R							R
6. Electricity is measured in volts, watts, and amps.			I				R				R			
7. Kinds of electrical equipment, their dangers, and safe behavior.								I	R	I				R
8. What to do in an electrical fire or other electrical emergency.											I	I	I	R

PROCESS SKILLS

1. Predicting what is likely to happen in situations involving possible electrical contact
2. Tracing or drawing the path electricity travels
3. Identifying conductors and insulators
4. Explaining the effects of contact with electricity
5. Inferring that although a situation may not actually result in injury, danger from electricity is always present.
6. Describing the effect of water in situations involving electricity
7. Converting units of measure
8. Applying what students know to new situations in order to identify proper, safe behavior

LEARNING STRATEGIES

1. Students read information and do activity individually.
2. Students work with partners or in small groups.
3. Students discuss information, ideas, and/or answers as a class.

QUESTIONS FOR REVIEW & ASSESSMENT

1. Can you trace or describe the path electricity travels in this picture? Pg. 2, 4-7
   (*Electricity either will travel in a closed circuit or will find its way to the ground through a person or another conductor that comes between electricity and the ground. Students should be able to identify the points of contact and the path electricity would take.)*
2. Which materials are insulators? Which ones are conductors? Pg. 3, 11
3. What happens if you get between electricity and the ground? Pg. 4, 6, 8, 9, 10, 12
   (*In all likelihood, you will be injured or killed. Information on specific effects can be found on page 4 and 8.)*
4. Why is there danger of electrical shock in the situation portrayed? Pg. 4-7, 8, 10-12
   (*Because a person either has come into contact or could possibly contact electricity, giving it a path to the ground. By its nature, electricity is attracted to the ground.)*
5. Can you describe a similar situation in which there is danger of contact with electricity? Pg. 4-7, 9, 10, 12-15
   (St*udent answers will vary, but must include a point of contact with electricity and with the ground.)*
6. Why are we almost always at risk of electrical shock?
   (*Because we are good conductors and because we are almost always touching the ground.)*
7. Describe a safe alternative to the situation shown/discussed. Pg. 4-7, 9-11, 15
   (*Student answers will vary and may include both general and specific safety "rules" such as: keep water and electricity apart; fly kites far away from power lines; be sure the insulation around the power cord to an appliance is not frayed or broken.)*
8. Describe proper precautions to take to avoid becoming part of electricity's path to the ground. Pg. 4-7, 9-15
9. List three steps to take in event of an electrical fire or electrical emergency. Pg. 13
   (*In case of electrical fire: leave the area; telephone for help from a safe location or tell an adult; tell an adult to use a proper chemical fire extinguisher on the fire. In case of electrical emergency: tell an adult to pull the plug or turn off the power at the circuit breaker/fuse box; call for help; when you are SURE all danger is gone, give first aid.)*
10. What may be the hardest thing to remember in an electrical emergency? Pg. 12-14
    (*That the best help may be to stay away from the victim or the scene to avoid becoming part of electricity's path to the ground.)*

SUPPLEMENTARY APPROACHES

To bolster student understanding or to take them deeper into the information, here are a few other activities and approaches to learning.

Main Concepts

Pages 2-4: Electricity travels in a closed path called a circuit.

Pages 4-10, 12, 14-15: Electricity always takes the easiest path to the ground. If you become part of that path, you will be injured.

Pages 5-8, 12, 15: Water is an excellent conductor of electricity. Because the human body is mostly water, we are also good conductors of electricity.

SUPPLEMENTARY APPROACHES

Page 2: Ask students to describe the path electricity travels to get to the lights in the classroom and back to the distribution grid.

Page 3: Water is such a good conductor that most insulators will not work if they are wet. Have students wet their best insulator from their experiment, observe what happens, and explain why it happened.

Page 7: Ask students to find a way to not touch the ground. Remind them about insulators and how they might be useful in this situation. (Students might suggest standing on a fiberglass mat, wearing rubber soled shoes [not athletic shoes], or some way to hold a layer of air between them and the ground.)

Ask students to locate GFCIs in your classroom or school. What conclusions can they draw about where GFCIs are placed? (*GFCIs are used outdoors and inside near water because those are the areas of greatest risk of contact.)* Have they seen GFCIs embedded in appliance cords? Why are they placed there? (*To perform the same function as a GFCI in the wall*.) What kind of appliances are most likely to have a GFCI in the power cord? (*Those to be used around water*.)

Main Concepts
Pages 4, 8, 12: Electricity is measured in volts, watts, and amps.

Pages 9-12, 15: Identifying kinds of electrical equipment, their dangers, and safe behavior.

Pages 12-14: What to do in an electrical fire or other electrical emergency.

SUPPLEMENTARY APPROACHES

Page 4: To understand the relationship of amps, watts, and volts, explain to students that electricity flowing through a wire is like water flowing through a garden hose. The amount of water depends on the diameter of the hose (*amps*). The pressure of the water depends on how far open the faucet is (*volts*). The amount of work that can be done (*watts*) depends on both volts and amps.

Have students test several drinking straws with different diameters. How hard do they have to suck to drink the same amount of water? Does the diameter affect how long it takes to drink the water?

Page 8: Watts = Volts x Amps. Assume you have a 1000 W hairdryer plugged into a 120 V circuit. How much amperage is available? (*1000/120 = 8.33 amps*) What would happen if you accidentally came into contact with that much amperage? (*8 Amps x 1000 milliAmps = 8000 mA. The effect is probably fatal.)*

Page 9: Take students outside the school building and locate lines, transformers, and entrance of electrical lines into buildings. What other equipment can they see? (*Probably the electric meter*.) What is it used for? (*To measure how much electricity is used in the building*.)

Page 10: Ask students to draw a map of their route to school. Mark the places where electrical equipment is placed (including overhead lines). Indicate places where there is danger of electrical contact.

Page 11: Ask your local electric company to send someone to your school to demonstrate safety equipment used by line workers.

Page 12: Ask students to go home and practice safe behaviors around downed power lines with their families.

Page 13: In case of fire, ask students to plan an emergency escape route with their families. Ask them to draw a map of the route and share it in class with a small group. What features do different plans have in common?

Page 14: It's important to tell students that if they touch someone who is in contact with an electricity source, electricity will travel through them as well, and they could be seriously hurt or even killed.

ANSWER KEY
Note: Many of the activities in *The Shocking Truth* don't have "Answers" per se, but are activities designed for cooperative learning.

Page 2:
1. Students should place an "X" on the Power Plant.
2. The path should be traced from the power plant to the video game control.
3. The path should be from the video control back to the power plant.

Page 3:
1. The following materials are conductors: water, foil (aluminum), paper clip (steel), can (tin). The following materials are insulators: toothpick (wood), dry dirt, glass, hose (air), leather, plastic, paper and rubber band.

2-4. Answers will vary according to what items the students choose.

Page 4:
The path electricity travels is called a circuit.
The amount of electricity flowing through a conductor is measured in amps.
The pressure at which electricity flows is called voltage.
The place where electricity is always trying to go is the ground.

Page 5:
Watering the grass while mowing with an electric lawnmower is not a safe combination. You may become part of electricity's path to the ground if you are accidentally sprayed by the hose.

Page 6:
1. When you touch electricity and the ground at the same time, you become part of the easiest path to the ground for electricity, and can be shocked or electrocuted.
2. If a bird touches the pole (an extension of the ground) and a wire at the same time it could be electrocuted. The birds are not injured because they are not in contact with the pole or ground.
3. An electric source (a wire) and the ground.

Page 7:
Circle only the top picture.
Cross out the other three pictures.

Page 8:
1. 1,000 milliamps
2. 10,000 milliamps
3. Probably fatal. Your body is 70% water.

Page 9:
The top left picture—F
The top right picture—B
The middle left picture—E
The middle right picture—D
The bottom left picture—C
The bottom right picture—A

Page 11:
The hard hat would protect their head from falling objects. Plastic is also a good insulator.
The safety goggles would provide better protection for the eyes.
The insulated gloves on the right are thicker, provide better insulation and won't tear easily.

Page 12: The car rests on four rubber tires that are insulators. The air and tires separate the metal car body from the ground.
If you touch the car and the ground at the same time, then electricity would have a path to the ground.
If you touch the body of the car to help someone from the car, you provide a direct path to the ground.
If you touch point A and point B at the same time, 2,500 volts would flow through the person's body.

Page 13: If a person tried to put out an electrical fire with water, the water would provide a path to the person's body and electrocute them.

CROSSWORD PUZZLE

ACROSS CLUES

2. If you put your **BODY** between electricity and the ground, electricity will flow through you.
4. You can be safe around **ELECTRICITY** if you take the right precautions.
8. Coming in contact with electricity can cause **SHOCK**, burns, or death.
9. The path electricity travels in is called a **CIRCUIT**.
10. GFCI's are Ground **FAULT** Circuit Interrupters.
11. Fly kites in **OPEN** areas away from overhead power lines.
14. Overloaded **OUTLETS** can cause electrical fires.
16. Obey warning signs like Danger High **VOLTAGE**.

DOWN CLUES

1. Electricity flows through **CONDUCTORS** easily.
3. **FRAYED** electric cords can cause shock and fire.
5. Electricity always seeks the **EASIEST** path to the ground.
6. **INSULATORS** prevent the passage of electricity. They keep the electricity flowing through wires.
7. Birds can sit on an electric line because they are not touching the **GROUND**.
12. Don't climb transmission **TOWERS**, utility poles, or substation fences.
13. The safest thing to do in an electrical emergency is to call for **HELP**.
15. The human body is 70% **WATER**.