ELECTRICAL SAFETY AT HOME AND WORK

Guide Booklet

Culver Company Booklet #42110

Presentation Guide for Science and Career Training

••Tools to meet safely dangerous situations involving electricity

SECTION I (pages 2-3)
WHAT'S SO DANGEROUS ABOUT ELECTRICITY, ANYWAY?

Objectives

- 〈 Draw or describe the path of electricity from the source of current through a conductor to the ground.
- 〈 Name at least three conductors and possible three insulators.
- 〈 Explain that even a small amount of electrical current can cause injury or fatality.

Real World Applications

1. Ask students to generate a list of insulators and conductors. Collect a sample of each material and have students check the accuracy of their predictions. Use one D cell battery and one holiday mini-light cut from a string of lights. Be sure several inches of wire extend from each side of the bulb, and strip the ends of the wire to connect with the battery. Test each material. Conductors should allow the bulb to light; insulators should not allow the bulb to light. Do all insulators or all conductors have any characteristics in common?
2. Ask students to try to develop a hypothetical situation in which they could contact electricity without getting hurt. (There aren't many situations where this is possible. Standing on a ladder, a chair, the roof, etc. are not acceptable alternatives because electricity could travel through the person and through the object to the ground. If students create some situations in which they may not be hurt, for example, a car with a downed power line on it, emphasize that they still would be in a gravely dangerous situation. The point of this exercise is to have students practice thinking through where they become part of the path to ground.) Have students present situations to the class for critique. For each strategy, identify the points of contact with electric current and with the ground.

Exploration & Assessment

1. Toward what destination does electricity naturally travel? (The ground.)
2. How does electricity endanger human beings? (If we contact electric current while we are touching the ground, the current will flow through our bodies and we will be injured or killed.)
3. How could you become part of electricity's path to ground around utility equipment? (Students will need to predict the answers, based on what they know about electricity. Possible answers: If you touched overhead power lines with a ladder or pole; if you ignored the warning sign and entered a substation; if you dug without calling the electric company first to find out the location of underground lines; if you opened a pad-mounted transformer; if you climbed a transmission tower.)

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•Teacher Note: Photocopy for use in classroom

4. What is the difference between birds sitting on a power line, and you touching a power line? (The birds are not touching the ground, so they are not harmed. People have no way to touch a power line without touching the ground or something connected to the ground.)
5. What is the difference in effect between contacting the amount of electricity in the power lines outside your house and in the socket of a night light? (None. In the right circumstances, both contacts are probably fatal.)

SECTION II (pages 5-6)

THE ELECTRINET: IT'S ALL DONE WITH WIRES AND CIRCUITS

Objectives
- Explain why plain metal conductors should not be substituted for fuses.
- Define a ground fault and identify GFCIs and appropriate placement.
- List situations that indicate inadequate wiring.

Real World Applications
1. Have students examine a fuse. Draw its components (a screw-in point of contact like a light bulb; a wire strip through which current flows, and an insulating glass housing). Identify the component that regulates the amount of current (the metal strip, which is rated to conduct only a certain amount of electricity). Ask students to explain why substituting a penny or aluminum foil for a fuse would cause a fire. (Fuses will only carry the amount of electricity for which they are rated. A plain metal conductor will carry unlimited amounts of electricity to wiring that can only carry limited amounts which can cause the wires to overheat and start a fire.)
2. Ask students to locate GFCIs in your classroom or school or in their homes. 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.)

Exploration & Assessment
1. What holds electricity in a circuit in your home? (Insulation. The wire is insulated all the way from the power source to the point of use and back again.)
2. What could go wrong with insulation? (It could melt from overloaded circuits, it could fray from wear, or it could be cut accidentally.) What happens if the insulation was broken in some way? (Electricity will go to ground.)
3. Where can you control the flow of current into the home? (At the service panel.)
4. Why would a ground wire be connected to a water pipe in your house? (Because pipes are laid in the ground, so they can carry electric current outside to the ground.) Would it be safe to touch a pipe and an electrical appliance at the same time? (No, because you could become part of the path to ground.)
5. Name four situations that show that home wiring is inadequate. [Fuses blow or circuit breakers trip often; appliances that heat (irons, etc.) do not get as hot as they should; TV picture shrinks when appliances go on; not enough wall outlets.]

SECTION III (pages 7-9)

NOW THAT YOU KNOW WHAT'S SAFE, CAN YOU DO WHAT'S SAFE?

Objectives
- Remember at least seven rules for safe behavior around electricity.
- Generalize safe behavior from the rules given to new situations.

Real World Applications
1. Explore with students their own experience with electricity. Has anyone in the class been shocked, burned, or injured in another way from electricity? Does anyone know someone who has? What happened? Why did it happen? What thoughts did the person have afterwards? Was anyone with the person? What did the other person do? Did the experience have an effect on the safety measures these people take around electricity?
2. Make a safety sign listing safe ways to handle tools and appliances. Make the sign so that people would want to look at it. Post in classroom, shop, lab, or at home in the workshop or utility room.

Exploration & Assessment

1. What makes appliances potentially dangerous? (They are a hazard around water; their cords can become worn without being noticed; and the inside parts can malfunction without being able to tell that there's a problem.)
2. In what ways can you become part of the path to ground for electricity inside the home? [By touching appliances with wet hands, by placing appliances so that there is the risk of them falling into water (tub, sink, etc.); by putting objects or fingers in appliances or outlets; by ignoring malfunctioning appliances; by forgetting to examine the power cords before plugging in appliances, etc. See paragraphs 1 and 2 on page 7.]
3. In what ways can you become part of the path to ground for electricity outside the home? (By touching the string of a kite or balloon caught in overhead lines; by entering or climbing utility installations and equipment; by touching power lines with poles, ladders, pruning shears, shovels, and other tools.)
4. What causes electrical fires? (See paragraph 3 on page 7.)

SECTION IV (pages 10-11)

SAFETY'S NOT MY JOB—IS IT?

Objectives

- List at least three new areas of potential hazard at work.
- Identify the role of personal responsibility in working safely.

Exploration & Assessment

1. Of the safety rules you already know, which might be especially applicable at work? (Power cords: Check for wear. Use suitable cords outside or in wet places. Look for GFCIs. Unplug correctly. Store loosely coiled in a dry place. Tools: Do not carry by the cord. Keep switch in OFF position when not in use. Check for wear or damage. Repair: Watch out for energized areas.)
2. How could emotions and attitudes affect workplace safety? (Hurrying, distraction, carelessness, frustration, anger, taking shortcuts, and not following directions can cause a worker to ignore procedures that insure safety on the job. Procedures include: importance of cleanliness in reducing risk of shock; following company lock out/tag out procedures to de-energize equipment before cleaning or repairing; using personal protective equipment to defend against shock and electrical burns; and keeping PPE in perfect condition.)
3. Why is personal responsibility important in working safely? (In handling equipment every day, you are in the best position to assess its problems and be sure it is kept in good working order. Even if you are not responsible for maintenance, you will be most aware of repair needs—and you are most likely to suffer from any malfunction. Also, your actions are likely to have an effect on those you work with.)

Real World Applications

1. Observe workers on a construction or maintenance job. Note the things they do to stay safe on the job. What is their attitude? If you were a safety inspector, what would you recommend they do differently? To which worker would you give a safety award? Why?
2. If you were on the employee safety team at school or at work, how would you train your co-workers to work safely? What would you do to help everyone continue to work safely? (Answers may include demonstrating safe handling of equipment and workplace safety procedures, using a checklist to close out work at the end of the day, posting reminders to work safely, inspection of work areas, incentives to recognize consistent, safe behavior.)

SECTION V (pages 12-15)

EMERGENCIES

Objectives

- List causes of electrical fires and what to do in case of electrical fire.
- Demonstrate what to do if you are in a vehicle that comes in contact with power lines.
- Explain how to appropriately assist someone who has contacted electricity without becoming part of electricity's path to ground.
- Identify appropriate actions to take when electric service is interrupted.

〈 List several protective actions to take when working around power lines.

Real World Applications

1. Role play safe procedures in an electric fire, in an energized car (one that is not on fire and one that is on fire), and with a person touching a fallen line. What happens to the person? What do by-standers do? Practice what steps to take and how to instruct others.

Exploration & Assessment

1. What makes electrical fires different from other fires? (A source of electricity is present in the fire, which presents electrical as well as fire hazards and changes the way the fire is handled.)
2. Why would you never use water to extinguish electrical fires? (Because water is a conductor, using it on an electrical fire could conduct electric current through the stream of water to the person fighting the fire.)
3. What should you do in event of electrical fire? (Unplug the source of electricity or interrupt power at the main switch. Follow company/school procedures to notify the fire department and specify that this is an electrical fire. If it's small, use a multipurpose fire extinguisher. If you doubt you can put it out, leave the area and take everyone with you.)
4. What should you do, if you are in a vehicle that comes into contact with a power line? (To stay in the vehicle, if at all possible.) Why? (Because the risk of shock upon alighting from the vehicle is greater than staying inside as long as there is not a fire or other reason to have to leave.)
5. Why are you not part of the path to ground if you are in a car with a downed line on it, but if you are on a ladder, you are part of the path to ground? (The vehicle's tires hold a layer of air between you and the ground. The ladder will conduct electricity, even if it is wood, so if you are touching the ladder, you become part of the path to ground.)
6. If you must leave an energized vehicle, how do you do it? (Jump, do not step, from the vehicle. Then roll or shuffle away.) Why? (Jump to avoid becoming part of electricity's path to ground. Shuffle away to avoid becoming a bridge for electricity from an area of high voltage to an area of lower voltage.)
7. What protective actions should you take when working around power lines? (Keep yourself and your equipment at a distance from overhead lines. Call the power company and ask if safety measures can be taken before you begin work. Call to check the location of underground lines before you dig. On farms, keep irrigation pipe at least 10 feet from power lines and store irrigation at least 100 feet from lines. Make sure water stream breaks up into droplets before contacting a line.)
8. What are the appropriate steps to take to assist someone who has been shocked or burned by electricity? (If possible, unplug the source of electricity or interrupt power at the main switch. Do not touch the victim until you are sure there is no danger of electrical contact. Call for emergency help. Give first aid: If the victim is not breathing, give CPR or mouth-to-mouth resuscitation. Loosen the victim's clothing. Keep him/her warm and lying down until help arrives. Do not touch burns, break blisters, or remove burned clothing.)
9. Why is it important to be sure the victim is taken to a doctor? (There may be electrical burns inside the body that do not show on the outside.)
10. What is the best way to cope with a power outage? (Have flashlight, batteries, candles, and matches handy. Also keep water and non-perishable food, first aid kit, and a battery-operated radio available. Call the utility company to report outage. Turn off appliances and lights. When power resumes, reset clocks and automatic timers. Refresh emergency supplies.)