

# **Stay Safe Around Electricity Workbook**

##### Discussion guide for teachers

**INTRODUCTION**

The Stay Safe Around Electricity workbook is intended for use in Years 3 – 7 for Science and Health and Physical Education levels 2, 3 and 4, and meets the following curriculum requirements:

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| **Science** |
| Learning strandsLearning intentions | Making sense of the physical world* Investigating and describing the role and sources of electricity.
* Investigating simple electric circuits.
* Understanding basic insulation and electricity conductors.
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| **Health and Physical Education** |
| Learning strandsLearning intentions | Safety and risk managementHealthy communities and environments: rights, responsibilities and laws* Identifying and using safe practices and risk management strategies around electricity.
* Identifying electrical hazards.
* Developing strategies for making hazards safe.
* Researching and describing safe guidelines and practices around electricity and electric equipment, including power lines and transformers, in the community.
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## AIM

To teach student the basic rules of electrical safety and the principles behind them.

## OBJECTIVES

Students will be able to:

* Describe how electricity is generated, distributed and used.
* Explain why electricity can be dangerous.
* Predict what is likely to happen in common situations involving potential electrical contact.
* Identify safe behaviours in each situation.

###### **FOUR SIMPLE PRINCIPLES ABOUT ELECTRICAL SAFETY**

Use these principles to help students understand the dangers shown in the workbook:

1. Electricity flows easily through ***conductors***, like metal and water. It does not flow easily through ***insulators***, like special rubber or glass.
2. Water is an excellent conductor of electricity. Because the human body is mostly water, we are also good conductors of electricity.
3. Electricity always takes the easiest path to the ground.
4. If you come between electricity and the ground, you become a conductor for electricity and can be shocked. An electrical shock can seriously injure or kill you.

**PRODUCTION, DISTRIBUTION AND USE OF ELECTRICITY (Pages 2 and 3)**

**Teacher background:**

Electricity is made at a power plant. Power plants use some form of fuel (hydro, coal, oil, natural gas, wind, solar or nuclear) to heat water into steam, which turns the blades of a turbine. The turbine spins a generator, producing electricity.

Electricity travels through a grid of wires, including transmission lines (which carry high-voltage electricity over long distances) and distribution lines (which carry lower voltage electricity for use in homes and businesses). Distribution lines run overhead or underground. Transformers, which change electricity’s voltage, are found either on power poles or in large metals boxes on the ground. Electricity enters buildings from distribution lines, and flows though wires in the wall that lead to lights and electrical outlets.

## Discussion/activities

Electricity is such a part of our lives that we take it for granted. Ask students to imagine a day without electricity. What would they use for cooking, lighting, heating?

## HOW ELECTRICITY CAN HURT YOU (Page 4)

## Teacher Background:

Electricity, by its nature, seeks the easiest path to the ground. It will travel there through any conductive material available. Human beings conduct electricity because we are 70% water, and water is a great conductor. If a person gets between electricity and the ground or something touching the ground, electricity will flow through him or her. A person standing on a tree, a ladder, or the floor is connected to the ground and can still be shocked.

Emphasise to students that an electrical shock is serious. It can lead to serious internal and external burns. It hurts. It can stop a person’s heart. It can kill a person.

## Discussion/activities

1: What is the difference between a bird sitting on the power line and you touching a power line? (*The bird is not touching the ground or anything that is in contact with the ground, so electricity does not flow through them).*

2: Have the class make signs showing where people can be hurt by electricity and how to be safe in that situation.

**CONDUCTORS AND ELECTRICITY** (**Page 5)**

**Teacher background**:

Conductors, like metal and water, allow electricity to flow through them. Water is such a good conductor that most insulators will not work if they are wet. The human body is 70% water, making us excellent conductors for electricity. Insulators, such as special rubber or glass, resist the flow of electricity.

**Discussion/activities**

1: Ask students to name a few common conductors. (*Wire, cords, metal pipes, water, anything wet, paper clips, fingers or any part of the human body.)*

2: Ask students to name a few common insulators. (*Glass, air, dry dirt, special ceramics, special rubber and special plastics.)* Make sure you explain the difference between insulating safety gear such as rubber boots, and household products such as sports shoes and latex gloves which do NOT protect against shock. Remind students never to experiment with these household products and electricity.

**ELECTRICAL EQUIPMENT (Pages 6 and 7)**

**Teacher background**

Substations, pole-mounted transformers and ground-mounted transformers may attract students’ curiosity. Substation fences may look fun to climb, but the danger of shock is high. Ground-mounted transformer boxes contain equipment that can cause electrocution. The boxes are usually locked; students should stay away from them and report any damaged or unlocked boxes to an adult. Pole-mounted transformers do not pose as great a threat as ground-mounted transformers because they are not as accessible. But the risk of shock is the same.

**Discussion/activities**

1: Look around the school and out the gate, and locate lines, transformers and the entrance of electrical lines into buildings. What other equipment can they see? (*Possibly the electricity meter)*. What is it used for? (*To measure how much electricity is used in the building.)*

2: Ask students to draw a map of their route to school, showing the places where they see electrical equipment. Include overhead lines, transformers and substations.

**POWER LINE SAFETY** (**Pages 4, 8, 9, 10, 11, 12)**

**Teacher background**:

Most overhead power lines are not insulated and are therefore located high off the ground to prevent accidental contact. The rubber coating on some overhead power lines should not be confused with insulation; it is there to protect the power line from the effects of the weather, and is not meant to protect people from shock. Even if the line is insulated, the tiniest pinhole or break in the insulation puts you at risk.

**Discussion/activities**

1: Why does electricity stay in overhead lines instead of flowing down the pole? (*The wires are held away from contact with the pole by insulators made of special glass, ceramic or plastic.)*

2: How are electricity line workers able to touch power poles safely? (*They always wear special protective gear. Sometimes workers turn off the electricity in the power line before working on it. When they work on live lines, they use insulated tools, wear special insulating work boots with rubber soles, and use insulating gloves.)*

3: Remind students that if they are in a car that contacts a power line (p.11) they are safe from electrical shock so long as they stay in the car. If they must leave the car before help arrives, ask students what they would do and why. (*Jump clear, being careful not to touch the vehicle and the ground at the same time, so your body doesn’t create a path for electricity to flow from the vehicle to the ground.)*

**HOME APPLIANCE SAFETY** **(Pages 13 and 14)**

**Teacher background:**

Home appliances are potentially dangerous because they are accessible to young children, their cords can become worn without being noticed, and the inside parts can malfunction without showing something is wrong. Appliances are often around water, which increases the risk of shock.

**Discussion/activities**

Discuss with students their experience with electricity’s dangers at home. Has anyone in the class been shocked, burned or injured from electricity? Does anyone know someone who has? How did it happen? What thoughts did the person have afterwards? Did the experience have any effect on safety measures around the person’s home?

**WHAT TO DO IN AN ELECTRICAL EMERGENCY (Page 15)**

**Teacher background**

Electrical fires are different from other fires because they have a source of electricity that is still conducting electric current. That is why you should never use water on an electrical fire. Putting water on an electrical fire gives electricity a way to travel to the rescuer, through the stream of water. Instead of water, an adult should use a multipurpose fire extinguisher designed for electrical fires, wood/paper fires, and flammable liquids.

In the event of an electrical shock, don’t touch the victim. Students may think that if a person is already shocked or burned, the danger could be over. But if the source of electricity is still live and near or touching the victim, the situation could be deadly for someone who gets too close. Instead an adult should unplug the source of electricity (if it is safe to do so) or turn off power at the mains switch.

**Discussion/activities**

1: Ask students to explain why we don’t use water on electrical fires. (*The electricity could travel through the water and shock you.)*

2: Ask students to describe the dangers to the rescuer in an electrical emergency. (*If a rescuer touches a person still in contact with the source of electricity that shocked him or her, the electricity flowing through the injured person would flow through the rescuer too. The rescuer would become another victim.)*

For more information visit
[www.wesafety.co.nz](http://www.wesafety.co.nz)

