



## Electrical circuits 5: Measuring electricity

### Components

	NAME	DESCRIPTION	AUDIENCE
	<i>Measuring electricity</i> teachers guide	This guide describes a simple experiment that demonstrates how fuses work. It includes a summary of common electrical safety devices found around the home.	teachers
	<i>Electrical units</i> fact sheet	Charge, current, voltage, power, resistance and energy are described in this series of fact sheets. Worked calculations and focus questions are included.	students
	<i>Electrical safety</i> worksheet	Students answer questions about earthing and safety in household electrical circuits.	students

### Purpose

Students **Explain** how safety devices and procedures can be put in place to reduce electrical accidents.

### Outcomes

Students:

- perform a procedure to demonstrate the effect of a short circuit in an electrical circuit;
- understand that a fuse is a safety device in a circuit designed to prevent electrical accidents;
- describe safety devices typically used in domestic electrical systems; and
- understand that adequate earthing of appliances prevents serious electrical accidents.
- understand the terms: charge, current, voltage, power, resistance and energy

### Activity summary

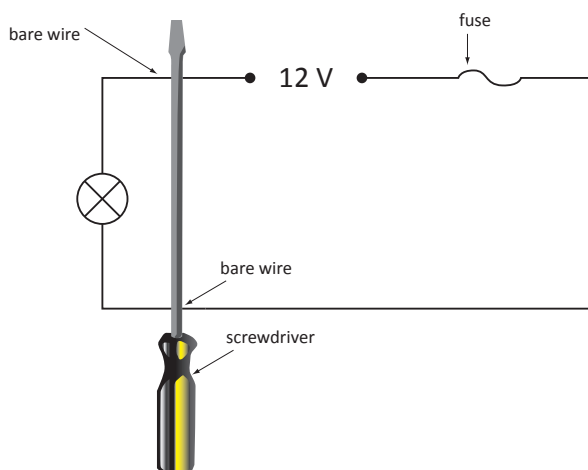
ACTIVITY	POSSIBLE STRATEGY
Students perform an activity that demonstrates how a fuse protects a circuit. See 'Fuse experiment' below.	students work in small groups
Students read the fact sheets, <i>Electrical units</i> . Focus question on these fact sheets may be used for class discussion or set as assignments.	individually, small group or class as a whole
Students complete the worksheet, <i>Electrical safety</i> , as a follow up to the experiment.	individual

### Fuse experiment

This is a small group practical activity to demonstrate how a fuse protects a circuit when a large current is permitted to flow (short circuit).

A simple circuit using a 12 V transformer, low current fuse wire, lamp and leads with some wires bare, can be short circuited using a screwdriver or similar conductor. Use protective mats under the fuse wire to prevent damage to bench tops.

Note: Students may be temporarily alarmed by the spark produced when the fuse wire melts.



## Teacher notes

The following common electrical safety devices are found around the home.

### fuses

- level of protection typically 8–10 A,
- protect against circuit damage caused by overload or short circuit, and
- have to be replaced (rewired) after melting or fusing.

### cartridge fuses

- level of protection typically 80–100 A,
- protect against major circuit failure, and
- have to be replaced by the electricity supplier.

### MCBs (miniature circuit breakers, or trip switches)

- level of protection typically 10–20 A,
- protect against circuit damage caused by overload or short circuit, and
- easy to restore after 'trip'.

### RCDs (residual current devices)

- operate when a current leak of 5–30 mA to earth is detected,
- trip within 40 ms, and
- easy to restore after 'trip'.

An explanation of how an RCD works is included in the answers to the worksheet, *Electrical safety*.

## Technical requirements

The guide, background sheet and worksheet require Adobe Reader (version 5 or later). This is a free download from [www.adobe.com](http://www.adobe.com). The worksheet is also available in Microsoft Word format.

## Acknowledgements

Banner image: 'Kamienczyk Waterfall' by JDavid.  
GFDL, [commons.wikimedia.org/wiki/File:Kamienczyk\\_Waterfall\\_2005-08.jpg](https://commons.wikimedia.org/wiki/File:Kamienczyk_Waterfall_2005-08.jpg).

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## Associated SPICE resources

*Electrical circuits 5: Measuring electricity* may be used with related SPICE resources to address the broader topic of electricity.

DESCRIPTION	LEARNING PURPOSE
<p><i>Electrical circuits (sequence overview)</i></p> <p>This learning pathway shows how a number of SPICE resources can be combined to teach the topic of electricity.</p>	
<p><i>Electrical circuits 1: Lightning</i></p> <p>Students are engaged in the topic of electricity through observing and exploring lightning.</p>	<b>Engage</b>
<p><i>Electrical circuits 2: Static electricity</i></p> <p>Students explore the effects of charge through a series of laboratory experiments.</p>	<b>Explore 1</b>
<p><i>Electrical circuits 3: Current electricity</i></p> <p>Students construct circuits using simple electrical components.</p>	<b>Explore 2</b>
<p><i>Electrical circuits 4: Circuit rules</i></p> <p>Students use an interactive learning object to record observations and derive rules for circuits.</p>	<b>Explain 1</b>
<p><i>Electrical circuits 5: Measuring electricity</i></p> <p>Models and analogies are introduced to help students understand concepts around properties of electricity and how it is quantified.</p>	<b>Explain 2</b>
<p><i>Electrical circuits 6: Bioelectricity</i></p> <p>Four fact sheets and a video provide examples of how electricity is used in living organisms, including humans.</p>	<b>Elaborate</b>