teacher guide

Electrical circuits 4: Circuit rules

Components

	NAME	DESCRIPTION	AUDIENCE
	*Circuit rules* teacher guide	This guide includes suggestions about how to use the worksheets to investigate Ohm's law.	teachers
	*Circuit simulator* learning object	This learning object is an alternative to using practical procedures to explore resistance, potential difference and current in circuits.	students
	*Series and parallel* worksheet	This worksheet accompanies the learning object, *Circuit simulator*.	students
	*Circuit calculations* worksheet	This worksheet examines quantitative aspects of Ohm's law (V = IR) and current in simple circuits.	students

Purpose

To extend the concept of electrical current to include quantitative aspects of Ohm's law and rate of charge drift.

Outcomes

Students:

- use the formula I = q / t to solve problems associated with current;
- use V = I R to solve problems associated with Ohm's law;
- manipulate components of an electrical circuit, read meters, and tabulate and analyse data;
- use rules for resistance to calculate total resistance in a circuit; and
- use data displayed in a learning object to explain relationships between potential difference, current and resistance in series and parallel circuits.

Activity summary

ACTIVITY	POSSIBLE STRATEGY
The learning object, *Circuit simulator*, may be used to consolidate concepts of resistance in a circuit. Students may use it to obtain information about potential difference, current and resistance in series and parallel circuits.	individual or small group
Students complete the worksheet, *Series and parallel*, as they use the learning object.	individual
Alternatively, students complete an experiment to verify Ohm's law. Laboratory manuals and websites have descriptions of suitable experiments.	small groups, or teacher demonstration
The worksheet, *Circuit calculations*, examines quantitative aspects of Ohm's law and relationships between current and charge in simple circuits.	individual

Teacher notes

A procedure to verify Ohm's law is a common experiment written up in many physics laboratory manuals and websites. Any version that is pitched at secondary level would be suitable for students to attempt, or for teachers to demonstrate.

The worksheet, *Circuit calculations*, need be used only if other sources of problems are not available. There are many problem books that students may use to practise using formulae for electrical work and power.

As an alternative, worksheets may be adapted and used for assessment.

Circuit simulator

- The lamp in the learning object has a resistance of 7.2 Ω. This value ignores any non-ohmic effects of the filament.
- The lamp is rated at 20 W. Its brightness varies depending on the current in the circuit.

Circuit calculations

The following rules relating to potential, current and resistance are important concepts that students encounter when completing the worksheet.

- At any node (junction) in an electrical circuit, the sum of currents flowing into a node is equal to the sum of currents flowing out of that node.
- The sum of electrical potential differences around any closed circuit is equal to the total potential in the circuit.
- The currents in branches of a parallel circuit are inversely proportional to the size of the resistances.

Circuit diagrams may be drawn to represent circuits students construct.

Technical requirements

The learning object requires a modern browser (eg Internet Explorer 9 or later, Google Chrome, Safari 4.0+, Opera or Firefox). It can be placed on a web or file-server and run either locally or remotely in a web browser.

The teacher guide and worksheets require Adobe Reader (version 5 or later), which is a free download from www.adobe.com. The worksheets are also provided in Microsoft Word format.

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SPICE resources and copyright

All SPICE resources are available from the Centre for Learning Technology at The University of Western Australia ("UWA"). Selected SPICE resources are available through the websites of Australian State and Territory Education Authorities.

Web: spice.wa.edu.au
Email: spice@uwa.edu.au
Phone: (08) 6488 3917

Centre for Learning Technology (M016)
The University of Western Australia
35 Stirling Highway
Crawley WA 6009

Associated SPICE resources

Electrical circuits 4: Circuit rules may be used with related SPICE resources to address the broader topic of electricity.

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