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To the Teacher

This is one in a series of hands-on science activity books for early secondary-school students. A survey of students of that age found that:

- more than half listed science as their favourite subject
- more than half wanted more hands-on activities
- 90 per cent stated that the best way for them to learn science was to do experiments themselves

The books in this series seek to capitalise on these findings. These books are not texts but supplements. They offer hands-on, fun activities that will turn some students on to science. Most of these activities can be done in school, and some of them can be done at home. The authors are teachers who have field-tested the activities in secondary school.

This book includes activities related to a force of nature, namely, electromagnetism. Every effort has been made to use readily available, inexpensive equipment. Activities range from the simple (playing with magnets and magnetic equipment) to the complex (creating electricity by means of thermocouples and working with photovoltaic cells). There is something for every student. We strongly recommend that you try these activities yourself before asking your students to perform them.

The activities can be used:

- to provide hands-on experiences pertaining to textbook content
- to give verbally limited children a chance to succeed
- as the basis for class or school science projects or for other science competitions
- to involve students in science activities
- as homework assignments
- to involve parents in their children's science education and experiences
- to foster an appreciation for science

This book provides hands-on activities in which students:

- manipulate equipment
- interpret data
- evaluate experimental designs
- draw inferences and conclusions
- make predictions
- apply the methods of science

8. If It Isn't a Series Circuit, It Must Be a Parallel Circuit!

TEACHER RESOURCE PAGE

INSTRUCTIONAL OBJECTIVES

Students will be able to:

- draw conclusions based on observations
- construct parallel electric circuits
- explain how the various components of a parallel circuit are connected

SCIENCE BENCHMARKS

YEARS 7–8

Content description
Abilities necessary to do scientific inquiry
Understandings about scientific inquiry
Transfer of energy
Abilities of technological design

YEARS 9–10

Content description
Abilities necessary to do scientific inquiry
Understandings about scientific inquiry
Motions and forces
Interactions of energy and matter
Abilities of technological design

YEARS 7–8

National Science Curriculum
Students practise safe, responsible and ethical behaviour when conducting investigations using standard equipment
Students plan and conduct scientific investigations in ways that lead to the collection, interpretation and presentation of valid data

YEARS 9–10

National Science Curriculum
Students plan experimental procedures which include the accurate control and measurement of variables
They identify inconsistencies in results and suggest reasons for uncertainty in data
They use scientific language and representations when communicating their results and ideas
Students explain trends and patterns in data, identify discrepancies in experimental results and suggest improvements to their investigations
Students explain how forms of energy can be transferred in a variety of ways through different mediums

VOCABULARY

- **crocodile clips:** clips attached to the ends of electrical wires that snap on other parts of an electric circuit
- **electric circuit:** the continual flow of electricity along a path from a power source to an electrical device or devices and then back to the power source
- **parallel circuit:** a circuit in which each resistor is connected directly to the power source (battery)
- **resistor:** any device that resists the flow of electricity through it, such as an electric lightbulb
- **series circuit:** a power source connected to a resistor or resistors by wires; the resistor in turn is connected to a switch, which is connected back to the power source by a wire.
- **switch:** a device used to complete an electric circuit or to break the circuit

8. If It Isn't a Series Circuit, It Must Be a Parallel Circuit!

TEACHER RESOURCE PAGE

MATERIALS

For each student group:

- three torch bulbs (3-volt ratings)
- two dry-cell batteries (6-volt standard lantern batteries)
- three torch-bulb holders
- switch
- eight 25-cm lengths of insulated copper wire with both ends stripped of insulation for approximately 2 cm and crocodile clips attached to each end

HELPFUL HINTS AND DISCUSSION

Time frame: one class period
Structure: cooperative learning groups of three students
Location: classroom or lab

In this activity, students will learn how to construct parallel circuits. It is important that your students carry out the series circuit activity before attempting this activity. Point out to students the difference between a series circuit and a parallel circuit. Review the components of a circuit: a power source (dry-cell battery), electrical wires, resistors (torch bulbs), and a switch. Mention the fact that electrons moving along a wire create an electric current. Encourage students to predict before testing each circuit. Organise the class into cooperative learning teams. Stress the need to check the connections in each circuit assembled. Test the batteries and bulbs beforehand to be sure that they are in good working condition.

MEETING THE NEEDS OF DIVERSE LEARNERS

Encourage advanced students to carry out the Follow-Up Activities. They should also work with and assist peers in the cooperative learning groups.

Organise students who need extra help in cooperative learning groups with advanced students. Discuss the need for cooperation among the members of each group. You may wish to assemble a demonstration model as a visual reference.

SCORING RUBRIC

Students meet the standard for this activity by:

- constructing functional parallel electric circuits
- explaining how the various components of a parallel circuit are connected
- demonstrating understanding of why a bulb may not light up
- recording data accurately

Name _____ Date _____

8. If It Isn't a Series Circuit, It Must Be a Parallel Circuit!

STUDENT ACTIVITY PAGE

OBJECTIVE

To construct parallel electrical circuits and explain the components

BEFORE YOU BEGIN

In a previous activity, you learned how to connect lightbulbs, a battery and a **switch** in a **series circuit.** The electric current had only one path to travel through the circuit. By doing this activity, you will learn how to construct a **parallel circuit.** In a parallel circuit, each bulb is connected directly to the battery, as shown in Figure 1. You will also learn how parallel and series circuits differ. Finally, you will determine if one bulb in the circuit receives more current than the others. Just bear in mind that the more current a bulb gets, the brighter the light.

MATERIALS

- three torch bulbs (3-volt ratings)
- two dry-cell batteries (6-volt standard lantern batteries)
- three torch-bulb holders
- switch
- eight 25-cm lengths of insulated copper wire with both ends stripped of insulation for approximately 2 cm and **crocodile clips** attached to each end

PROCEDURE

Use the diagrams in Figure 2 as a guide to set up your circuits.

Figure 1: Parallel Circuits

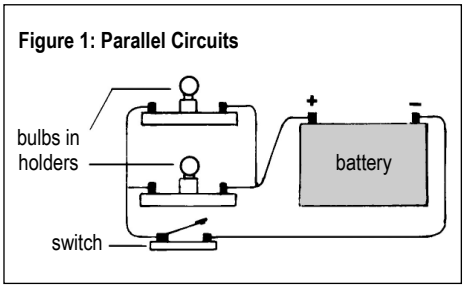
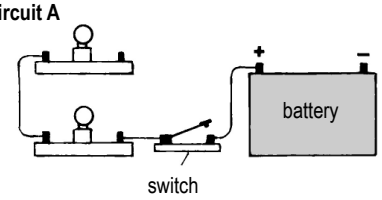
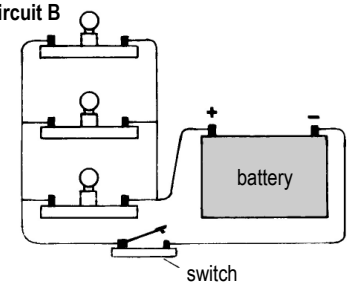


Figure 2: Test circuits

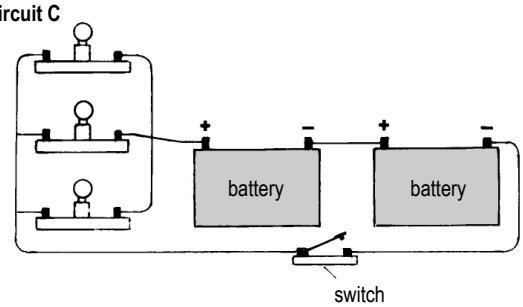
Circuit A



Circuit B



Circuit C



Circuit D