

Time

30 minutes: set-up 5-15 minutes: observations

Materials and Preparation

- 2 6 Volt batteries
- 3 small, switches
- Four flashlight bulbs and sockets
- 10' thin, enameled, copper wire
- Assorted electrical connectors
- 2 labels: "Electrical Circuit: Loads in Series," "Electrical Circuit: Loads in Parallel"
- 2 schematics

Teacher Preparation

 Attach two flash light bulbs, in sockets, in series with one switch and power source to create first electrical circuit.
Attach two flash light bulbs in sockets in parallel configuration with switches before each load. Add power source to create second electrical circuit.

The Electrical Circuit: A Quick Guide

Hands-on Activity for Understanding the Basic Elements of an Electrical Circuit.

Key Question

How can you determine if the power source on board the space station is working correctly?

Background

There are four elements that are needed for a complete electric circuit. An electromotive force, a switch, an electrical conductor, and a load. An electromotive force or emf is a source of power such as a battery or a photovoltaic cell. The switch allows power to be "turned off" or "turned on". The load can be an appliance that requires electrical power to work.

Different circuits can be wired in different ways. The loads on a circuit can be wired in a series or in parallel. A single pathway circuit through which electricity can flow is called a series circuit. A parallel circuit is a circuit where there is more than one pathway through which electricity can flow.

Teacher Notes:

- 1. There are many possible configurations to these circuits. Please proceed as economically and efficiently as possible by asking a local Radio Shack salesperson to assist you. Radio Shack is only one of a number of electrical supply vendors that may be in your area.
- 2. The symbols for electrical devices are simple and can be found by scrolling down the following URL to the section entitled Electric Circuits:

http://www.web.axs.net/jhutton/webstu3.htm#W20

 The difference between a simple circuit in series and parallel is described at: <u>http://www.yale.edu/ynhti/curriculum/units/1989/7/89.07.01.x.ht</u>

PROCEDURE FOR PART ONE

ml#b

- 1 Explore the electrical circuits. Switch on and off the switches in both the parallel and series circuits. Disconnect and reconnect one of the wires to the battery. Which type of circuit permits greater control?
- **2** Unscrew first one then the second light bulb in each circuit in turn. Which type of circuit permits greater control and safeguards?

CLOSURE QUESTIONS FOR PART ONE

1. Do you know any devices that prevent appliances from becoming overloaded in case of an electrical power surge from outside of your home?

2. How might these devices be useful on the space station following a coronal mass ejection?

3. Draw a schematic of the two circuits that were used in this exercise. You can use your own symbols. These circuits will be tested during the final exploration of compass galvanometers to measure the electrical currents at various points on the circuits before and after the flashlight bulbs.