Electric Circuits

12.2

What do MP3 players, televisions, and flashlights have in common? They all require a flow of electrons in order to operate. When you turn on an MP3 player, electrons flow from the battery through conductors and other electrical components of the player. The electrons eventually return to the battery. The flow continues for as long as the MP3 player is on, providing that the battery does not become dead. This continuous path for electron flow is an **electric circuit**.

electric circuit a continuous path in which electrons can flow

To understand how electrons flow through an electric circuit, you can think of how blood flows in the circulatory system of your body. In the circulatory system, your blood vessels are filled with blood. For example, when the heart pumps, some blood moves through blood vessels from the heart to the tips of your toes and then back to the heart. A looped set of pipes (blood vessels) creates the continuous path needed for blood to flow in the circulatory system. In the same way, current electricity must have a continuous path in order for electrons to flow. A simple electric circuit includes an energy source, a load, conducting wires, and, sometimes, a switch (Figure 1).

LEARNING TIP

Word Origins

The word "circuit" comes from the Latin word for "circuitus," which means "going around." If a circuit is open, the electrons cannot flow.

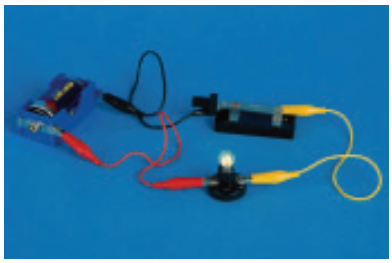

Figure 1 A source of electrical energy, conducting wires, a control device, and a load are required for a functioning electric circuit.

The energy source can be as small and portable as a battery, or as large as a generating station. The **load** is a device that transforms electrical energy into other usable forms of energy. Loads can be heaters, lamps, fans, computer hard drives, or microchips. A light bulb is an example of a load that converts electrical energy into light energy, as well as some thermal energy.

load the part of an electric circuit that converts electrical energy into other forms of energy

Conducting wires (also called "connecting wires") join all the parts of an electric circuit together. They provide a pathway for electrons to flow from one component of the circuit to another. Connecting wires are usually made of insulated copper or aluminum wires.

A **switch** controls current flow in an electric circuit. When the switch is "on," the electric circuit is closed, providing a complete path for electron flow. When the switch is "off," the electric circuit is open and the path is incomplete. Hence, there is no electric current. "On/Off" switches are used to control household devices like the flashlight in Figure 2. Switches are sometimes hidden inside an appliance, such as the switch that shuts off the hard drive of a computer when it is idle for a period of time.

switch a device in an electric circuit that controls the flow of electrons by opening (or closing) the circuit

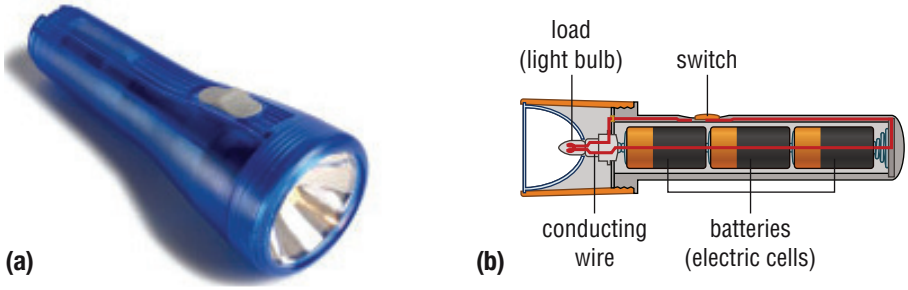

Figure 2 (a) A flashlight contains an electric circuit. (b) The batteries are the energy source, the bulb is the load, the switch controls the flow of electrons, and the connecting wires provide a closed path that joins all of the parts of the circuit together. The red line represents the continuous flow of electrons in the circuit.

TRY THIS BUILDING CIRCUITS

SKILLS: Observing, Communicating

SKILLS HANDBOOK 2.D., 3.B.6., 3.B.9.

In this activity, you will practise building your own circuits.

Equipment and Materials: 4 conducting wires with alligator clips; battery; switch; various loads (for example, miniature lamp, light-emitting diode [LED], small motor, portable electric fan)

Figure 3

1. Using the alligator clips, connect the battery to one of the electrical devices in such a way that the device works. Create a diagram to show how your circuit is connected. Label all parts.
2. Repeat step 1 using a different load.
3. Connect more than one load in your circuit and try to get the device to operate. Draw a diagram showing how you connected the circuit. Label the parts.

A. Use your diagrams to explain what components were required for your circuits to work. T/I C

B. Sort the components you used into four categories: sources of electrical energy, loads, control devices, and conductors. K/U T/I

C. What do you think would happen if you connected more than one battery together in your circuits? Try it and see. Does this affect how the loads operate? T/I

UNIT TASK Bookmark

How can you apply what you have learned about electrical circuits to the Unit Task on page 586?

IN SUMMARY

- An electric circuit is a continuous path that allows electrons to flow. It is made up of an energy source, conducting wires, a load, and a switch.
- Energy sources include batteries and generating stations.
- The load in a circuit can be any electrical device that converts electrical energy into other usable forms of energy, such as a light bulb.
- A switch is used on electric circuits to enable you to turn the circuit on or off.

CHECK YOUR LEARNING

1. Did you already know something about circuits before you read this section? How has the reading changed what you know about circuits? C
2. Copy and complete Table 1 in your notebook. K/U

Table 1 Parts of a Circuit

Part	Function
switch	
	provides a path for the electrons to flow
	transforms electrical energy into other types of energy
source of electrical energy	

3. In your own words, describe an electrical circuit. K/U C
4. A student connects a light bulb directly to an electric cell using connecting wires. She notices that the light bulb lights up. Is anything missing? Why would you consider the missing part necessary? T/I
5. A student builds a circuit that has a source of electrical energy, connecting wires, a switch, and a load. However, the circuit does not work. Suggest three possible reasons why the circuit does not work. T/I
6. Which of the following parts of a circuit would be considered a load? Justify your answer by explaining your choice(s). T/I C
   - light
   - switch
   - motor
   - battery