Chapter 2

Simple Circuits

INTRODUCTION

Electrical circuits are found everywhere in today's society. From the lights that brighten our homes, to the ovens that cook our food, to the televisions, radios, and video games that keep us entertained at home and in the car, hundreds of everyday items rely on electricity and electric circuits to do useful work.

In this chapter we'll learn more about electricity and build working electric circuits!

Goals of this Activity

When you have completed this Activity, you will be able to:

1. Identify the three parts of a simple electric circuit:
   - the energy source
   - the circuit path
   - the load
2. Build a simple circuit using the PowerPage.
3. Describe the difference between an open and closed circuit.

Parts of a Circuit

Electricity is a form of energy that travels through conductors in electric circuits. Under normal conditions we can't see, hear, or smell electricity, but we know that it can do useful work. Electric circuits are made of three connected parts:

1. An energy source, such as a **battery**,
2. A conductive path for the electric energy to follow or flow through, such as a wire, and
3. Devices that control the flow of electricity, such as a **switch**, or loads that use electricity to do work, such as a lamp.

Definitions and Symbols

We will use the following new terms in this chapter.

Closed Circuit

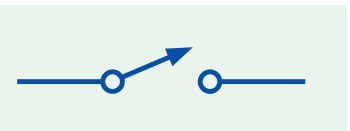
A closed circuit is an electric circuit through which electricity flows. Electricity flows from an energy source through conductors and loads and back to the source. Think of circuit like a circle. Electricity will only flow when there is a completely connected circuit.

Open Circuit

An open circuit is an electric circuit that is not completely connected. Electricity cannot flow in an open circuit.

Switch

A switch is a device in a circuit that can stop and start the flow of electricity. Switches are used to open and close circuits. When you turn on a light in your home, you are closing (completing) a circuit allowing electricity to flow through the light.



Activity 1 Simple Circuits

You will need these parts to complete this Activity:

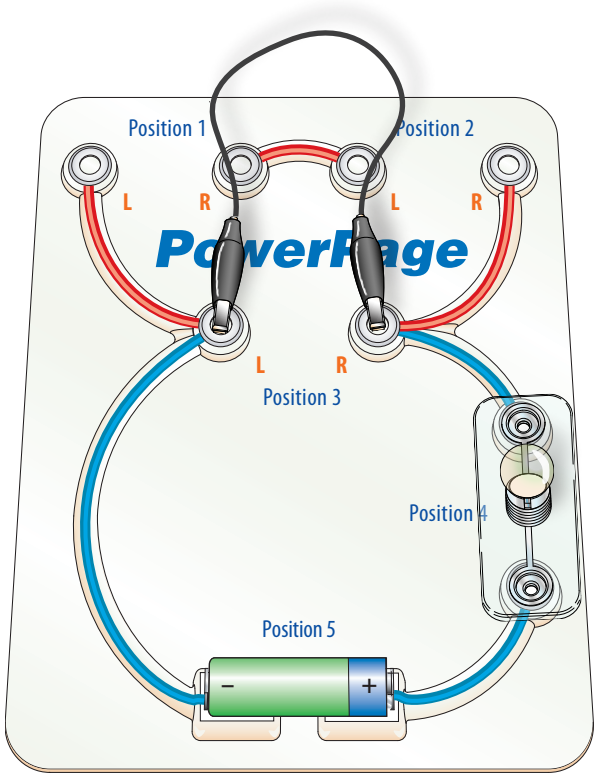
- 1 Battery
- 1 Lamp
- 1 Jumper wire with alligator clips

1. Place the battery in Position 5 with the positive terminal on the right.
2. Place a lamp in Position 4. Does it light up? Why or why not?
3. Take one of the jumper wires and clip one side to Position 3R (right) and clip the other side across Position 3 to 3L (left).

   Does the lamp light up? Yes, the lamp lights because you have made your first working electric circuit!

   Electrical energy is flowing from the battery through the lamp and back to the battery. You have made a closed circuit. That means you have made a *complete* circuit (remember: a circle) with the path of electricity.
4. Disconnect the jumper wire from Position 3L.

   What happened? Did the light stay on or go out? You have just created an open circuit. You opened the circuit path. Now electricity cannot flow and do its work.
5. With one side of the jumper wire still connected to Position 3-R, connect the other side of it to Position 2-R, then to 2-L, 1-R and finally to 1-L. When did the light come on? Can you trace that circuit path? Which circuits were open and which were closed?
6. Disconnect the jumper wire.
7. Remove all parts and return them to the tray or go on to Activity 2 when you are ready.

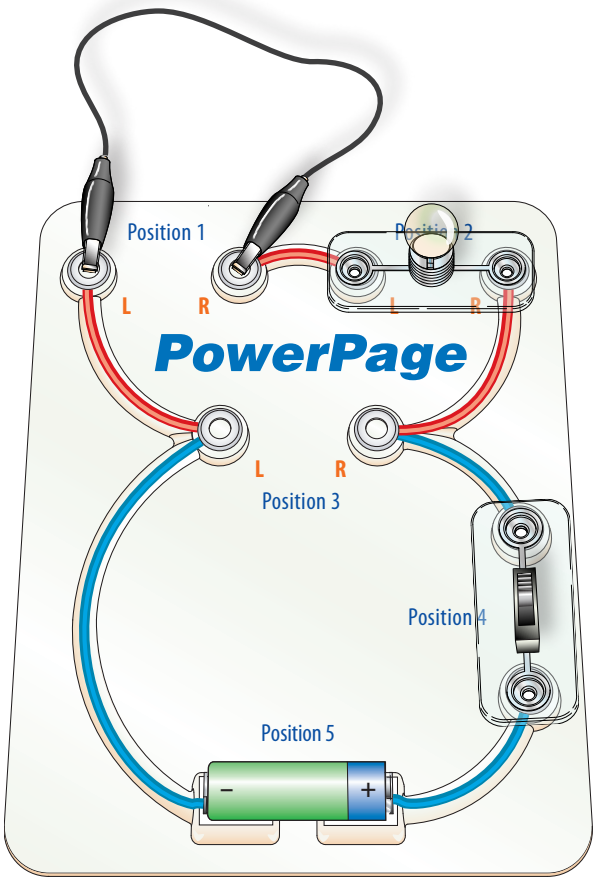


Activity 2 Lamp

You will need these parts to complete this Activity:

- 1 Battery
- 1 Lamp
- 1 Jumper wire with alligator clips
- 1 Slide switch (fixed)

1. Place the battery in Position 5 with the positive terminal on the right.
2. Place the slide switch in Position 4. Slide the switch into the OFF position.
3. Place a lamp in Position 2. Does the lamp light up? Why not? Electricity is not flowing because you still have an open circuit. That means you do not have a complete circuit through which electricity can flow.
4. Place one of the jumper wires across Position 1 (clip one side to Position 1R and clip the other side to 1L). Slide the switch to the ON position. The lamp should light up because you have closed the circuit. Electrical energy is flowing—from the battery through the PowerPage wires, through the switch, then through the lamp, the jumper, and back to the battery.
5. Using the switch, you can turn the light on and off. This works just like the wall switches and lights in your home and classroom. Remember, a switch is a device that opens and closes a circuit. Can you trace the circuit path starting with the battery?
6. Place the switch in the OFF position.
7. Remove all parts and return them to the tray or go on to Activity 3 when you are ready.

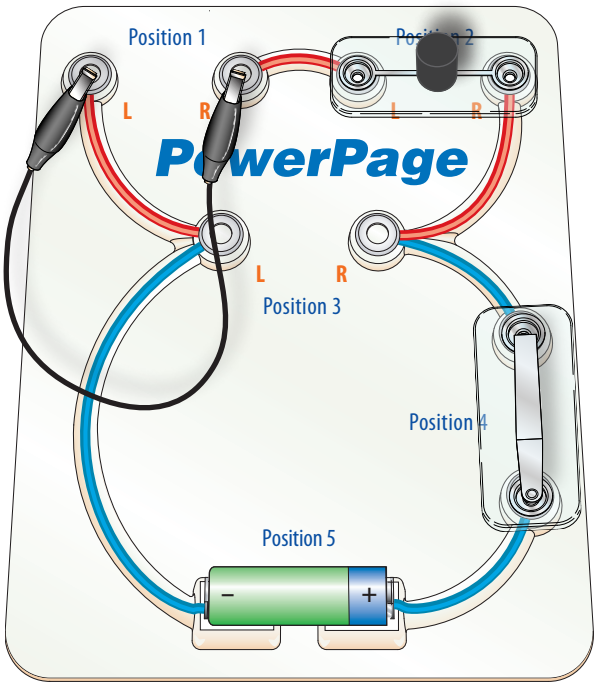


Activity 3 Buzzer

You will need these parts to complete this Activity:

- 1 Battery
- 1 Buzzer
- 1 Jumper wire with alligator clips
- 1 Push switch (momentary)

1. Place the battery in Position 5 with the positive terminal on the right.
2. Place the push switch in Position 4.
3. Place the buzzer in Position 2 with the "+" side to the right. Press down on the push switch. Does the buzzer make a sound? Why not?
4. Take one of the jumper wires and clip one side to Position 1R and the other side across Position 1 to 1L. Now press down on the push switch. Does the buzzer make a sound now? Yes, because you have made a complete circuit! The electrical energy is now flowing from the battery through the buzzer, doing its work of making sound.
5. Let up on the push switch. What happened?
6. Using the push switch and the buzzer you can send signals like Ham Radio operators do with Morse Code (see table). Each time you close the circuit, the buzzer makes a sound. Each time you let up, you open the circuit and the buzzer stops buzzing. Can you signal your name in Morse Code?
7. Remove all parts and return them to the tray. Complete the reading and questions at the end of this chapter.



Morse Code

A	•–	E	•	I	••	M	––	Q	––•–	U	••–	Y	–•––	3	•••––	7	––•••
B	–•••	F	••–•	J	•–––	N	–•	R	•–•	V	•••–	Z	––••	4	••••–	8	–––••
C	–•–•	G	––•	K	–•–	O	–––	S	•••	W	•––	1	•–––––	5	•••••	9	––––•
D	–••	H	••••	L	•–••	P	•––•	T	–	X	–••–	2	••–––	6	–••••	0	–––––

Did You Know?

All conductors and loads offer at least some resistance to the flow of electricity. This means they try to hold back the flow of electricity. Some have more resistance than others. Because of this resistance, electricity will always flow through the easiest path. In other words, it prefers to flow through the path of least resistance. So, the path of least resistance ends up carrying the most electric current.

Resistance is like friction and causes heat to be produced. The more current flowing through a conductor, the more heat is produced. Sometimes this is a good thing. For example, the burners on an electric stove are big resistors. They generate the heat we need to cook our food.

If a material has a very large amount of resistance, it is said to be an insulator. Insulators completely prevent the flow of electricity. We'll learn more about insulators in Chapter 4.

Questions

1. Name the three parts of a simple electric circuit.
2. What energy source did we use in our activities?
3. Does electricity flow in an open circuit? Why or why not?
4. The load in a circuit uses electricity to do work. Loads can give us light, keep us warm or move us from one place to another. Name two things that move us from one floor to another in a building. (*Hint:* They are both powered by electric motors.)

Challenges

1. With an adult's help, find a non-rechargeable flashlight at home and take it apart. See if you can find the source of electric energy and the device (load) that does something useful for you. Do you see evidence of a path through which current can flow? Can you find a part of the flashlight that controls the flow of electrical energy?
2. Who was Samuel F.B. Morse and for what is he most famous?