

TWO LIGHT BULBS AND A BATTERY: AN ELEMENTARY CIRCUITS ACTIVITY*

Darryl Morrell

This work is produced by OpenStax-CNX and licensed under the Creative Commons Attribution License 2.0[†]

Abstract

In this problem-based learning activity, you will experiment with a battery and light bulbs to build your own flashlights. The purpose of the activity is to develop understanding of fundamental electrical circuit concepts, including voltage, current, and closed circuits, and to help eliminate common misconceptions.

NOTE: Development of this material was supported by the Arizona Board of Regents' Learner Centered Education Grant Program, Grant #11BU06.

NOTE: Instructor information for this module is available here¹.

1 Introduction

The objective of this problem based learning activity is to create several simple electrical circuits with light bulbs and a battery. The purpose of the activity is to introduce you to several fundamental concepts in electrical circuits and identify and correct some potential misconceptions that you may have about electrical circuits.

2 Lighting One Bulb

Suppose you are driving late at night along a dark road and your car suddenly stops. Hoping to figure out what is wrong with the engine, you grab your flashlight and step out of the car, but accidentally drop the flashlight on the the pavement where it breaks into several pieces. You retrieve a battery and a light bulb from the black top. You have a few wires in the glove box leftover from your attempt to install a stereo. Can you use the battery, light bulbs, and wires to create enough light to check your engine?

2.1 Preliminary Reading

Before beginning the activity, read this description of a light bulb². Pay particular attention to the figure of the light bulb-how is the filament connected to the two contacts?

*Version 1.1: Mar 6, 2007 5:29 pm -0600

[†]<http://creativecommons.org/licenses/by/2.0/>

¹"Two Light Bulbs and A Battery: an Elementary Circuits Activity (Instructor Information)"

<<http://cnx.org/content/m14369/latest/>>

²<http://home.howstuffworks.com/light-bulb.htm>

2.2 Additional Reading Resources

The following resources give additional information about circuits, and you may find them useful and interesting either before or after the problem based learning activity.

- The concepts of voltage and current³
- Brief definitions and descriptions of voltage and current⁴
- Extended definitions and descriptions of voltage, current, and resistance⁵
- Basic ideas and definitions associated with circuits⁶
- Information about using multimeters is here⁷ and here⁸ .

2.3 Preliminary Questions

Before beginning the activity, answer the following questions:

1. On Figure 1, mark the path that electricity takes through the light bulb.
2. Sketch how you could connect a wire, battery, and bulb to light the bulb.

Discuss your answers with your team.

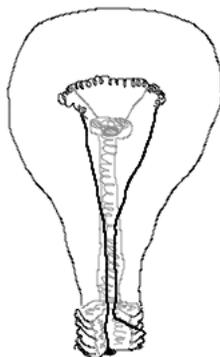


Figure 1: Cutaway drawing of a lightbulb.

2.4 Activity

Working in your team, connect the battery and light bulb using wires so that the light bulb is lit. Once you create a working circuit, try disconnecting each wire in your circuit (and then reconnecting it); what happens?

³"Voltage, Current, and Generic Circuit Elements" <<http://cnx.org/content/m0011/latest/>>

⁴http://en.wikibooks.org/wiki/Circuit_Theory/Variables_and_Units

⁵http://www.lightandmatter.com/html_books/4em/ch03/ch03.html

⁶http://en.wikibooks.org/wiki/Circuit_Theory/Circuit_Basics

⁷<http://en.wikipedia.org/wiki/Multimeter>

⁸<http://www.doctrionics.co.uk/meter.htm>

2.5 Post-Activity Questions

1. Sketch your working circuit-how is it different from your initial sketch? Why is it different?
2. What path does electricity take through the light bulb?
3. What path does electricity take through your working circuit?
4. An electrical schematic is a symbolic representation of a circuit. Figure 2 shows schematic symbols for a battery and a light bulb; lines between the symbols represent wires. Draw a schematic that represents your working circuit.

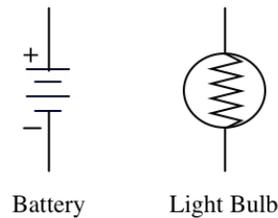


Figure 2: Schematic symbols for a battery and a light bulb.

3 Lighting Two Bulbs

After you successfully light up the bulb, you discover that it is too small to illuminate the engine compartment. You remember that your flashlight had a spare bulb; you eventually locate it and try to create a circuit that generates twice as much light.

3.1 Preliminary Question

Before beginning this portion of the activity, complete the following preliminary question:

1. Sketch how you will connect wires, the battery, and both bulbs so they both light and provide more light than a single bulb.

Discuss your sketch with your team.

3.2 Activity

Working in your team, find two different configurations in which the battery, wires, and lights are connected so that both bulbs light. For each configuration,

- Draw a schematic diagram.
- Note the brightness of both light bulbs.
- Measure and record the voltage across the battery terminals.
- Measure and record the voltage across the two lightbulbs.

3.3 Post-Activity Questions

1. Which configuration provides the larger amount of light? Can you relate this to the voltage across the light bulbs?