



Throughout the guide teaching tips are in red.

Activity Description and Estimated Class Time

In this 50 minute activity, students are challenged to make a light bulb illuminate using a battery, a wire, and a light bulb. In the process, they understand that electrical circuits require a complete loop for an electrical current to pass. Students demonstrate understanding by completing an electrical current diagram.

Objectives

Students will develop an understanding of the following ideas and content:

- Electrical circuits require a complete loop for an electrical current to pass.
- Energy can exist in different systems, and can be transferred from one system to another.

Correlations to North Carolina Science Standards

7.P.2.3 Recognize that energy can be transferred from one system to another when two objects push or pull on each other over a distance (work) and **electrical circuits require a complete loop through which an electrical current can pass.**

Brief Science Background

Electrical circuits are a way to transfer energy from one system to another. In the case of a battery and bulb, energy moves from a chemical system inside a battery to a system inside a bulb that produces light. However, the electricity can only move when it has a continuous, unbroken path through a material that can conduct electricity, such as a wire. Every part of the path contacts a conductor that leads through the battery and the object that is using the electricity, such as a bulb or a motor. When they are all connected, all of the elements of the path conduct electricity, including the battery, the wire, and the bulb.

Part 1 – Light the Bulb Challenge (50 minutes)

Materials and Procedures

Materials for the whole class

- Support Document-1(SD1) Electrical Circuit Diagram

Materials for groups of 2 students

- 1 wire
- 1 AA battery
- 1 light bulb
- Science notebook (for each student)*

* Item supplied by the teacher

Procedure

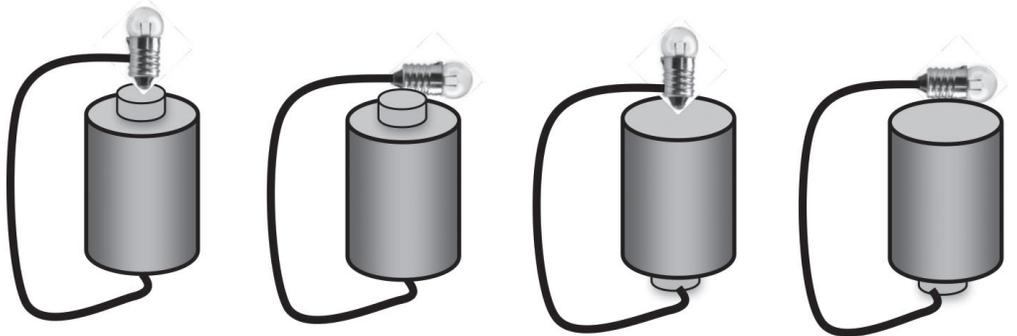
1. Inform students that they will work with a partner to solve this problem: Using only one wire, one light bulb, and one battery, get the bulb to light.



2. As they puzzle through the challenge, ask them to keep track of every attempt in their notebook, especially the ones that don't work. Ask students to draw a diagram for each attempt, whether it is successful or not.
3. Hand each pair of students one light bulb, one battery, and one piece of wire and let them begin.

This challenge can be frustrating. Allow time to explore and experiment. Avoid giving hints. Eventually all pairs will get the bulb to light.

4. As students work, be sure they record all results in their notebooks. **NOTE: For students who light the bulb, to save batteries and bulbs, ask them not to keep the bulb lit.**
5. At some point, a pair of students will get the bulb to light. When they do, challenge them to find three other ways, using the same materials, to get the bulb to light. There are 4 ways.



6. To help students who are struggling, allow them to ask one question that would help them move forward. After they ask the question, have a student who has successfully completed the challenge answer it.
7. Continue until every group has lit the bulb.
8. Lead a discussion and have students report how they went about solving the problem.
9. Project SD1 and introduce the idea of a circuit and how it is necessary for the electrical current to pass.
10. Give out SD1 to each student. Their job is to add arrows to the diagram inside the circles showing the path and direction of the electricity at each point.

Allow students to ask questions as they attempt to complete the diagram. For example, students may not know that electrons move from (-) to (+).
11. Ask students to look at their notebook and identify an attempt to light the bulb that failed. Ask them to explain why the attempt failed and what they did or could have done to correct it. Have several students share failed attempts and ask the class to discuss why it failed.
12. The following explanation is necessary to meet the part of standard 7.P.2.3 that deals with electricity and energy transfer.
 - Hold up a battery and ask how the class knows it has energy. **It does things when connected (lights a bulb, runs a motor, etc).**
 - Ask what kind of energy it has. **Students will have many different answers, but the most common is electric.** Ask what electrical activity they see in the battery. **None.**



- Connect the battery to a bulb and ask what kind of energy the bulb has when lit. Ask how the energy gets from the battery to the bulb. **Through the wires.**
- Explain: Batteries contain chemicals that react when the terminals are connected to something that conducts electricity. The chemical reaction transfers electrical energy into whatever conductor (such as a wire) is connected to the terminals. In the process, the energy changes from one form to another **[from chemical to electrical to light]**.

Teaching Opportunity: The kit comes with working batteries and bulbs. However, bulbs may burn out and batteries may go dead. It is possible that some students may have the set-up correct but the bulb may not light. If this happens, guide students to identify the problem and try a different bulb or battery to confirm.

