

Completing a Circuit

FRAMEWORK

I. Scientific and Engineering Practices

II. Cross-Cutting Concepts

III. Physical Sciences

SKILLS/OBJECTIVES

The goal of this lesson is to introduce electrical circuits and explain their importance in our everyday lives. The students should learn how light bulbs are able to light and the ways in which a simple electrical circuit works.

MATERIALS

- Materials List
- For all activities and demos
- With needed amounts assuming 15-20 kids

NOTES

- Activity 3: This activity is aimed for 10 and 11 year olds; however, younger students are capable of completing this activity with the aid of an older student or adult. Younger students should be placed into groups of 4-6 while older students can be placed in groups of 3-4. This lesson should last about 20 minutes to half an hour long. Not much prepping needs to be done for this activity, except for cutting up the aluminum foil.
- Some material substitutions: 2 paper clips can be substituted in place of the aluminum foil and different batteries can be used to test the brightness of the light bulb depending on the battery used.

BACKGROUND

- This lesson will introduce the idea of more complex uses of electricity. It will show the students how electrical circuits are used to produce heat, light, sound, and magnetic effects.
- Ask students: what is electricity? How does electricity work? What do we use electricity for/what is the purpose of electricity? What are electrical circuits? Why are electrical circuits necessary in generating electricity?
- For a circuit to function, both the + and - sides of the battery must be connected so that the electrical energy has a path to follow.
- To connect both sides of a battery, you must use conducting materials, which are materials that allow electricity to flow through it. For example, metals are good conductors, but paper is not.

| Activity #1 | Flashlight |
|-------------|---|
| Materials | <ul style="list-style-type: none">- 1 flashlight- batteries for flashlight |
| Worksheet | No |

- Take apart a simple flashlight to show the students how a flashlight works.
- Explain the circuit within a flashlight. Show how the positive and negative sides of the batteries match up to connect the whole circuit. Explain how a flashlight represents a simple form of electricity but light in our classrooms and houses are designed in a similar fashion, using circuits to generate electricity.

| Activity #2 | Electrical Circuits |
|-------------|--|
| Materials | <ul style="list-style-type: none">- 4 different groups of index cards with a "+", "-", " |
| Worksheet | No |

- Depending on the number of students you have, **pass out the 4 different types of index cards so that there is the same number of each one out there.** (Note: If there is an odd number of students or a number of students that is not a multiple of 4, pass out more wires/batteries than any of the other three cards, since there can be more than one wire or more than one battery in a circuit.)
- Explain to the students that their goal is to **find at least 3 other people to complete a circuit with.** In order to complete the circuit, they need to have a "+", "-", at least one wire, and at least one light bulb in the group. The "+" and

the “-“ must both connect to the light bulb in some way to make the circuit work.

| Activity #3 | Electrical Circuits |
|-------------|--|
| Materials | <ul style="list-style-type: none"> • A big plastic ziplock bag to resemble their “backpack” • Batteries (C, D, or AA) • Small light bulb from a flashlight (or different sized light bulbs) • Piece of aluminum foil (about 4 inches by 12 inches) • 12 paper clips, or short wires • A few index cards • Picture of Lechuguilla Cave (Printed out) • Worksheet for drawing pictures of which circuits worked and which circuits did not work (this can be a blank piece of paper) • Pencils to write/draw with |
| Worksheet | Yes (need to create) |

- Begin the activity by setting up a scenario for the students. First, **split the students up into group of 3-6, depending on the age group.** Then, **tell the students to pretend that he/she and his/her group members are exploring a cave.** *(If you want to, you can say that they are exploring Lechuguilla Cave, the sixth longest cave (130.24 miles (210 km)) known to exist in the world, and the deepest in the continental United States (1,604 feet (489 m)), in New Mexico. Show a picture of this cave. Not necessary though.)*
- All of a sudden, the person leading the group walks into an overhanging rock and the light on their helmet breaks. All they have left is their “backpack”, which includes a few different sized light bulbs, a few C/D/AA batteries, some paper clips, a few index cards and the aluminum foil left over from their turkey sandwich lunch.
- **Pass out the materials to each group.** Explain to the students that their task is to light the light bulb using the materials in their backpack (aluminum foil, battery, and light bulb are the key elements to completing the circuit).
- **Hand out the worksheet at the beginning of the activity and tell the students to draw and label their circuits.** Explain which ones worked and which ones did not work.
- **Fold the aluminum foil several times to make a strip 12 inches long and about ½ inch wide**
- **Set the battery on one end of the strip**
- **Hold the metal base of the light bulb to the other end of the battery**

- **Touch the metal base of the light bulb with the aluminum foil strip**
- This can also be done by splitting the strip of aluminum foil into two separate strips and touching one strip from the light bulb to one end of the battery and the other strip from the light bulb to the other end of the battery
- If there is extra time, **ask the students to try different battery sizes to see how that affects the brightness of the light bulb**
- **Try using different sized light bulbs and adding wires to make more complex circuits**
- Why did this activity work? The aluminum foil strip makes a path for the energy in the battery to follow. The energy flows from the battery through the aluminum foil to the light bulb. This energy will light the light bulb. It is necessary that both sides of the battery are connected in the circuit, or else it will not work. Explain that the index cards would not work in the circuit because they are not good conductors of electricity. Metals are good for conducting electricity and for passing electrical energy through a circuit. Explain that electrical circuits are used almost everywhere we go. Give examples to the students and ask them where they have seen electrical circuits or just electricity in general.

CONCLUSIONS

- For a circuit to function, both the + and - sides of the battery must be connected so that the electrical energy has a path to follow.
- To connect both sides of a battery, you must use conducting materials, which are materials that allow electricity to flow through it.
- We use circuits to power our electrical appliances, like the lights in the ceiling and our flashlights.