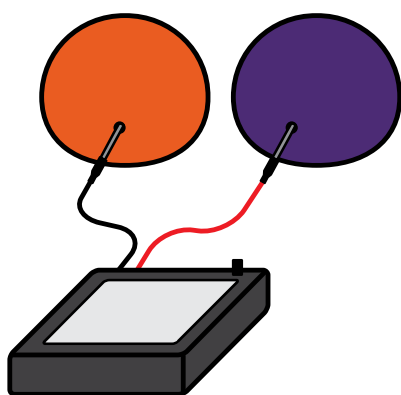


Lesson 1: Sculpting Your First Circuit

Summary and Background Knowledge

In this lesson, students will create a functioning electrical circuit using a battery pack, LEDs, and conductive and insulating play dough. By completing student-led experiments, groups of two to three students will work together to attempt to light their LED up using the materials listed above.

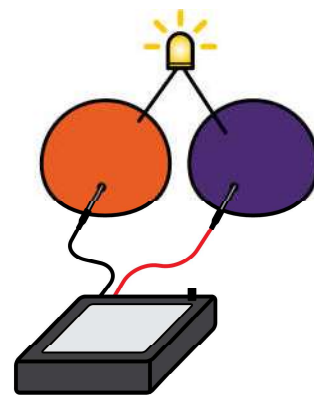
At the most basic level, electricity is a stream of small bits of electrical charge, called electrons. These electrons flow through components and cause them to do work. For example, when they flow through a light bulb, they produce light. These electrons move through conductors. When building a Squishy Circuit, the play dough replaces the wires typically used in the circuit, making them more user-friendly and familiar to students.



Let's investigate a simple circuit using Squishy Circuits. With the conductive dough, create two pieces of dough (they can be any size or shape). Insert one wire from each side of the battery terminal into each piece of dough.

Now, create a bridge across the two pieces of dough with an LED (separate the legs if necessary) so that the electrons can flow through the LED to the other side and back to the battery pack. Way to go! You have created your first Squishy Circuit!

The LED is lighting because the electrons are flowing from the battery pack, through the wire and into one piece of conductive dough, through the LED into the other piece of conductive dough, and finally back to the battery pack. It can be helpful to visualize the circuit as a circle of electrons. Since the electrons can flow in the circuit, it's called a closed circuit.

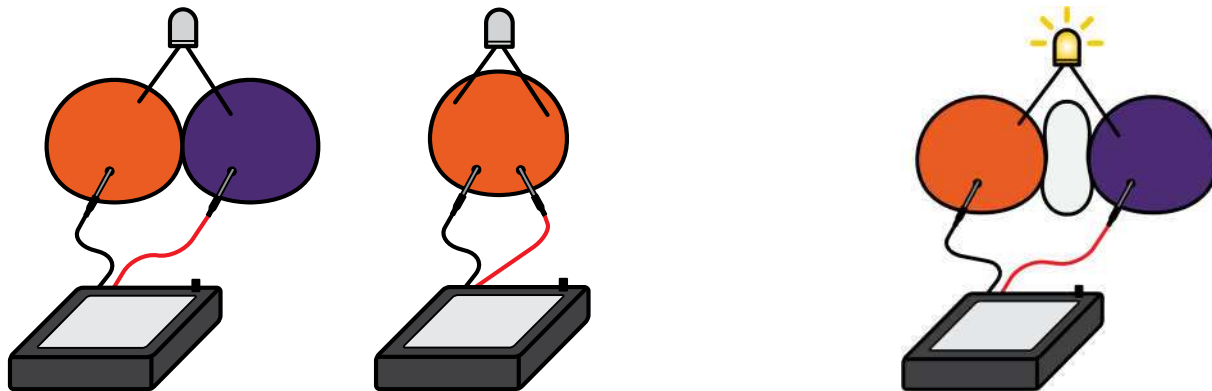


Reminder –

LEDs have polarity, which means they only operate if inserted correctly in the right direction. The longer leg should go into the dough with the red wire. You can just try switching the LED around if it's not working.

An open circuit means that there is not a path for the electrons to flow. Try taking out one leg of the LED and you'll notice that it turns off. This is because there is no conductor for the electrons to flow through to complete the circuit.

First time Squishy Circuit users often create short circuits when exploring. These are circuits in which the electrons can simply bypass the LED and go through the conductive dough to close the circuit. Since no electrons are flowing through the LED, it stays unlit. They can be fixed by separating the two pieces with air or the white insulating dough.



Now try getting more creative with your circuits and replacing the LED with a motor or buzzer. Does polarity matter with them also?

Applicable Vocabulary:

- Closed Circuit
- Open Circuit
- Short Circuit
- Polarity
- Insulating material
- Conductive material

Main Objective:

Upon completion of this activity, students will be able to construct a working (input results in a desired output) closed circuit using the materials provided with a Squishy Circuit kit. Students will be able to demonstrate an understanding of a closed vs. open circuit as well as conductive and insulating materials by completing a variety of student-led, inquiry-based experiments. They will also be able to describe the basic flow of electricity and why these circuits are working.

Materials:

- Insulating dough (roughly $\frac{1}{4}$ cup per pair of students)
- Conductive dough (roughly 2 cups per pair of students)
- 1 battery pack with four (4) AA batteries
- At least two light emitting diodes
- Optional: motors, fans, buzzers, and switches
- Student science journal or provided handout

Time:

- Pair students and hand out materials: 5 minutes
- Discovery time (Steps 2-3): 10 minutes
- Sharing: 5 minutes
- Redesign, retest: 10 minutes
- Data recording: 5 minutes

Total Time: 35 minutes

Instructor Procedure:

1. After students have been divided into pairs or trios, provide each student with the materials listed above
2. Provide students with the following directions:
 - a. *With your partner, discuss different ways you think you could make the LED light up. (Use this time to investigate your materials, but don't hook anything up yet)*
 - b. *Draw in your science journal how you will attempt to solve the challenge: "Make your LED light up using only the materials in front of you."*
 - c. *Using the materials, work with your partner as a team to create working circuit.*
3. Spend time wandering the classroom to identify student misunderstandings, comprehension, and answer questions as well as ask questions. *Provide guidance as you see fit.*
4. When students have completed the challenge, ask pairs to share with neighboring groups. Allow students one minute to do this.
5. Bring the class together. Invite a few groups to share.
6. Provide students with another challenge: *"Using what you learned from the first challenge as well as hearing from your classmates, design a new way(s) to make your LED's light up."* Encourage students to plan and document in their journals or handout as a way of emphasizing the engineering design process.
Optional: Allow groups to join together.