



Circuits and Our Environment (Resource Exchange)

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Circuits and Our Environment.

Circuits consist of a closed path along which an electrical current can flow. All circuits must have a voltage source which provides power, a conductive path that the current will follow, and a load which consumes the power. In this activity, students will use batteries as their source of energy, either conductive dough or binder clips as their path, and light emitting diodes as their load. This lesson will teach students a basic understanding of circuits, demonstrate multiple ways to create functioning circuits out of real world materials, and discuss how circuits and electricity can apply to the world around them.



Grade Level

Designed for 3rd-5th grade students.



Goal

Connect what we have learned about electricity and circuits to real world applications.



Estimated Time

45 minutes - 1 hour

Objectives:

Students will be able to demonstrate knowledge of how circuits function.

Students will be aware of multiple ways to create circuits with household materials.

Students will be able to make connections between what they create during the lesson to applications in the real world.

Next Generation Science Standards:

4-P S3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric current.

4-P S3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Materials/Resources:

Presentation on basic circuitry
For conductive dough circuits:
Water
Salt
Flour
Vegetable oil
Measuring cups
Bowls for mixing
Food coloring (optional)
Battery packs
LEDs

For scrappy circuits:

Cardboard pieces (2 to 3 in squares)
Cell batteries
LEDs
Binder clips

Academic Language:

Circuits
Voltage
Parallel
Series
Conductive
Insulating

Assessment (Did we meet these objectives and how?):

Observations during circuit construction
How did students problem solve when they couldn't figure out why their circuit was not functioning correctly?
How did students collaborate with each other to show what they have learned?
Were students able to apply what they learned with the conductive dough when they built their scrappy circuits?

Equity Measures/Differentiation:

Students will be given time to discover how to create their circuit by themselves, with guidance from students around them or from educators as necessary.

Students who have a background understanding of circuits may get their dough or scrappy circuits working faster, and educators can encourage them to try to lengthen their circuit or connect more LEDs to their circuit.

Students who struggle to create an open circuit (a functioning circuit that lights the LED) may be helped by their peers or educators. The focus is to play around with the circuit and see what makes it work or not work, rather than to have the students get to the initial circuit by themselves.

Contingency Plan:

Students may work in small groups to collaborate with one another. Those that finish early are encouraged to consider if they made their circuits in parallel or in series, and if they can create a circuit in the other form as well. Encourage them to make circuits out of shapes that aren't circles, or to team up with other students to create more powerful circuits.

Observations and questions during final discussion:

What kind of materials do students think are conductive and why? How did this impact how they began to make their circuits?
What kind of circuits do they use in their daily life?

Lesson Plan.

Prep:

- Gather supplies
- For conductive dough: recipe is 2 cups of flour, 2/3 cup of water, 1/3 cup of oil, and 2 tablespoons of salt. Food coloring may be added to the water to color the dough.

Learning Plan:

Opening/Motivation: 5 minutes

- Ask students if they can think of any examples of circuits in their house

Presentation/Instruction: 10 minutes

- Talk about circuits and their necessary components
- Use diagrams to show how electric currents flow through circuits from the positive end (the voltage source) to the negative end (the ground)
- Talk about materials that are conductive and why (we are making dough with salt, would it still work with sugar instead of salt?)
- Talk about insulating materials and their uses
- Describe parallel and series circuits and show a diagram of each

Structured Practice:

20 minutes

- Have students mix their dough to get the correct consistency
- Encourage students to set up a circuit so they can light their LED using the dough
- Once they have their circuits set up (most do parallel first), challenge students to try circuits in series or to add more LEDs to their original circuit

15 minutes

- Transition to scrappy circuits: describe how they are using a cell battery instead of a battery pack, ask them to describe what they could make a conductive path out of instead of using the dough
- Have students create their circuit
- Discuss why the battery must be turned to a certain side for the circuit to be complete and why the positive and negative sides make the circuit run

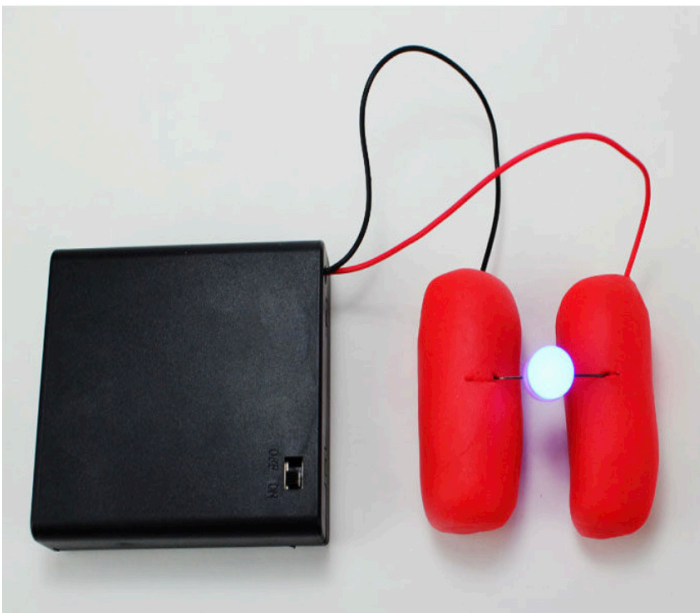
Closing: 10 minutes

- Discuss the two types of circuits they made and talk about similarities and differences between the two
- Ask students for examples of circuits that they recognize in their house, school, or around them in other parts of their environment
- Talk about the necessary components of circuits again and ask what fulfills each component in the examples they think of

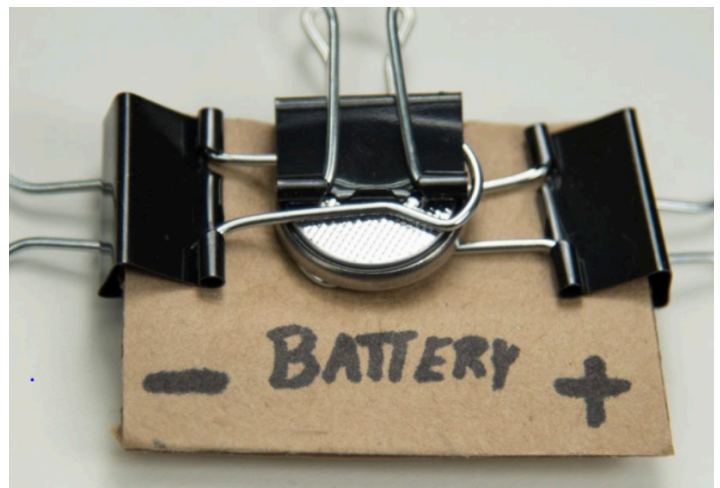
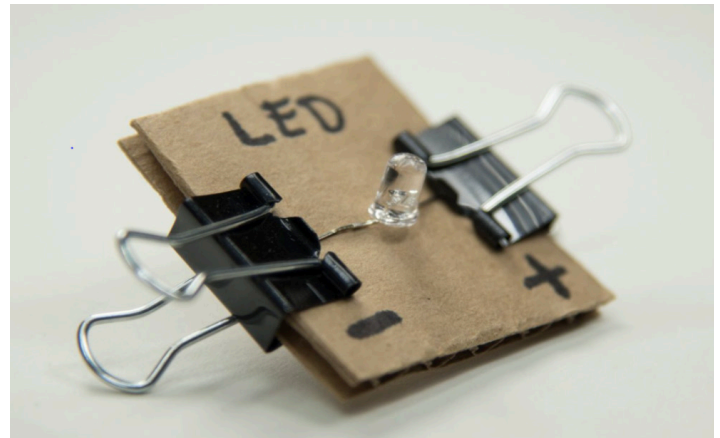
Additional Notes:

Encourage students to be creative with their dough or cardboard: there are many ways to create complete circuits, and they do not all have to look like their neighbors.

The biggest part of this lesson should be the applications to common situations so that circuits don't seem strange. We want to emphasize that there are circuits in every house, building, and appliance that they use, and these are only two fun ways to create them. The connection will help them understand that there are applications of engineering and electricity that go beyond the abstract ideas they might have.



Conductive dough connected to a battery pack lighting up an LED light.



Scrappy Circuits LED and Battery setup for reference.