

**BUILDING ELECTRIC CIRCUITS** 



## LEARNING OBJECTIVES

Youth will design a circuit and learn how the circuit affects the flow of current. Youth will investigate series and parallel circuits and their effects in current flows.

### **LIFE SKILLS**

- Critical Thinking
- Problem Solving
- Decision Making

#### SUPPLIES

- Folder
- Aluminum foil
- Diodes
- Clear tape
- Brass fasteners/brads
- 9V battery

#### TIME

30-45 Minutes

### **STANDARDS**

HS-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

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# BACKGROUND

Today you will explore the differences between series and parallel circuits by building your own. For your first circuit, please follow the diagram design that will be shown to you. After you make the additional design, get creative! Explore the effects of changing your circuit design –make sure you record all your observations. By adding more lights to the circuit, the dimmer they will shine due to the sharing of energy, if you add more batteries to the equation, it will cause the lights to brighten.

## DO

- 1. Cut the aluminum foil into 1-2-inch-wide strips to serves as your wires.
- 2. Tape the foil on top of the folder in a rectangle to make a series pathway. Leave spaces for where your switch, light, and battery will go.
- 3. At one of your gaps, punch a brad through one end of the foil and fold securely. Use a second brad do the same on the other side. Punch it through from the opposite side with a third brad and fold it down between the two other brads and pieces of foil. This way, it can be twisted to have the ends touch the brads and be a closed switch, or it can be twisted to not be touching to be an open switch.
- 4. At another gap, tape a light to connect the space between the foil. Place the exposed wire ends under the foil and tape down over the foil.
- 5. At your final gap, place a 9V battery vertically so that each terminal touches some of the aluminum foil you taped down to connect the ends. Do this with the switch open.
- 6. Once everything is in place, close the switch and observe what happens.
- 7. Experiment with the circuit. Open and close your switch. Change out the battery with one with a different voltage. Add more lights. Take notes of what you changed and record your observations.
- 8. On the other side of the folder or on a different folder, use the same method to assemble a parallel circuit. Record your observations.
- 9. For an additional challenge, create a parallel circuit that allows one light bulb to be one while another is off. Record how you made this happen.



- 1. To make this simplest circuit setup possible, what did you have to include in your design.
- 2. Explain the different results you observed when the brad switch was opened vs. closed.
- 3. Describe what you observed when you manipulated your initial series circuit. What would happen if you added more lights? What would happen if you changed the battery? What else did you do to experiment with the circuit?
- 4. Sketch the initial series circuit you made below.
- 5. How did you set up the parallel circuit differently form the series?
- 6. Describe what you observed when you manipulated your initial parallel circuit.

# APPLY

Many things you use in your everyday life are powered by electrical circuits, from your cellphone and computer to the lights in your phone. It is important to know that designing safe and effective circuits requires knowledge of how circuits and electrical currents work. How could you use this in your everyday life?

## **RELATED CAREERS**

**Electrician**- a person who installs and maintains electrical equipment.

**Linesman (Power-line Technician)** - one who sets up or repairs electric wire communication or power lines. **Electrical Engineer** - concerned with studying, designing, and applying equipment, devices, and systems that use electricity, electronics, and electromagnetism.

**Renewable Energy Technician** - set up and inspect their equipment, make adjustments to the equipment, and perform some maintenance and minor repairs.

## **COMMUNITY PARTNERSHIPS**

Use the following to make a connection in your local community. You can have a professional come in to demonstrate what they do, speak about their career path, and more!

- Alliant Energy Iowa Communities
- MidAmerican Energy
- Job of a Lineman | Lineman Central

Alliant Energy - Alliant Energy Community

## STUDENT EVALUATION

RESOURCES



- To make the simplest circuit setup possible, what do you need?
- I feel comfortable creating a simple circuit. Yes or No.
- I am interested in STEM (Science, Technology, Engineering, and Math) after this lesson? Yes or No.
- Do you want more information about Electrical careers?
- Share something you learned today.

Written in 2023 by Alexa Groff, Iowa State University Extension and Outreach 4-H STEM Program Specialist. Copyright 2023, Iowa State University of Science and Technology.

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The switch is open, therefore the circuit is open.

The switch is closed, therefore the circuit is closed.

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