CIRCUIT EXPLORE (K-G2)

In this workshop, students will experiment with the components of simple circuits: power, loads, and switches. They will explore how different kinds of batteries and lights work together. Educators will guide students in constructing their own circuits with a battery-powered light, which they will use to power a lightning bug bot that they can take home. See p. 3 for standards this workshop supports.

SCIENCE CONCEPTS

Many of the items we interact with use electricity, which runs in circuits.

- A **circuit** is a closed path that electricity runs through. Unless the circuit is closed (think of a complete loop), it will not power anything. Most of the circuit is made of wire.
- Circuits must have a **power supply**, such as a battery.
- Circuits also contain a **load**, or something to use up the electricity, such as a motor or light.
- Most circuits also contain a **switch**, or a way to close (turn on) and open (turn off) the circuit.

There are many ways to make the same kind of device.

- Lights come in many shapes and sizes.
  1. Old lightbulbs or holiday lights with wires inside are **incandescent**, meaning they glow because electricity passing through the wire makes it hot enough to give off light.
  2. LEDs glow because they are **electroluminescent**, meaning the electricity makes the LED itself glow, but not because of heat.
- Batteries also look different depending on their type.
  1. Students are probably most familiar with batteries shaped like cylinders, like AA, AAA, or D batteries.
  2. Button batteries are often used in small devices like watches and hearing aids.
  3. Batteries might also be large and rectangular, like car batteries, or small and rectangular, like cell phone batteries.
  4. All batteries have a **positive and negative** side, so it matters how we attach them into a circuit.

BEFORE YOU VISIT

Why do we use wire in electronics?	Wire is made out of metal because metal is a good conductor of electricity, meaning electricity flows easily through metal. This makes wire a good path for electricity.
Why do electronics include switches?	We usually want a way to turn devices off, as a way to conserve the energy of our battery or other power supply. Or, for objects like lights or televisions, we simply don't want them on all the time.
What are some objects you use regularly that might have circuits inside them?	Most electronics contain circuits. Lamps, computers, and electronic toys are all examples. Students will probably think of many more. Anything you plug into a wall socket or insert a battery into has some kind of circuit inside.

AFTER YOU VISIT

Questions

- Think about the first part of the activity, when you explored with lights. What would happen if you added a second battery into your lightning bug? (Answer: the light should glow even brighter.)
- What if you add a second light, but only have one battery? (Answer: the light might glow less brightly. The LEDs that we use actually require very little electricity to power them, so we can usually run many LEDs from one tiny battery. But when using the incandescent holiday lights, which require more energy, adding more lights to one battery will result in a noticeably less bright bulb.)
- Think about common objects in your house. What do you think is happening when you turn them on and off? (Answer: somewhere inside, the switch is interrupting the flow of electricity, similar to how pressing down on our light bot turns the light on and off.)

Activities

How is your lightning bug bot like a lamp?

- Lamps and light bots both have:
  1. A power source
  2. A lightbulb
  3. A way to turn them on and off
  4. Might have an artistic design or shape to make it more fun and enjoyable
- Lamps and light bots are different:
  1. They probably use different power sources (battery vs. plugging into a wall)
  2. Different shapes
  3. Different kinds of bulbs and switches
- See if kids can come up with other similarities and differences!

CAREERS THAT USE ENGINEERING

Electrical engineer: These engineers learn extensively how electronic systems work. They are often the people who design new kinds of electrical systems, and might work for companies that make complicated electronics for new cars, or even for NASA, figuring out how to power spacecraft that fly far from Earth.

Electrician: Electricians must understand the systems of wires and circuits that go into a house or other building. They might plan or install the wiring for a new building, or fix problems with an existing system. Rather than years of schooling, electricians often learn on the job in apprenticeships or special training programs. Electricians get to work hands-on with tools and wiring, and see the results of their work when they finish.

Broadcast engineer: Someone has to manage the complex systems that we use to transmit television, radio, and other forms of communication and entertainment. Broadcast engineers must understand not only electronics, but also the kinds of wiring that visual and audio signals travel over. They may work in one location, or they may get to travel widely.

Learn about **more careers** that use engineering!

MINNESOTA ACADEMIC STANDARDS FOR SCIENCE K-12

0.1.1.21 Use observations to develop an accurate description of a natural phenomenon and compare one's observations and descriptions with those of others.

2.1.2.2.2 Describe why some materials are better than others for making a particular object and how materials that are better in some ways may be worse in other ways.

2.2.1.1.1 Describe objects in terms of color, size, shape, weight, texture, flexibility, strength and the types of materials in the object.