

**Curriculum topics:**

- Circuits
- Light
- Energy
- Engineering
- Design

**Subject:**

**Physical Science**

**Grade range: 3-7**

**Who we are:**

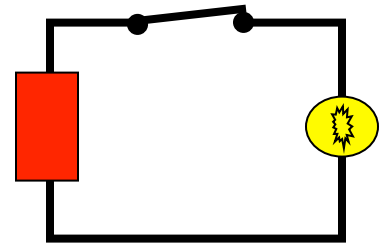
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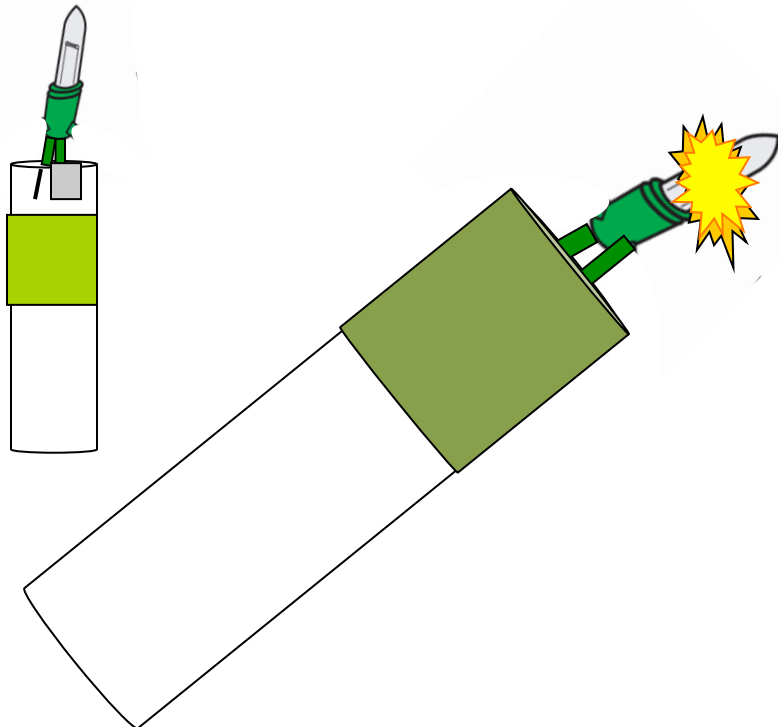
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# FLASHLIGHT FUN

Learn about electric circuits by building a simple flashlight



An everyday flashlight is a wonderful example of a simple electronic circuit in action. Students will enjoy investigating the inner workings of real flashlights, and then building their own flashlights using common materials.



# Materials required

Per Flashlight:

- 2 AA batteries
- Cardstock, 4" x 5"
- Rubber band (#64)
- Christmas Tree light bulb clipped from strand and stripped exposing about .5" of copper
- Aluminum foil, 2 sheets 3"x 6"
- Cardstock, 2" x 4"
- Fabric or thin foam, 1" x 4"
- Tape

## How to build it

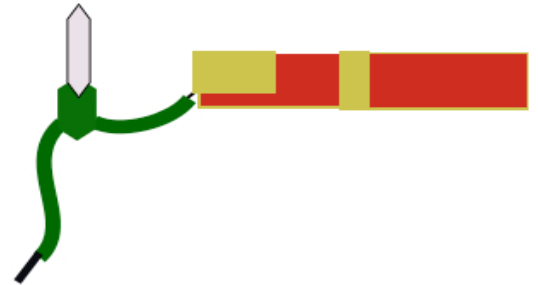
**Caution: Wash hands after handling electrical components.**

### Make a battery pack by taping two AA batteries together

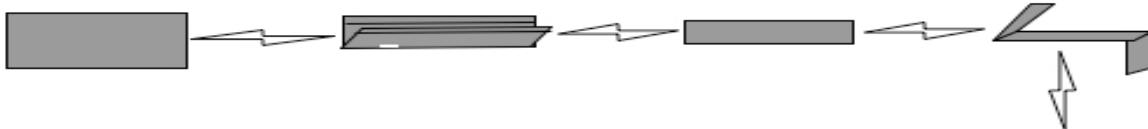
**together.** Tape the batteries together so that a positive end of one is touching the negative end of the other. Tape the batteries enough to hold them together but do not allow any tape to be in between the two ends. One wrap is generally enough, too much tape may cause the batteries to lose their contact.



**Attach one wire from the light bulb to one end of the battery pack (It does not matter which end).** Be sure the wire insulation is removed and the exposed metal is touching the center of the end of the battery. The metal is a conductor, meaning it allows electricity to flow. Use plenty of tape, so that the electrical connection will be very secure and all of the un-insulated wire is covered by tape.

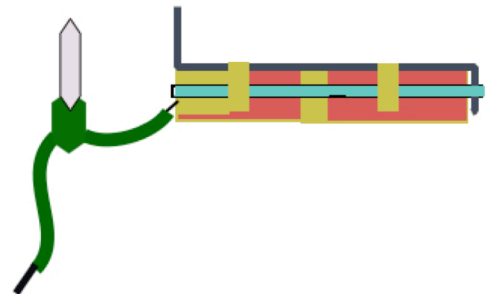


**Fold the other piece of the foil to make a strip roughly 1/2" wide (or smaller) x 6" long.**



### Attach the foil strip to the end of the battery pack that is not already attached to the bulb.

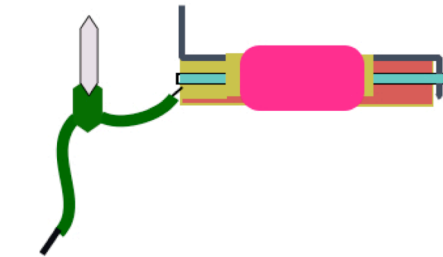
**Tape it firmly to the end and side of the battery as shown at right.** Then wrap the rubber band around the battery pack from end to end to further secure the wire and the foil in place. It is important to make sure there is no contact between the wire and the foil, which would result in a short circuit and rapid build up of heat and depletion of power in the battery. Then tape the rubber band into place as well.



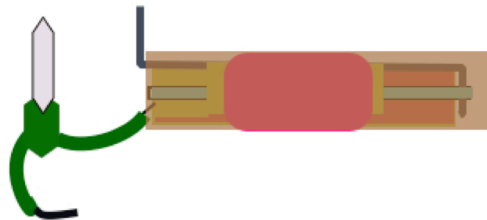
**Roll the large piece of cardstock to form a cylinder roughly 1” in diameter.** Tape it firmly so that it does not unroll. Set this aside for a later step.

**Wrap one piece of foil around the small piece of cardstock and tape it in place.** The way the foil is wrapped does not matter. Set this aside for a later step.

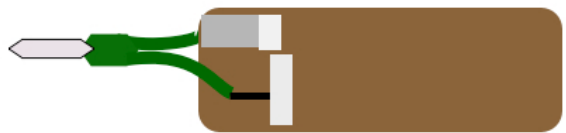
**Wrap the battery pack in the foam so that it is just over 1” in diameter.** Tape the foam so that it does not unroll. This will allow the battery pack to fit snugly within the cylinder made in the previous step.



**Press the battery pack into the cardstock cylinder.** The battery pack should not fall out of the tube. Make sure the bulb, the remaining wire, and foil strip stick out of the top of the tube as shown.



**Fold the foil over the end of the tube and tape it to the side of the tube leaving a portion of the foil exposed.** Then tape the remaining wire to the side of the tube so that it does not touch the foil. Leave some of the uninsulated wire uncovered by the tape. The exposed conductor of the wire and foil will allow electricity to be conducted around the circuit later.



**Wrap the remaining cardstock around the tube, with the foil on the inside.** Tape the outside of the cardstock to itself to create a “sleeve around the tube.” The cardstock should be tight against the tube, but should be able to slide up and down over the foil and wire as shown. Slide the sleeve over the strip and wire so the foil in the tube completes the electrical circuit. The light should come on! Slide the tube down and the light will go off.



**Teacher Tip: Encourage all students to look closely at their device to verify that the electrical circuit is completed. Students with working flashlights can assist students who need help. This is how engineers work together!**

## The science behind the activity

Batteries store electrical energy in the form of a chemical reaction in the waiting. There are two metals. One has an abundance of electrons and is called the cathode. The other needs more electrons and is called the anode. When these two metals are linked with a conductor, electrons flow through the conductor from the cathode to the anode forming an electric circuit, a path through which electrons can flow.

In the case of the flashlight, the aluminum foil and the copper within the wire function as the conductors that allow the electrons to flow. The “sleeve” functions as a switch. When it touches both the aluminum foil and the copper wire the circuit is complete, or closed, allowing the electrons to move. While they are moving they flow through the filament of the light bulb. The filament does not allow the electrons to move as easily as they do while flowing through the foil because it has high resistance. As the electrons flow through the filament the resistance causes heat to form. This heat causes the filament to glow, creating the light of the flashlight.