

Clverbud Investigators: STEM for Every Season



Christmas Lights & Electricity

December

Background:

The holiday season is upon us and we are busy with the holiday hustle and bustle. We must find the right gift, visit family and friends, sing carols, make sweets with hot chocolate and decorate the house and tree! Picking out the perfect tree is a true highlight of the holidays, as well as helping decorate it. The way we decorate our Christmas trees has changed quite a bit over the years. There are many legends about how the Christmas tree came to be. One legend credits a man named Martin Luther back in the 16th century with starting the traditions when he decorated a small tree with candles. He wanted to replicate how the stars twinkled in the sky for his children. In the 17th and 18th centuries there are accounts from Austria & Germany of people using the tops of evergreens, hanging them upside down in the corners of their living rooms and then decorating them with apples, nuts and strips of red paper. In America, the first record of Christmas decorations was in the German Church settlement of Bethlehem, Pennsylvania in 1747. The people there built a wooden pyramid, covered it with branches of evergreens and decorated it with lit candles. It was not until the American Revolutionary War that the United States was first introduced to the new custom of a Christmas tree, brought to America by German Hessian Troops.

Early Christmas tree decorations were homemade decorations, often made by young ladies. Decorations were crafts such as: quilled snowflakes, stars, little pouches for secret gifts and paper baskets for sugared almonds. Around 1880 the first glass ornaments were created and in 1882 the first patents for electric lights was filed. In 1892, metal hooks were developed to safely hang decorations onto the trees. Fast forward to today and we have battery operated lights, LED lights, lights that blink to music, solar lights and so much more!

Today we are going to be investigating battery operated Christmas lights. But first we need a little knowledge about how batteries work. Let's watch a short video to help us understand how a battery works.

Overview from the video: Let's review, a battery has a negative (-) and a positive (+) end. Inside the battery are three things that make it work, the anode (negative charge), the cathode (positive charge), and the electrolyte. The battery also has elements like zinc, graphite, and ammonium chloride. These elements work together by causing a chemical reaction inside the battery. The anode (negative charge) starts to have extra electrons, which makes an imbalance in the battery. The electrons want to move or rearrange to place the extra electrons in the cathode (positive charge) but they can't just travel through the battery itself, they need help! To travel, the electrons need a conductor to flow through. To achieve this, we need a circuit. A circuit is a closed path through which electric current can flow. We can have two types of circuits, an open circuit or a closed circuit. With a closed circuit, we can turn something on. A closed circuit allows electricity to flow in a complete circle with electrons traveling through our conductor through our lightbulb and back into the other side of the battery. If we have an open circuit, we can stop the flow of electric and which turns off the light.

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In our experiment today we will have a battery, wires, and something to turn on. In this case, our light. With these items, we can build a closed circuit, which makes electrons in the battery happy and balanced again. As the electrons travel from the anode through the wires/conductor, they will pass energy to the light, making it light up. The electrons then continue to travel to the cathode, restoring balance to the battery.

Now that you know how a battery works, we need to build a closed circuit to make our lights glow.



December's Mystery: Can a battery and a couple of wires make a light bulb shine?

Supplies:

- Alligator Clip
- AA Battery
- Light Bulb
- AA battery Holder
- Light Bulb Socket Holder

Safety:

- *Always have an adult present
- *Never mix water & electricity



Science Behind Lights & Electricity:

An electric circuit is a circular movement of electrons that flows consistently until the loop is broken. **Description of the flow of electricity:** Electricity flows from the negative end of the battery through the wire to the electricity receiver, light bulb, through the wire to the positive end of the battery.

Closed Circuit: a complete circuit the electricity flows.

Open Circuit: an incomplete circuit the electricity will not flow.

What to Do:

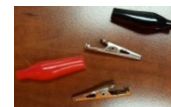
Step 1: Carefully insert light bulb into the light bulb socket holder.



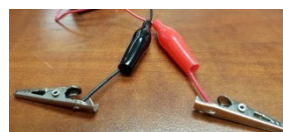
Step 2: The red coated copper wire from the battery holder should be connected to the positive side of the battery holder. While the black coated copper wire from the socket holder should be connected to the negative side of the battery holder.



Step 3: With help, slip the protective cover off the alligator clips.



Step 4: Feed the red protective cover with the small end first on the red wire. Do the same with the black protector.

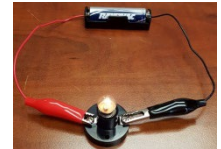


Step 5: Carefully connect each of the wires to the alligator clips, one wire per clip. Slip the protective cover back over the clip, this will also help hold the wire in place.



Step 6: Insert one AA+ battery into the battery holder, positive side toward the red coated copper wire.

Step 7: Clip one alligator clip on each side of your light socket holder. This should complete your circuit and power on your light bulb. You can even take it a little farther by connecting together more lights and batteries.



Go Over Findings:

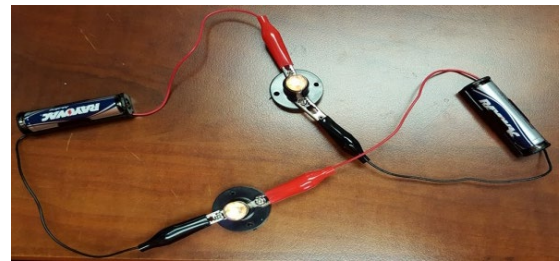
What happened when we completed our circuit?

What happened when our circuit was open?

Which end do the electrons flow from?

What else do you think we could power with our battery?

Can you think of a career that might involve working with electricity?



Investigate, Create, & Take: Investigators can take with them:

- ✓ An Ornament
- ✓ Their own complete circuit Christmas card

Sources:

Marshall Brain, William Harris & Robert Lamb "How Electricity Works" 28 May 2004.
HowStuffWorks.com. <<http://science.howstuffworks.com/electricity.htm>> 20 January 2016

Mocomi & Anibrain Digital Technologies Pvt. Ltd. "How Do Batteries Work?"
<https://www.youtube.com/watch?v=KkRwuM4S8BQ>



Additional Links:

The Noeltunes, The Christmas Channel, “Christmas Songs For Children”

<https://www.youtube.com/watch?v=Z8vhMH2Irn0&index=1&list=PLRh9rItV4xltL4Y7eAKYQ3nGbjo2CWdZt>

AHA!Videos, “History of the Christmas Tree”, https://www.youtube.com/watch?v=yoJ_ubhVboI

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