

WestFest

SCIENCE & SUSTAINABILITY

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Glow and Tell: Fun with Paper Circuits

Materials

3mm LEDs	Conductive (Maker) tape	Coin cell battery
Paper rocket	Paper cutouts	Cardstock card
Glue stick	Scissors (not provided)	Clear tape (not provided)

The power of circuits

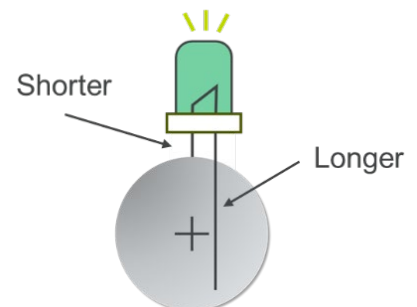
Turning on your phone, tablet or gaming device can be as easy as pushing a button, but what gives your devices the power to work? The answer is Electricity! **Electricity** is a form of energy that we use every day. Besides devices, electricity helps power our lights, refrigerators, microwaves and so much more. Electricity can come from many sources, such as batteries, which is able to contain or store energy until it is release.

Batteries have two ends: one positive (marked with a "+") and the other negative (sometimes unmarked or marked with a "-"). For electricity to flow out of the battery and do work (such as turning on a light) a **circuit** – a path or loop that electricity can flow through – needs to be created to connect the positive and negative ends of the battery. Let's explore the four circuits listed below to learn more about circuits! *(Note: you will need to reuse the coin cell battery for each circuit).*

Circuit 1: Lighting up the LED

To get started, let's power up our LED by creating a path for the energy in the battery.

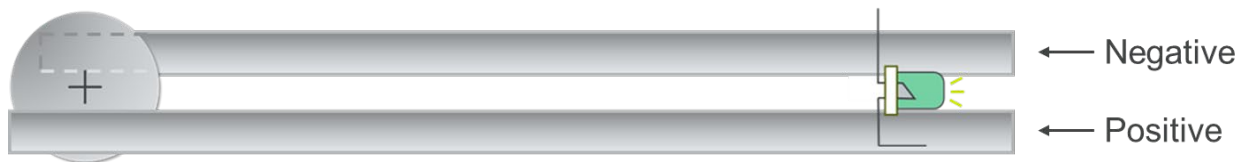
1. Place the anode (longer leg) on the positive (+) side of the coin cell battery.
2. Place the cathode (shorter leg) on the negative (-), back side of the battery.
3. Your LED should light up!



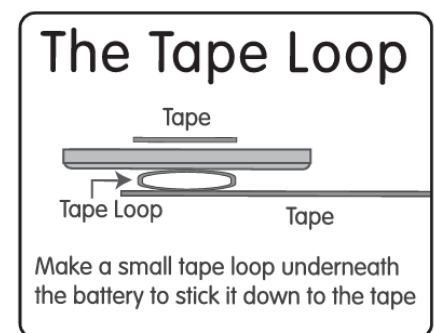
What happens if you switch the legs so that the anode (longer leg) touches the negative (-) side and the cathode (shorter leg) touches the positive (+) side? Try it and find out! (*Answer: LEDs require energy to flow from one specific direction to the other, that's why when you switch the legs, nothing will light up!*)

Circuit 2: Creating a simple path

Some materials can conduct, or carry electricity, but some materials cannot. We can use materials that conduct electricity, such as the Maker Tape, to make longer paths between the battery and the LED. Create the image shown below following the instructions listed and by taping each component directly on the paper.



1. Cut two (2) 5-inch pieces of Maker Tape (or use the image above as a guide).
2. Cut one (1) ½-inch piece of Maker Tape.
3. Unpeel the backing of one piece of the 5-inch Maker Tape, and tape it down on the line labeled “Negative”. The dotted line indicates the part of the Maker Tape that will be hidden under the battery.
4. Take the ½-inch Maker Tape and make a tiny tape loop, by taping it back on itself. Make sure to have the sticky side on the outside.
5. Put the tape loop on the “Negative” line and place the battery on top of the tape loop with the positive (+) side of the battery facing up.
6. Unpeel the backing of the second piece of 5-inch Maker Tape, and tape it down on the line labeled “Positive”. One side of the tape should go on top of the battery.
7. Bend the LED legs and using clear tape, tape the cathode (shorter leg) to the negative (-) line, and tape the anode (longer leg) to the positive (+) line. (*Note: Put an extra bend in your anode leg so you won't easily confuse the two legs.*)
8. Your LED should light up!

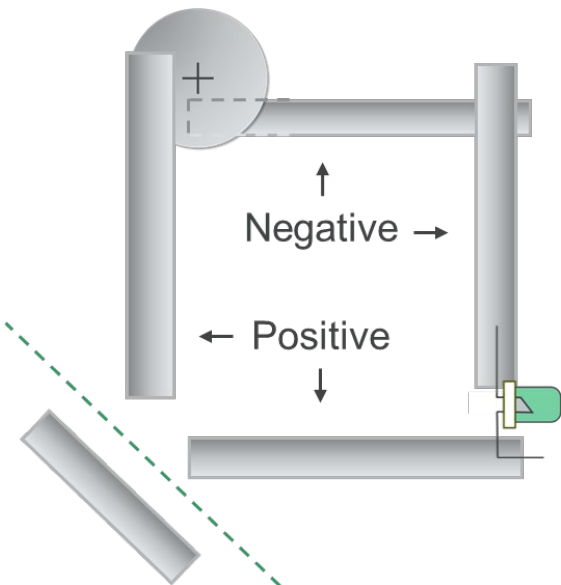


Tape Loop method instructions provided by Brown Dog Gadgets.

Circuit 3: Adding a “switch” to your path

Your LED will light up when there is a continuous path from the negative side of the battery to the cathode of the LED, pass through to the anode of the LED, and circle back to the positive side of the battery. You can create a “switch” for paper circuits by purposefully breaking the path and include a creative way to join the path back together. Look at the image below and notice the break in the path on the bottom left-hand corner. The layout below is currently an “open” circuit, or a path with a break in it. We can complete and create a “closed” circuit, by connecting the extra piece of Maker Tape to the path by folding the paper along the dotted line. Use the image below to create a simple switch.

1. Cut roughly three (3) 2-inch piece of Marker Tape, one (1) 1.5-inch piece of Maker Tape and one (1) 1-inch piece of Maker Tape. Or use the image below as a guide to cut the length of Maker Tape needed. And if you need, a ½-inch Maker Tape for the tiny tape loop.
2. Tape down the Maker Tape, battery, and LED in the corresponding areas.
3. Fold the paper at the dotted line and hold the paper down so that the Maker Tape below the dotted line completes the continuous path.
4. Your LED should light up!
5. Can you think of over creative ways to make a switch?



Circuit 4: Out of this world greeting card

Create a card for a friend or a family member by using your newfound circuit skills! Follow the pattern below on the paper rocket and cardstock included in your activity kit.

1. *Optional: glue down the extra printed parts of your rocket to give it a color boost.*
2. On the back of the rocket, use clear tape to tape the transparent rectangle over the windows.
3. Follow the layout below to create an “open” circuit on the back of the rocket.
4. Make a tape loop with clear tape, and tape it on top of the battery.
5. Turn the rocket over and tape the rocket down by placing the tape loop on the cardstock card.
6. Tape a small piece of Maker Tape on the cardstock where the break occurs in the rocket to create a switch.
7. When the bottom of the rocket is pushed down, the circuit will be complete, and you LED should light up!
8. Write a note on the back of the card and give it to your friend or family member!

