NOVEMBER
PAPER CIRCUIT
ROBOT

TAKE-AND-MAKE BAG SUPPLIES
Template
LED bulb
Coin-cell battery (3V) CR2032
Copper tape (1/4") with conductive adhesive

OTHER SUPPLIES
Scissors
Clear tape
Glue stick (optional)
WARNINGS

Copper tape can have very sharp edges and is able to cut skin like a paper cut, so be careful!

There are small items used in this project, such as LED bulbs and lithium coin batteries, that can be a choking hazard and dangerous for children under 3 years.

PARENTAL SUPERVISION REQUIRED!
DEFINING THE TERMS

WHAT IS ELECTRICITY?
Electricity is the flow of electrical energy from one place to another.

WHAT IS A CIRCUIT?
The path electric current travels on if the loop or circle is closed.
SIMPLE CIRCUITS

COMPONENTS

CONDUCTORS
Some types of material allow the electric current to pass through easily. These conductors are usually made out of materials such as silver, gold, steel, water, or copper.

POWER SOURCE
Source of voltage/electricity, i.e. a battery, a direct current (DC) power supply, or alternating current (AC) from the power grid.

ELECTRICAL COMPONENT
A device that uses the power, i.e. a light bulb, toaster, motor, TV, etc.
Electricity only flows in one direction and in a loop, and it needs a complete circuit in order for something to work. If you break that loop with a switch, the power stops flowing and your bulb will turn off.

A simple circuit definition is a closed loop of a conductor that electrons can travel around, a power source (like a battery), and an electrical component or device (like a light bulb).

**WHAT HAPPENS IN A CIRCUIT?**

An electrical circuit is composed of a source of electrical power, such as a battery, a device that will use the power, and conductors that connect the two.
WHAT IS A PAPER CIRCUIT?

A paper circuit is a low-voltage electronic circuit that is created on paper or cardboard using conductive copper tape, LEDs, and a power source, such as a coin-cell battery.

WHAT ARE LEDs?

Light Emitting Diodes - A particular type of diode that converts electrical energy into light. LEDs are all around us: they create backlighting in our phones and TVs, light up billboards, and even help light the inside of our cars. Any time something electronic lights up, there's a good chance that an LED is behind it. They come in a huge variety of shapes, sizes, and colors!
HELPFUL HINTS

LED HINTS
Mount the LED to the copper trace using clear tape. To do this, bend both legs of the LED at a 90° angle and then tape the legs securely to the copper. Make sure that the long leg of the LED goes to the positive (+) side of the copper trace. The image below shows how to tell which leg of an LED is positive.

+  

BATTERY HINTS
Only put tape on the edges of the battery. It needs to be able to make contact with the copper tape. **HINT:** To make the battery last longer, open the flap when you're not using your paper circuit!
LOOkING FOR MORE?

Stop by the Bala Cynwyd Junior Room to check out books about electricity, circuits, and more!

NON-FICTION

Ramblin' Robots: Building a Breed of Mechanical Beasts
by Ingrid Wickelgren

The Magic School Bus and the Electric Field Trip
by Joanna Cole

The Book of Terrifyingly Awesome Technology
by Sean Connolly

How Ben Franklin Stole the Lightning
by Rosalyn Schanzer

All Charged Up: A Look at Electricity
by Jennifer Boothroyd

Experiments with Electricity
by Salvatore Tocci

The History of Electricity
by Elizabeth Lachner

What is Electricity?
by Lisa Trumbauer

Electricity
by Harriet McGregor

Robotics
by Helena Domaine
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FICTION

Nick and Tesla's High Voltage Danger Lab
by Bob Pflugfelder

Nick and Tesla's Robot Army Rampage
by Bob Pflugfelder

The Eyes of the Killer Robot
by John Bellairs

The Homework Machine
by Dan Gutman

The Chosen Ones
by Scarlett Thomas

The Wild Robot
by Peter Brown

Robot Dreams
by Sara Varon

City of Ember
by Jeanne DuPrau

Tesla's Attic
by Neal Shusterman

EngiNerds
by Jarrett Lerne