



PAPER CIRCUITS

MATERIALS IN KIT:

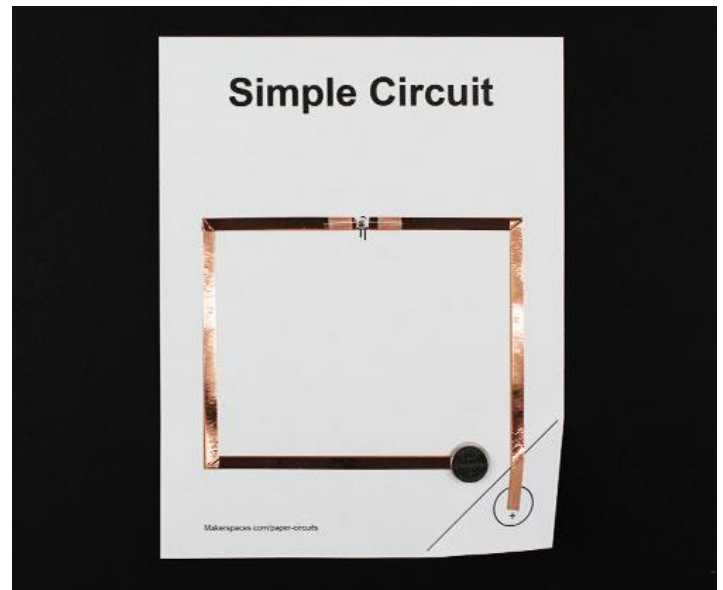
Coin Cell Battery Copper Tape
Cardstock Paper 3 LED Lights
Paper Circuit Template Binder Clip

VOCABULARY:

Circuit	Electricity	Conductor	Insulator
Parallel Circuit	Series Circuit	LED	Light
Closed Circuit	Short Circuit	Battery	Positive
Electrons	AC/DC	Negative	

SIMPLE CIRCUIT DIRECTIONS:

1. Lay the Simple Circuit Pattern on the table.
2. Apply copper tape to all trace lines as marked in brown on the template.
3. Smooth the copper down with your finger. Try to maintain a continuous strip of copper tape versus cutting it at the corners.
4. Fold copper tape at the corners by bending it at a 45' angle in the opposite direction of where you are going. Then fold it back at a 180' angle and continue applying to the trace line.
5. Make sure to leave a gap in the copper tape so the LED can be mounted properly.
6. Cut the remaining copper tape once you reach the designated battery area.
7. Score and then fold the corner line. A scoring tool is very helpful when making folds during a paper circuit project.
8. Mount the LED to the copper trace using clear tape or another piece of copper tape on top of each leg. To do this, bend both legs of the LED at a 90' angle and then tape legs securely to the copper. Make sure that the long leg of the LED goes to the positive (+) side of the copper trace.
9. Last step is to place the coin-cell battery on the copper trace. In this example, make sure the battery (-) is facing down on the copper. The corner flap which is (+) should then be able to contact the battery (+) when folded.
10. At this point you can secure the corner using a binder clip or tape the battery down with clear tape (just make sure you leave the middle of the battery tape free so it can connect with the copper tape when the corner is folded).



TROUBLESHOOTING

Is your LED not lighting? Most of the time it's a very simple fix. Here is a list of the common ways to make your paper circuit functional.

1. Make sure that the LONG leg of your LED is secured to the positive (+) side of the circuit because this is easy to mix up.
2. Sometimes the LED legs are just not contacting the copper tape well enough. Rub the clear tape that secures the LED to ensure there is a solid connection with the copper tape below.
3. Inspect the battery. Make sure the negative (-) of the battery is touching the negative side of the copper tape and the same goes with the positive. Also make sure there is a solid connection between the battery and copper. Sometimes you need to tape the battery down using clear tape.
4. It's highly recommended that you try to maintain a continuous strip of copper foil versus cutting it. But sometimes you just need to make a cut. Make sure you push down and rub the two pieces of copper that are taped together. There needs to be a solid connection.
5. Ensure all copper tape has been smoothed down on the paper with as few wrinkles as possible.

6. Is there a short in the circuit? A short can happen when the positive and negative copper tape make contact with each other. Check around the battery area and the LED area which are common places for this to happen.
7. Finally, are your parts even functional? At times you might just have a bad battery or bad LED. One easy way to test both of these items is to place the LED directly onto the battery. Make sure the LONG leg is touching the positive side of the battery.

THE SCIENCE BEHIND THE EXPERIMENT:

A circuit is a path that electricity flows along. If the path is broken, it is called an open circuit and the electrons can't flow all the way around. If the circuit is complete, it is a closed circuit and electrons can flow all the way around from one end of a power source (like a battery), through a wire, to the other end of the power source. In a battery circuit, the positive and negative ends of a battery need to be connected through a circuit in order to share electrons with a light bulb or other object connected to the circuit.

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

MAKE IT AWESOME:

Try creating your own pattern for a simple circuit- you can even try making a picture that lights up!

EXTENSIONS:

1. How can you use LED lights to light up other projects? Find ideas here: <https://www.makerspaces.com/paper-circuits/>
2. Learn how to make a battery holder here: <https://chibitronics.com/paper-battery-holder-tutorial/>

WEBSITES AND VIDEOS:

1. Step-By-Step Paper Circuit Directions with Pictures: <https://www.makerspaces.com/paper-circuits/>
2. Make a Paper Circuit without a Template and Use Aluminum Foil: <https://makezine.com/projects/simple-paper-circuit/>

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