



Paper Clip Circuits

GETTING STARTED:



The battery will power your circuit. It stores electricity that makes your circuit light up. The battery pack has a positive side marked in red and a negative side marked in white. The on/off switch can help you control when your circuit is powered on.



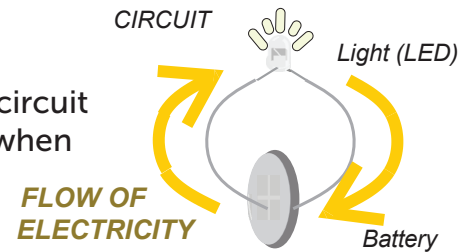
LED stands for Light Emitting Diode and they turn electricity into light. These components allow you to light up your projects. They have a positive (red) and negative (white) side.



A tilt switch opens and closes an electrical circuit based on its angle. When you hold the switch vertically the metal ball inside touches the conductive ends - closing the circuit! This means you can control your LED by the direction of the switch. Remember to use the blue tinned sides when creating your circuit.

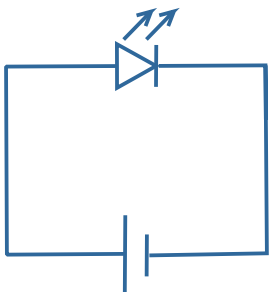
WHAT IS A CIRCUIT?

A circuit is a closed path through which electricity flows. The simplest circuit we can work with is a battery connected to a light. The light turns on when electricity flows from the battery, through the light and back to the battery.

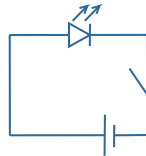


A common way of drawing circuits is called a circuit diagram. In a circuit diagram, a battery is shown as two parallel lines and an LED as a triangle and line with arrows representing the light.

CIRCUIT DIAGRAM



In this circuit, the light is always on until the battery runs out of energy. When you add a switch to the circuit, you can control when the light is on or off. The switch is drawn as a 'door' that open and closes the circuit. Switches come in many forms and are in almost any device with electricity.



Simple Circuit with 1 Switch

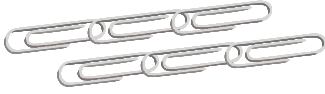
Conductive materials allow the flow of electricity. Conductors are usually made out of metal such as paper clips, copper tape, and aluminum foil. Have students explore to find other conductive materials to build their projects with. Discuss why pipe cleaners are conductive.

Resistance is the measure of how difficult it is for electrical current to flow through a material. Higher resistance means less current will flow through a circuit, and low resistance means more current will flow.

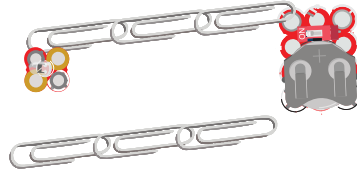


CREATE A BASIC CIRCUIT:

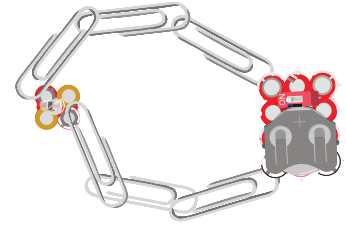
In order to create a working circuit, you must create a complete loop using conductive materials. Connect the components by attaching the conductive sides which are color coded. Red indicates positive, white is negative and blue indicates that the component does not have a positive or negative side. The part of the component without metal aren't conductive but they can be used to secure your circuit in place.



Start by linking a few paper clips into two chains.



Hook one paper clip chain to the tinned red side of the battery and LED. Then hook the other paper clip chain to the white side of the battery and LED.



Use the on/off switch to turn the LED on.

LESSON PLAN:

1. Start by reviewing each component. You can have students start filling out their worksheet. Ask students to describe when they might have interacted with batteries before. What they think a battery does? And where they might have seen an LED.

Review the flow of electricity and why it is important to connect the positive side to the positive and negative side with the negative.

2. Distribute one battery holder, LED and paper clips to each student. Go through the paper clip circuit exercise.

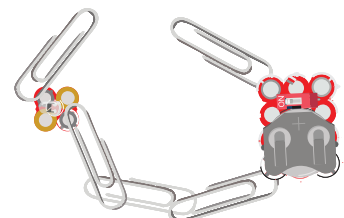
3. Discuss why the circuit may not have turned on for some. What was the issue?

4. What do students notice about their circuit? Is the LED always on? How can they control if it's on or off? Can they think of another way of controlling if it's on?

5. Have students complete the conductivity exercise using their circuit as a probe. Discuss why they think certain materials are conductive.

6. What did students discover while testing their hypotheses?

Touch material with both ends of the paper clips to test conductivity



Student Worksheet

Name: _____

1. Describe the function of a battery and an LED. Where have you seen them or used either of them before?

2. Sketch out a circuit. What do you need to create a complete one? Describe your work.

3. List 10 materials in your classroom that you think might be conductive.

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

4. Use your paper clip circuit as a probe to test whether the materials you listed are conductive. Write down whether or not it is conductive next to each material above.

5. Based on your results, what properties do you think make a material conductive?