BrainStorm
STEM EDUCATION

STEM KIT

BUILD & LEARN
GUIDE

CIRCUITRY

SUSTAINABLE MATERIAL

NO GLUE OR MESS

SAFE AND EASY USE

PROJECT OVERVIEW

Learn about circuitry, the basic components and how to differentiate between the different types of circuits. This lesson will focus on the overall concept of electricity; how it flows and what causes it. What is the difference between static and current electricity?

SAFTEY WARNINGS:

Please read all saftey warnings before use:

Choking Hazard: Small parts not for children under 6 years or any individual who have a tendency to place inedible objects in their mouths.

Eye protection should be worn at all times.

Adult supervision required.

MATERIALS

Durable wooden construction pieces
LEDs
Colored Tubes
Battery
Key Ring

1

NOTE: If you can not break out the pieces by hand, use a blunt tool or a small knife to cut or punch them out. If you have no experience with tools or use a knife, get help from an adult. If there are any burrs, points or rough spots do to breaking or cutting, smooth them with a piece of sand paper.

2

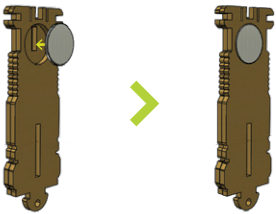
x1

x1

3

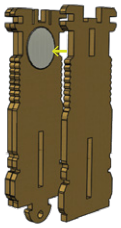
Positive Side of Battery

Negative Side of Battery



x1

4



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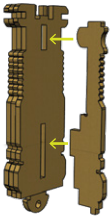

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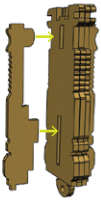
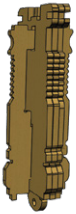
6





x1

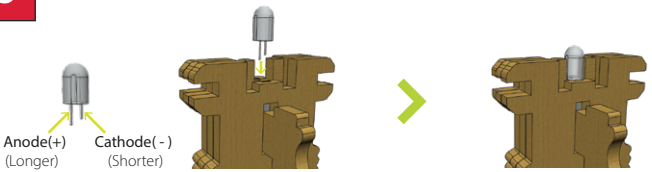
7

x1

8

TWIST TO LOCK

9



x1

NOTE: The Anode should be inserted to make contact with the Positive side of the Battery

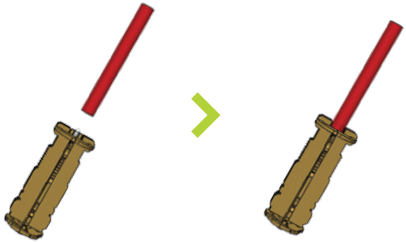
10

x1

11

x1

12



x1

13

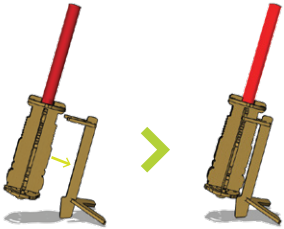
x1

x1

14

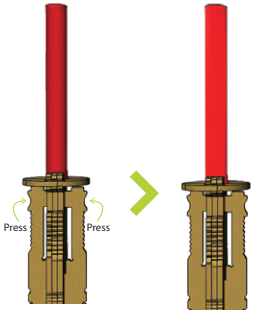
x1

HOW TO USE



Place on to Stand

OR



Press & Squeeze

WHAT IS ELECTRICITY?

Electricity is the flow of an electrical charge. The charge of an atom is a property of its matter. We can measure the charge of the atom by the breakdown of protons and electrons in the atom. Atoms are broken down into 3 components; Electrons, Protons and Neutrons. Neutrons are Neutral meaning they carry no charge. Protons are positively charged an they are found in the nucleus of the atom with the neutrons. Electrons are negative and can act as charge carriers between atoms. The electrons float in the space around the nucleus in varying distances from the nucleus. The electrons that are the furthest from the nucleus require the least amount of force to be pulled away from the atom. If we are able to pull the electron away from the atom and cause it to move, this will form an electric current.

Static vs. Current Electricity
Depending upon where you see electricity, you could see it take form in two different ways: static or current. While the circuit sword experiment is a form of current electricity, it is important to understand the difference between static and current electricity.

Static Electricity
Static electricity exists when there is a buildup of charges on or within an object. The charge will stay at rest or in static electricity until the two groups of the opposite charges can find a path between each other to balance out the electric system. When the charges do find a path between to equalize the system, there is a resulting static discharge that can result in a release of energy in the form of light.

Depending upon the level of attraction with the charges and what is insulating the space between them, you can have small discharges as little shocks or very large ones in the form of lightning.

Current Electricity
Current Electricity is the form of electricity that allows us to use electricity in electronics. This only exists if the charges are able to constantly flow. Current electricity is dynamic meaning that the charges are always moving, as opposed to static electricity which is at rest until it has a reaction to the opposing charges. We can harness the energy of current electricity by controlling it in a circuit.

UNDERSTANDING ELECTRIC CURRENT

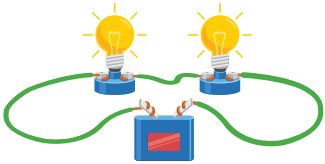
In order to understand the science behind our brainstorm circuits swords, there are a few components we need to breakdown.

Electric Current
The current is the flow of an electric charge. A circuit does not work unless the electric charge is flowing. Typically with electricity, we can control the eclectic current by having it flow through wires.

Circuit
A Circuit is something that starts and ends at the same point. In terms of electricity, this means that the electric current flows from the power source through all the components of the circuit and back to the other side of the power source. A basic electric circuit needs to have a power source, wires and some sort of device to use the electric current such as a light. If the circuit does not connect back to the beginning, it will not allow the electricity to flow through it; this is called an open circuit. If a circuit is fully connected and the electricity can flow through it is called a closed circuit.

Series VS Parallel Circuits
Circuits can be built with different paths for the current to flow through. In a series circuit, all of the components are connected end-to-end meaning that the circuit forms a single path. If one component in a series circuit stops working, it will make the circuit open and not able to conduct electricity. In a parallel circuit, all the components are divided into separate paths meaning that if one component stops working, the circuit can still conduct electricity. The amount of voltage from the power source is divided across all of the circuit components, meaning that a 2 volt battery would provide 1 volt to each light bulb in a 2 bulb series circuit. Whereas in a parallel circuit, the voltage is the same across all of the components.

SERIES CIRCUIT



PARALLEL CIRCUIT

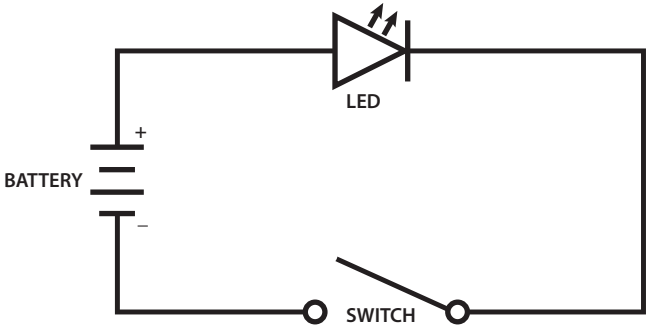
COMPONENTS OF A CIRCUIT

Light Emitting Diodes

LEDs or Light Emitting Diodes are semiconductors that when the electrons flow through a circuit it creates light. LEDs work by forming a p-n junction which is a connection between a p-type semiconductor and an n-type semiconductor. The P-type contains positively charged carriers and the n-type contains electrons. When the electrons flow through a closed circuit, from the n to p, the junction is formed and the LED emits light. The P-type corresponds to the anode side and the N-Type corresponds to the Cathode side. The electricity can only travel from positive to negative, so it is important for the LED to be positioned correctly in order to light up.

Power Source / Battery

All electric circuits need to have a power source to provide the electricity. In small devices, the power source is provided from a battery. In circuits on a larger scale such as a building, the power will come from a public power plant. A Battery is a container for chemicals that store energy to change into electric energy while being used. The battery has a positive side and a negative side. The positive side is called the cathode and the negative side is the anode which are separated by an electrolyte. When the 2 sides of the battery are connected by an outside wire, the electrolyte causes electrons to flow from one side of the battery to the other and out through the circuit.



HOW THE CIRCUIT SWORD WORKS

Circuits and Switches

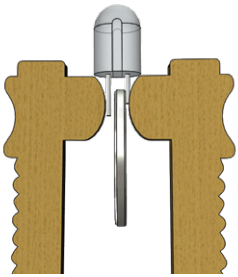
A Switch is put into an electric circuit to allow us to control the flow of an electric current. A switch will allow the user to make the circuit go from open to closed. If you flip a light switch from off to on, it closes the circuit to allow the electricity to flow through and turn the light on. The symbol in a circuit drawing that denotes a switch is seen below.

OPEN SWITCH

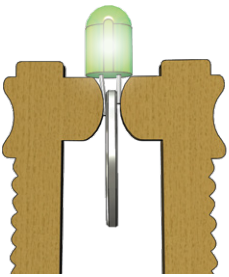
CLOSED SWITCH

The Circuit Sword Switch

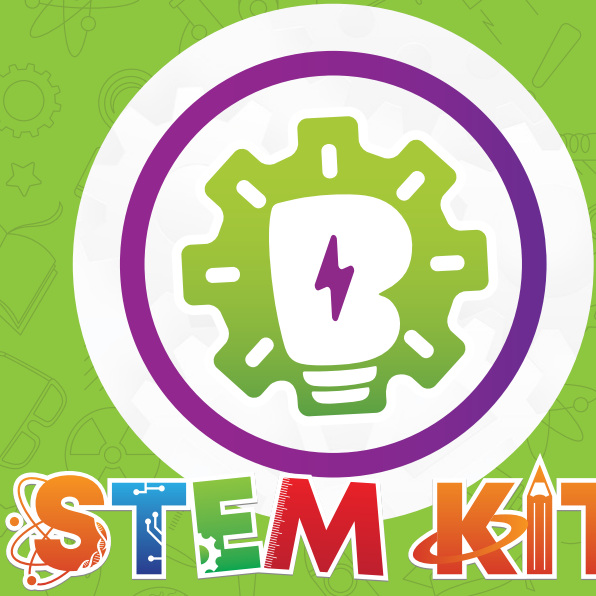
The Circuit Swords are a very basic circuit that works in order to make an LED light up and give the illusion of a sword made out of light. This Circuit is composed of a Battery, an LED and a Switch. When you build your circuit sword, you are putting the LED so that the anode is in contact with the battery, while the cathode is elevated. Since the cathode is not connected to the battery, it is an open circuit meaning electricity is not flowing through the LED. The wooden sides of the circuit sword act as a switch for our circuit. When the sides are squeezed together, it pushed the extended cathode of the LED to make contact with the battery closing the circuit and turning the LED on!



OPEN



CLOSED



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