



ENERGY STICK CIRCUIT

MATERIALS:

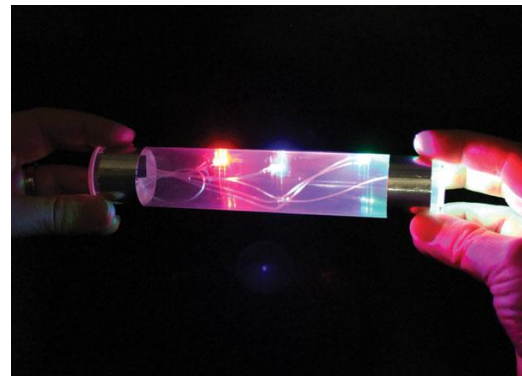
Energy Stick	Alligator Clips	Oranges
Christmas Lights	Aluminum Foil	Potatoes
Pie or Cake Pans	Binder Clips	Cups
Metal Silverware	Lemons	Water
Masking Tape	Play Dough	Paper Clips
Pipe Cleaners	Christmas Lights	
Other Conductive Materials		

VOCABULARY:

Circuit	Electricity	Conductor
Parallel Circuit	Series Circuit	Negative
Battery	Positive	Insulator
Electrons	AC/DC	Volts
LED	Transistor	Electrode
Resistor	Current	Circuit Breaker

HUMAN CIRCUIT DIRECTIONS:

1. Using both hands, grip the Energy Stick with a hand on each silver ring. You see flashing lights and hear an unmistakable noise like a weird siren. It changes pitch if you hold on long enough, too!
2. Let go with one hand and it shuts off!
3. Grab the silver ring again and the Energy Stick goes off again.



GIANT HUMAN CIRCUIT DIRECTIONS:

1. Have a large group of friends form a circle and hold hands.
2. Open the circuit by letting go of the hand of a person next to you; everyone else hangs on.
3. Grab a silver ring on one end of the Energy Stick while the person next to you grabs the other one.
4. The Energy Stick flashes and buzzes because the circuit is complete again! Should anyone break the circuit, the detector stops.
5. Explain that switches and breakers are nothing more than devices that either connect conductors to turn something "on" or separate them to turn something "off."
6. By the way, how many people were in your circle? Why not try 10 or 20 or even 50?!

ENERGY STICK CIRCUIT DIRECTIONS:

1. Collect an assortment of conductive materials like metal silverware, fruit, potatoes, cups of water, aluminum foil, etc.
2. Use items like aluminum foil, alligator clips with wires, masking tape, etc. as connectors.
3. Create a giant circuit using the materials. The circuit should start and end at the ends of the energy stick.
4. Example:
 - Tape a strip of aluminum foil to one end of the energy stick.
 - Clip an alligator clip to the other end of the aluminum foil.
 - Clip the other end of the alligator clip to a metal fork.
 - Clip another alligator clip to the other end of the fork.
 - Press the other end of the alligator clip into an orange.
 - Press one end of another alligator clip into the other side of the orange.
 - Clip the other end of the alligator clip to a piece of aluminum foil.



- Tape the other end of the aluminum foil to the other end of the energy stick.

THE STEAM BEHIND THE EXPERIMENT:

Energy Sticks can be used in solo or group experiments. Simply touch both ends of an energy stick to complete a circuit, and the energy stick should light up and emit sounds. For group activities, form a circle where everyone holds hands. Then, pick two people to hold either end of the Energy Stick. When the circuit is complete, the Energy Stick should activate. So how does it work? Don't try to take the Energy Stick apart! It's securely glued together and you will have to destroy it to open it. You can see the major parts through the clear body of the tube. The guts of the stick include a circuit board, two button batteries, an integrated circuit, three light emitting diodes (LED), a piezoelectric transducer, a transistor, and two electrodes. The batteries are connected in series (head to toe) to form a small power supply. Each button battery (cell) supplies direct current (DC) electricity. Since the cells are so small, they provide very little current (milliamps), and therefore, very little power (milliwatts). Three volts at low current is a level generally considered safe. Inside there is a circuit board with an integrated circuit, or chip. It contains tiny transistors, resistors, diodes, and other electronic parts that produce the noises and the flash pulses. The light emitting diodes (LEDs) are like small red, blue, and green lights, except that they have no filament. The lights are produced by brightly glowing junctions on semiconductor chips. The piezoelectric transducer functions like a speaker – it's what makes the noise. It consists of a very thin slice of quartz mounted on a brass disk. When electrical pulses are applied to the quartz, it vibrates, and that vibration is what we hear as sound. Transistors are electronic switches. In this case, the integrated circuit provides the sound waves, but they're not powerful enough to be heard by the transducer. So, the integrated circuit tells the more powerful transistor to turn on or off, and it controls the transducer.

Electrodes are simply the electrical conductors. They are the two metallic strips that you touch to complete the circuit. All of these elements of the energy stick remain inactive because the electric current cannot flow continuously, that is, until you hold onto each end with both hands. Human bodies conduct electricity, so by holding onto both ends of the stick, your body is closing the electrical circuit needed to let the current flow continuously and activate all of the above elements.

Electricity is nothing more than free electrons moving from atom to atom through a material. This flow is called a current. Currents go in one direction at a time, and can be given a very strong charge or a very weak charge. Something that allows a current to move through it freely is called a conductor. Good conductors include most metals such as copper, aluminum, iron, silver, gold, and lead, but there are others like water, mercury, and neon. If a material slows or even stops the current altogether, it offers resistance to the current and is called an insulator. Materials like glass, rubber, plastic, paper, cloth, and wood are very good insulators. However, if the charge is high enough, an insulator won't stop the current. Not to worry about this with an Energy Stick in your hands.

Since your body is mostly water and there are water and minerals on your skin, your body can be a conductor, but a poor one. The weak current travels from one silver ring onto one hand and then across the surface of your skin to the other hand and onto the other silver ring. This complete loop is called a closed circuit and allows the Energy Stick to do its detection thing. Take a hand off a silver ring and you break or open the circuit and the current stops flowing to the Energy Stick. If the charge is big enough, the current can jump this gap and a bright, blue arc is the result (but it won't happen with an Energy Stick). Grab the silver ring once more and you make a complete circuit. That's just what a switch on a wall does or a circuit breaker (or fuse) does in the breaker box on a house. It stops the current.

MAKE IT AWESOME:

Try creating a giant circuit that has at least 20 or 30 connections. How many can you come up with?

EXTENSIONS:

1. Try making a circuit using more than one energy stick.
2. What other changes can you come up with for this experiment?

WEBSITES AND VIDEOS:

1. Steve Spangler's Giant Kitchen Circuit: <https://www.tiktok.com/@stevespangler/video/7038714241376996613>
2. Energy Stick Circuit Video: <https://youtu.be/Jmt3ao4Dw38>

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