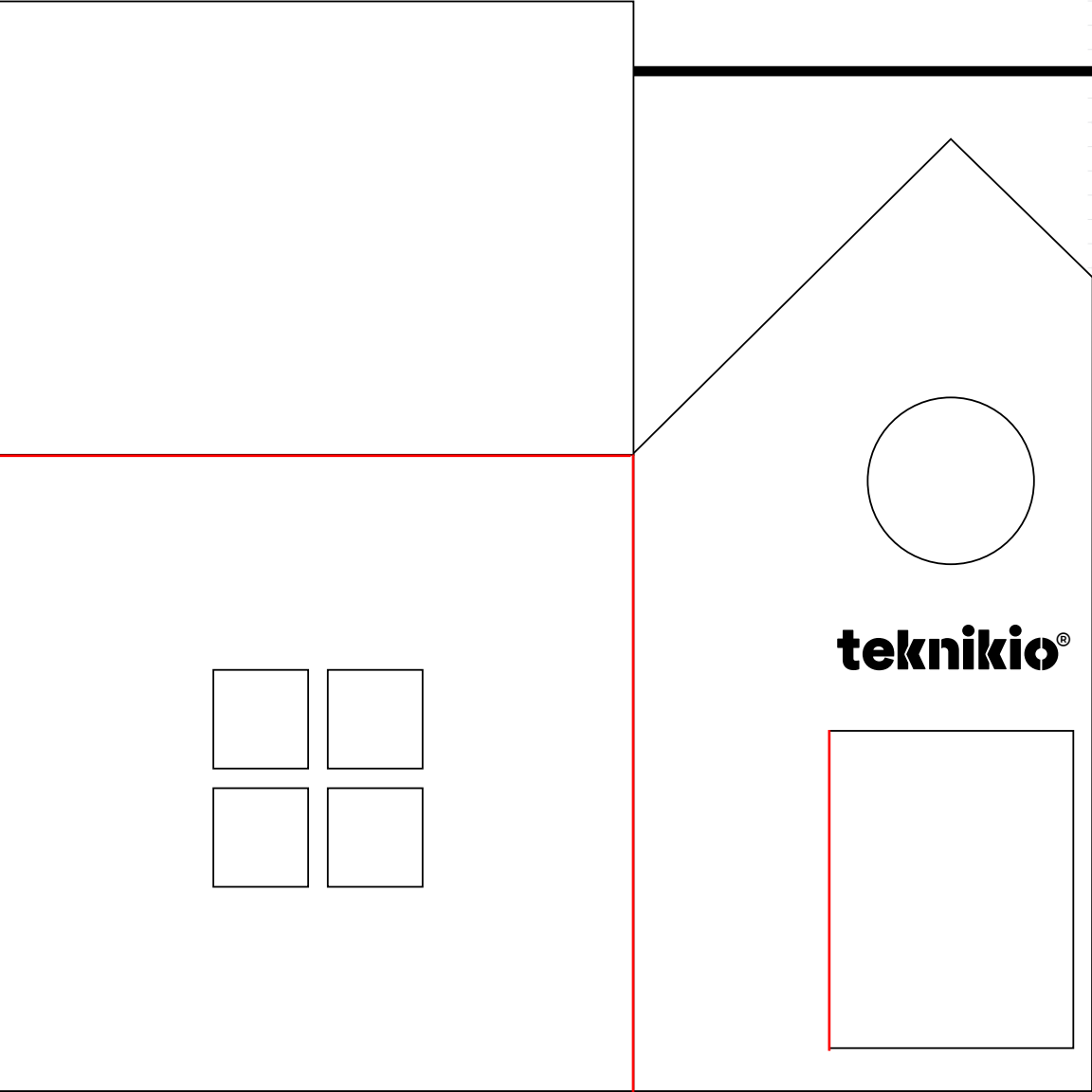


teknikio®



**SPARKING SENSE
INVENTION GUIDE**



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YOUR MATERIALS



2X COINCELL BATTERIES

This small battery can provide power and fit in tight places. The top smooth side and rim of the battery are positive and the bottom textured side is negative. The batteries are CR2032.



1X MAGNETIC REED SWITCH

When exposed to a magnetic field, the metal reeds inside the switch pull together and the switch turns on. When the magnetic field is removed, the reeds separate and the switch is off.



1X BATTERYBOARD

The conductive pads on the corners are labeled as positive and negative. When inserting your battery in the board make sure the smooth side with the "+" is facing up.



1X PUSH BUTTON SWITCH

This switch turns on when you push down on. The push button will spring back to an off position when there is no pressure applied. It is in a class of switches called "momentary switches."



1X CONDUCTIVE TAPE

This tape can carry or transmit power and signals through a circuit.



1X TOGGLE SWITCH

The toggle switch will hold the state (on or off) when clicked into position and won't change until clicked back.



1X LEVER SWITCH

To turn "on" push down on the lever, to turn "off" release. Or, push down to turn off and release to leave on, depending on how you connect to it.



2X LEDs

LEDs turn on when electricity is flowing through them and produce light. They have a positive end (longer leg) and negative end (shorter leg).



4X ALLIGATOR CLIPS

Alligator clips are conductive meaning they let electricity pass through them. You can use the alligator clips to attach parts without making a permanent connection. Just squeeze the ends to open the claws and clip them to parts.



1X TILT SWITCH

The Tilt switch contain metal beads that roll back and forth in a capsule. When they touch it is on, otherwise it is off.

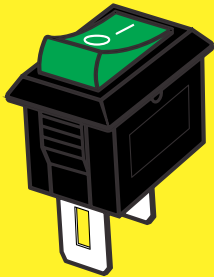


1X BUZZER

The buzzer in your kit creates a beeping tone when powered.

BASIC CIRCUITS

WHAT IS A SWITCH?

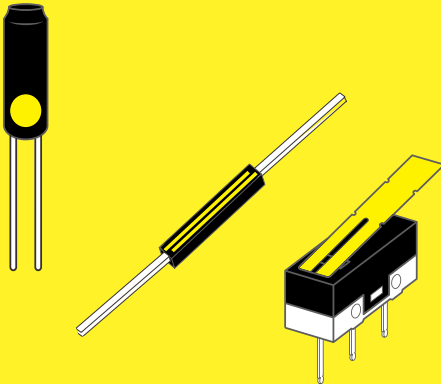


You use switches every day to turn things **on and off**, and that's basically what they do. Switches and buttons have a latch inside of them that can **open, close, or change position of a connection in a circuit**.

In a **closed** position switches allow electricity to flow through them and in an **open** position they cause a break in the connection and electricity can flow through.

The 1 and 0 symbol on switches was introduced by engineers during the Second World War. It comes from the binary system where 1 or | means on, 0 means off.

WHAT IS A SENSOR?



A **sensor** senses an **external pressure or force** and sends a **signal**. Switches are also sensors. The switches in your kit are used as sensors in the everyday world:

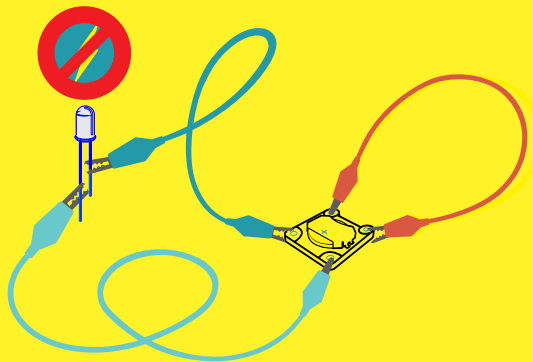
Tilt switches are used to sense motion or a change in direction. They are used in machines to warn workers in case the machine is tipping over.

Reed switches are used to sense distance. They are used on door alarms to sense when the door is closed or open.

Lever switches are used to sense pressure and can open or close a circuit rapidly. They are used vending machines to sense when the claw has reached the top and stop the track from sending the claw too far up or

BASIC CIRCUITS

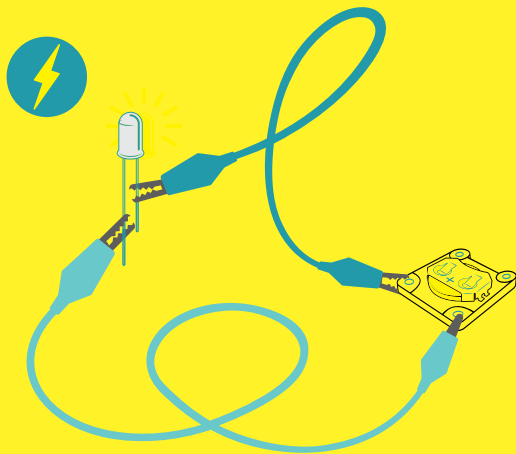
A



Electricity will always take the path of least resistance. For example, if you connect the components like in diagram A, the light will not turn on!

The light switch is the most commonly used switch to operate electric lights. The first light switch using "quick-break technology" was created by John Henry Holmes in 1884. The first toggle light switch was invented by William J. Newton in 1917.

B

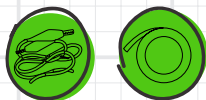


If you were to connect the circuit like in diagram B, the current will flow through the red alligator clip and skip the path that connects to the LED.

This will result in a **short circuit**—a short circuit is basically equivalent to connecting from the positive end of the power source to the negative, without putting anything in between.

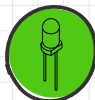
This will drain or "burn out" your battery very quickly. You should always make sure there are no short circuits in your design.

BASIC CIRCUITS



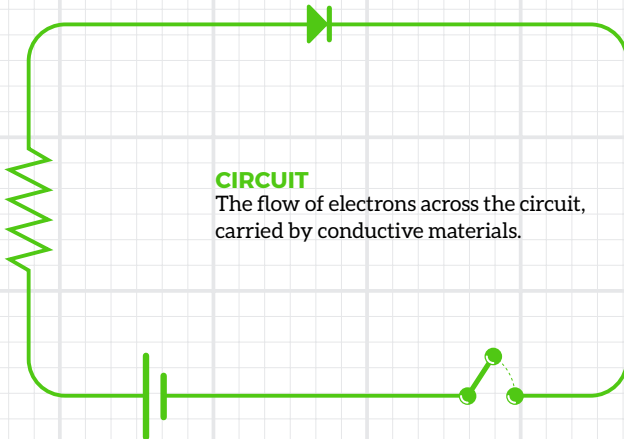
RESISTANCE

Restricts the rate at which electrons flow through the circuit. Conductive materials have different resistances.



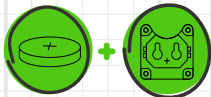
OUTPUT

This is the part that is powered in a circuit. The LEDs and buzzer are outputs in your kit.



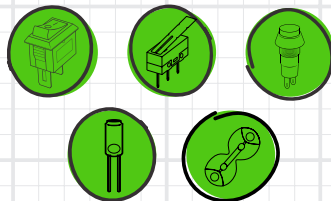
CIRCUIT

The flow of electrons across the circuit, carried by conductive materials.



POWER SOURCE

Provides power to the circuit. Yours is the coin cell battery.



SWITCH

Closes and opens a break in the circuit.

STEP 1: GETTING STARTED

On September 30, 1882, the first residence in the world was powered by electricity. It is now a museum- the Hearthstone House located in Appleton, Wisconsin, United States.

THINGS TO REMEMBER:

A CIRCUIT IS ALWAYS A LOOP.

ELECTRICITY FLOWS FROM POSITIVE TO NEGATIVE AROUND THE LOOP.

EVERYTHING IN THE CIRCUIT MUST BE ORIENTED IN THE SAME DIRECTION

ANYTIME A COMPONENT IS PUT INTO THE CIRCUIT BACKWARDS, IT CAUSES A BREAK IN THE CIRCUIT, MEANING IT BREAKS THE LOOP.

ELECTRICITY WILL ALWAYS TAKE THE PATH OF LEAST RESISTANCE.

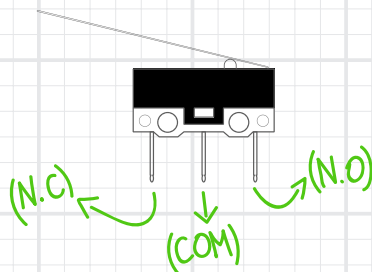
Find the house template on the inside cover of this guide. You could fold the paper directly or trace onto thin cardboard or foamcore.

Next you will prepare to fold the house: Score to fold along the red lines. Cut along the black lines.

LET'S GO OVER HOW THE SWITCH WORKS:

We need to use the terminals that are Common (COM) and Normally Open (N.O.). In this drawing, those terminals are in the middle and on the right.

The Normally Closed (N.C.) terminal is not used in this design.



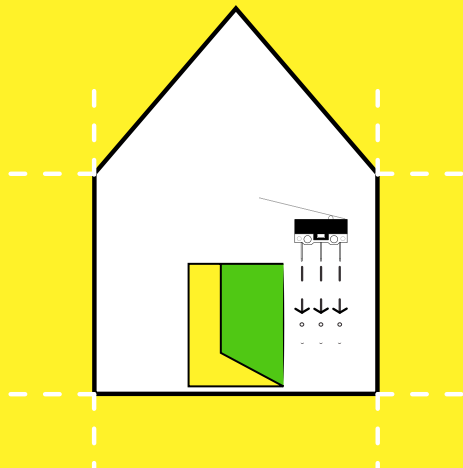
STEP 2: BUILDING THE HOUSE

Flip your house over. You will be working from the inside of the house from here on out.

Place the lever switch near the middle on the right side of the doorway and orient it so the lever pushes down on the left-hand side.

Push the switch through the cardboard.

Remove the switch so you can see the holes that were made. The circuit will only be using the middle hole and on the right.



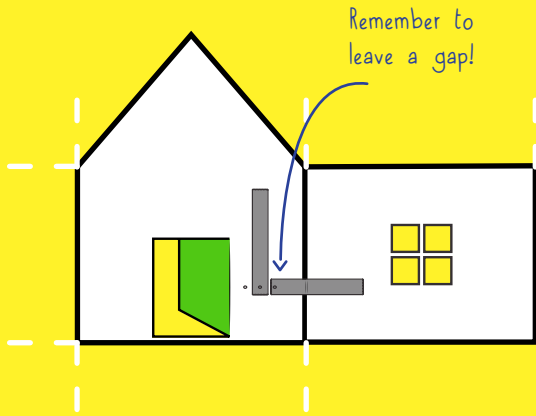
STEP 3: PLACING THE CONDUCTIVE TAPE

Place a strip of conductive tape parallel to the doorway, covering the middle hole that we made with the switch. Make sure that the conductive tape does not cover the left or right holes.

Place a small strip of conductive tape to the right of the first piece, forming an "L"

Be sure that the conductive tape covers the hole on the right and that there is a small gap between the two pieces of tape!

Now push the legs of the switch through the conductive tape into the holes.



STEP 4: ADDING THE SWITCH

Now for the interesting part! We are going to make it so that the door activates the lever switch.

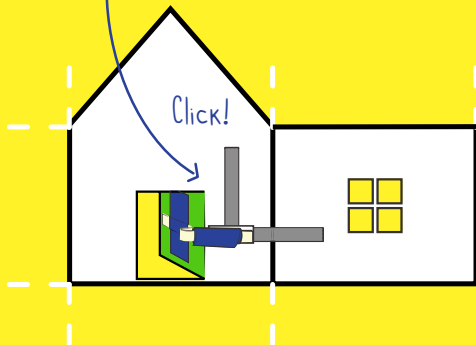
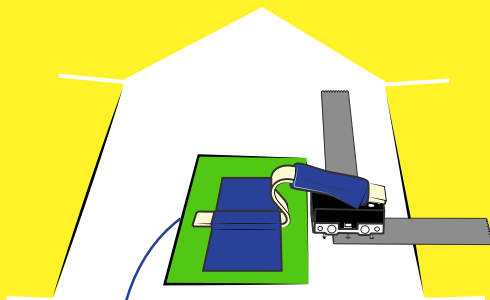
Cut a small rubber band in half and trim it to be about 2 inches in length.

Without stretching the rubber band, tape one end of the rubber band to the lever on the switch and tape the other end of the rubber band onto the door as shown in the diagram to the right.

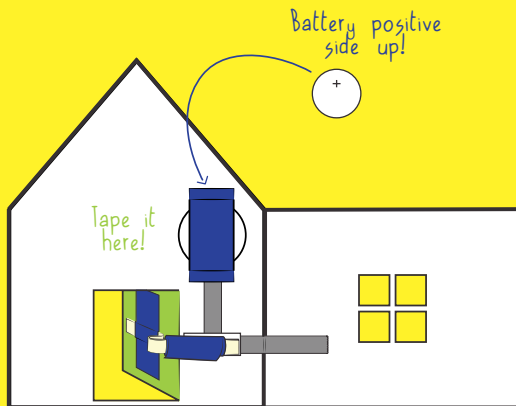
Now let's check the door switch. When the door is closed, the switch should be off, and when the door is open the switch should turn on.

If you hear a click coming from the switch as you open the door, the circuit is working! If it not working, make sure the rubber band is secure and that it is being stretched when you open the door.

Mechanical switches are physically activated by moving, pressing, releasing or touching. Electronic switches are activated by changes within their material state. All the switches in your kit are mechanical switches.



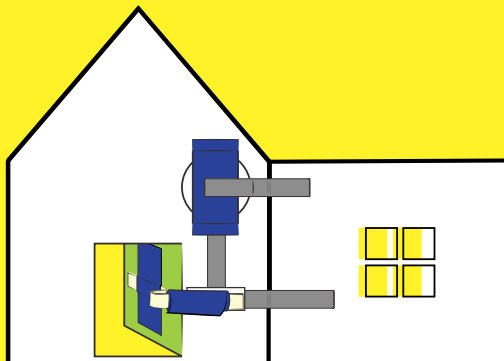
STEP 5: TAPING THE BATTERY



BE SURE TO LEAVE SOME EXPOSED SPACE ON THE TOP OF THE BATTERY AS YOU WILL BE MAKING

Place the battery on top of the first piece of conductive tape as shown. **Be sure that the positive side (+ sign) of the battery is facing up.** Tape the battery down tightly onto the house, using a regular tape.

STEP 6: POSITIVE SIDE OF THE CIRCUIT



THIS PIECE SHOULD BE SHORTER THAN THE PIECE THAT IS CONNECTED TO THE SWITCH.

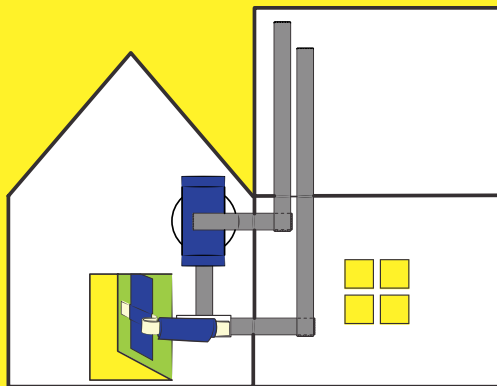
Add another piece of conductive tape that starts from the top of the battery make sure it makes contact with the exposed part of the battery.

STEP 7: MORE CONDUCTIVE TAPE

Now you will add two more pieces of conductive tape.

First, add a long vertical strip, perpendicular to the piece from step 7.

Next, add another piece parallel to the previous one, that starts from the piece in step 8 and continues vertical into the roof, a little bit higher than the stripe beside it.

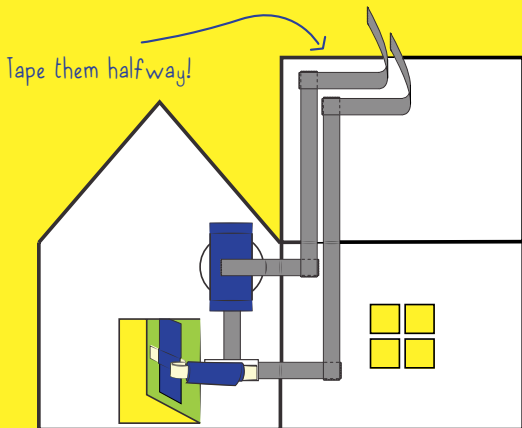


STEP 8: LED TRACKS

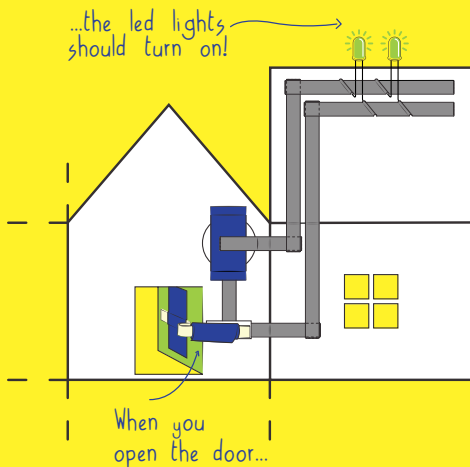
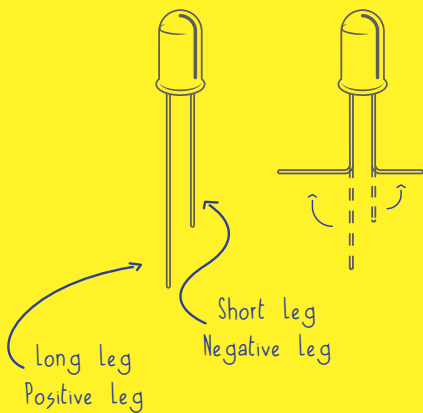
You are going to add two more strips of conductive tape across the inside of the roof as shown.

The top strip is our positive side and the bottom strip is our negative side.

They will tape your LEDs to the house ceiling. For now just tape them down half way.



STEP 9: LIGHTS ON!



Time for the lights! LEDs have one short leg and one long leg. The short leg is the cathode (negative) and the long leg is the anode (positive). Bend the legs of the LED's as shown.

Place the LEDs onto the last two strips of conductive tape such that the positive legs are attached to the top strip and the negative leads are attached to the bottom strip.

Now you can tape down the other half of the conductive strips from step 10.

Ever wondered how electricity gets to your home? Electricity is made by huge generators at power plants. It then travels through the powerlines and enters your house through a meter. From there it travels to the service panel often found in the basement or garage. From the panel, the electricity travels through wires to the outlets and switches of your house!

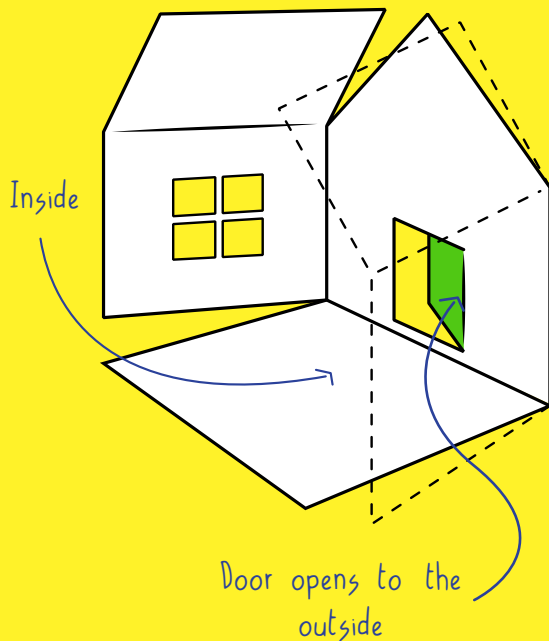
STEP 10: FOLD IT UP!

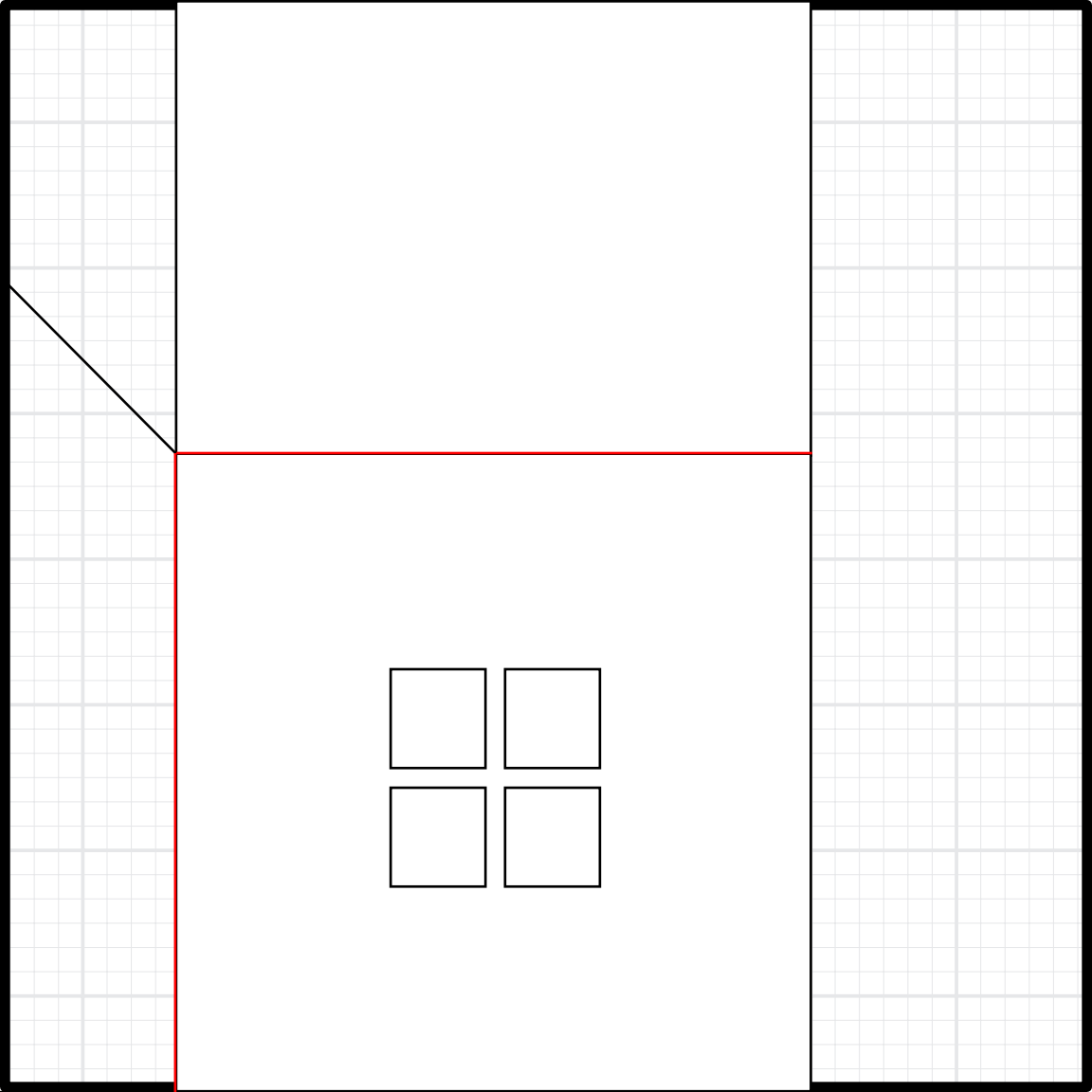
Test your circuit by opening up the door.
When opening up the door, your LED's should light up!

If your LED's are not lighting up, be sure to check that all of your conductive tape connections are tight and secure. Also be sure to check that the LEDs are wired correctly and that your battery is oriented with positive side up.

Now you are ready to fold the house! Tape or glue the sides of the house together!

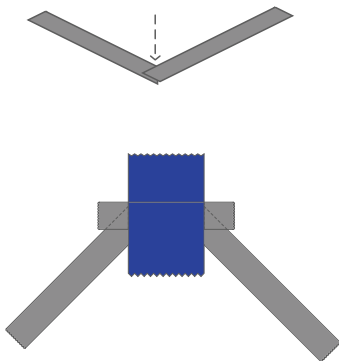
What else do you power in your house? Heaters, speakers, refrigerators, and other appliances all use electricity. Think about these systems to find inspiration for your next project!





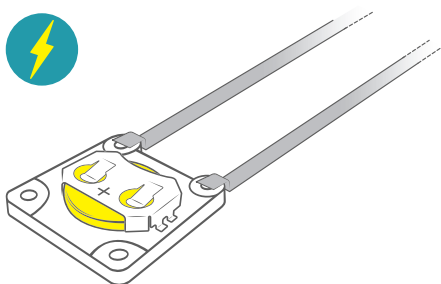
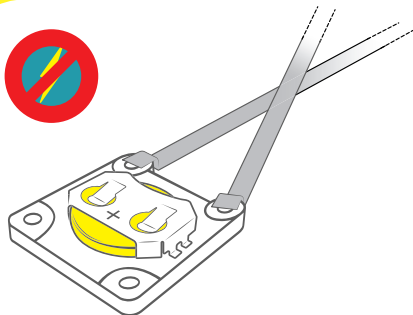
TROUBLESHOOTING

Do not tear or cut the tape!



To make a corner pinch the tape at a 45 degree angle and turn the other side of the tape perpendicular like in the diagram above.

To “patch” two pieces of tape you can take another piece of conductive tape and place across the gap you want to patch and then stick a piece of scotch tape over the top.



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