



DIY Lego LED Bricks

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<https://learn.adafruit.com/diy-lego-led-bricks>

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Overview



DIY Lego LED Bricks

In this guide, you'll learn how to build our own DIY Lego Light Bricks! Inside these bricks are 3D printed and house a tiny LED with batteries. They're pretty cool for adding lighting effects to your scenes and you can easily connect to them to just about any lego compatible brick. You can make them in several colors and turn them on with a tiny button on the side.



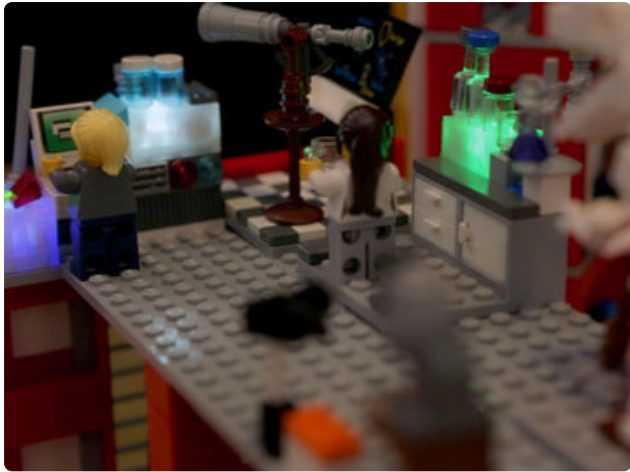
The Research Institute

The set used in this project is **LEGO Cuusoo Research Institute 21110**. This set was voted by LEGO idea members and was successfully supported and manufactured as a limited edition. Originally titled, "[Female Minifigure Set \(https://adafru.it/uvA\)](https://adafru.it/uvA)", this set was designed to encourage women to get into science and technology professions. The goal was to help overcome gender stereotyping in construction play toys. The set features female paleontologist, astronomer and chemist. The set has [VERY limited availability on amazon \(https://adafru.it/uvB\)](https://adafru.it/uvB).



More Glowy!

Compared to official light bricks, these diffuse the whole brick instead of just being a spotlight. They're both the same size but offer different types lighting. The lego light bricks are great for pointing light, while the 3D printed brick glows brighter and can fit in tighter spaces. But you can connect them together to make interesting combinations that illuminate your projects.



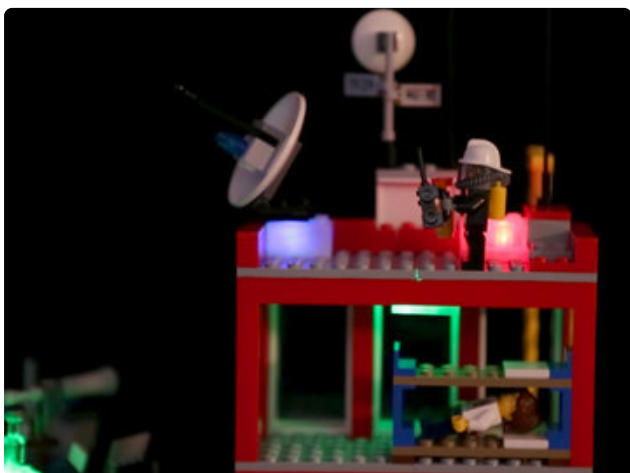
This looks great because the LED is small enough to diffuse the whole brick by angling the light.

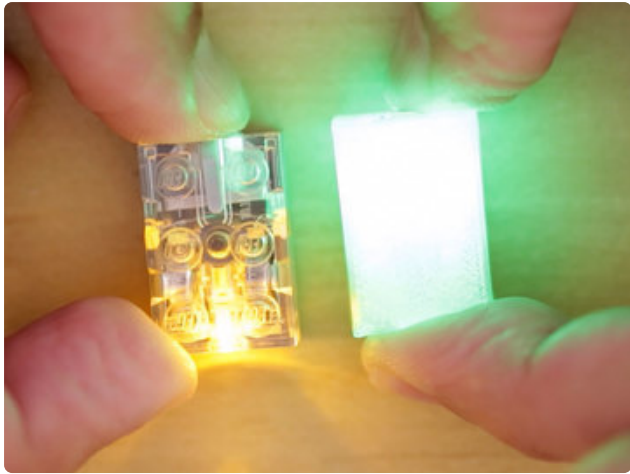


Our printed version uses a tiny push button to turn the lights on and off. Of course the two parts can fit together, so you can combine them to any existing light bricks!



These bricks can fit on even the smallest build plates, so it should print on all 3D printers. It's also a pretty fast print, taking about 8 minutes to finish!





LED Sequins

These are the kid-sister to our popular Flora NeoPixel, they only show a single color and they don't have digital control, but that makes them smaller easier to use for many projects!



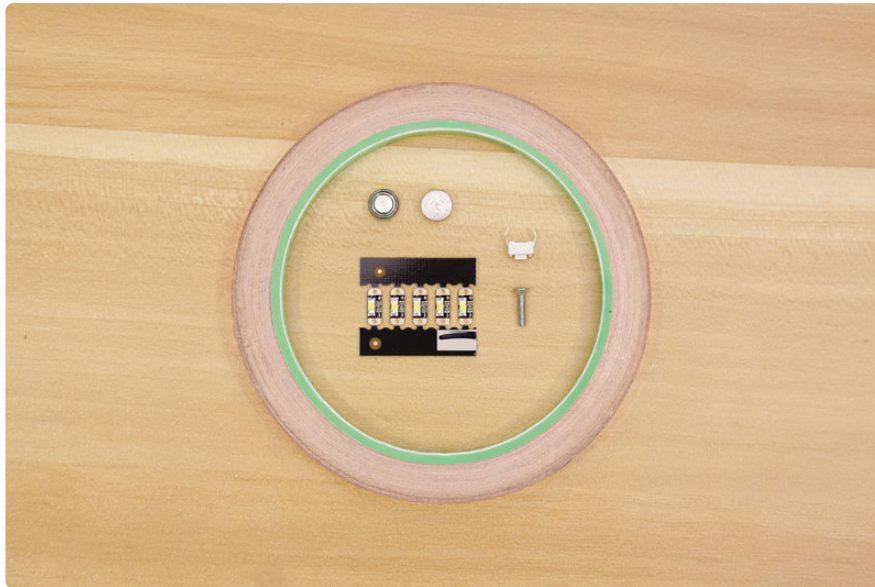
We noticed the green LEDs seem to light bricks the brightest!



Prerequisite Guides

We recommend walking through the following tutorial to get familiar with the components used in this project.

- [Collin's Lab: Soldering](https://adafru.it/rBf) (<https://adafru.it/rBf>)
- [Collin's Lab: Multimeters](https://adafru.it/tlf) (<https://adafru.it/tlf>)
- [All about LEDs](https://adafru.it/uuC) (<https://adafru.it/uuC>)



Parts

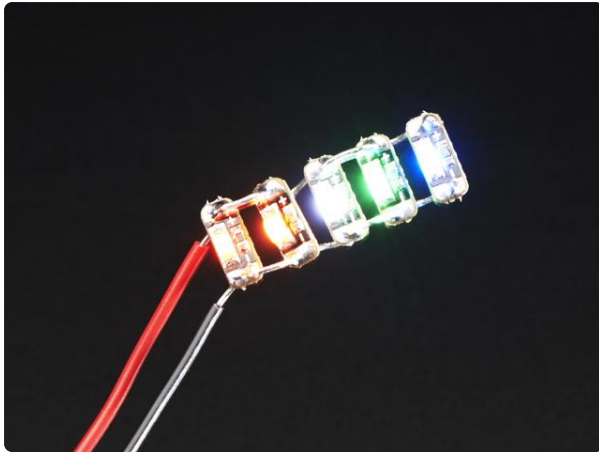
You'll need the following parts to build this project.

- [LED Sequins \(http://adafru.it/3377\)](http://adafru.it/3377)
- [6mm Push Button \(http://adafru.it/1489\)](http://adafru.it/1489)
- [2X LR41 Coin Cell Batteries \(https://adafru.it/uuD\)](https://adafru.it/uuD)
- [M2x.4x9mm \(https://adafru.it/pek\)](https://adafru.it/pek) or #2-56x3/8 screw
- [Tactile Switch Buttons \(6mm slim\) \(http://adafru.it/1489\)](http://adafru.it/1489)
- [Copper Tape \(http://adafru.it/1128\)](http://adafru.it/1128)
- [Translucent PLA \(http://adafru.it/2451\)](http://adafru.it/2451)

Tools & Supplies

You'll also need the following tools and supplies to complete this project.

- [Soldering Iron & Solder \(https://adafru.it/drl\)](https://adafru.it/drl)
- [Tweezers \(http://adafru.it/3096\)](http://adafru.it/3096)
- [Wire Strippers \(http://adafru.it/527\)](http://adafru.it/527)
- [Diagonal Flush Snips \(http://adafru.it/152\)](http://adafru.it/152)
- [Helping Third Hands \(http://adafru.it/291\)](http://adafru.it/291)



[Adafruit LED Sequins - Multicolor Pack of 5](https://www.adafruit.com/product/3377)

Sew a little sparkle into your wearable project with an Adafruit LED Sequin. These are the kid-sister to our popular Flora NeoPixel,...

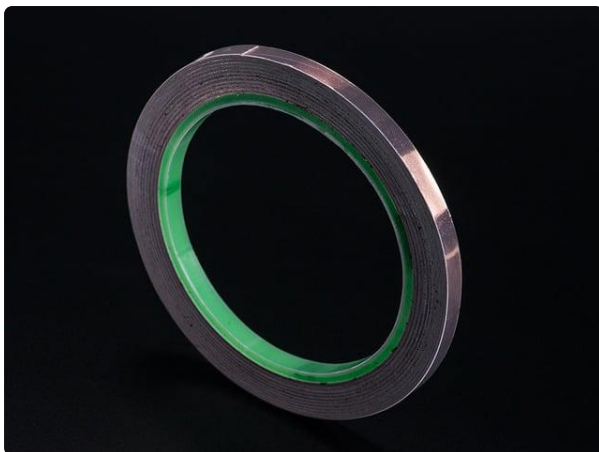
<https://www.adafruit.com/product/3377>



[Tactile Switch Buttons \(6mm slim\) x 20 pack](https://www.adafruit.com/product/1489)

Slim clicky momentary switches are standard input "buttons" on electronic projects. These are half the width of classic 6mm tactile switches so they line up better on a...

<https://www.adafruit.com/product/1489>



[Copper Foil Tape with Conductive Adhesive - 6mm x 15 meter roll](https://www.adafruit.com/product/1128)

Copper tape can be an interesting addition to your toolbox. The tape itself is made of thin pure copper so its extremely flexible and can take on nearly any shape. You can easily...

<https://www.adafruit.com/product/1128>



[PLA Filament for 3D Printers - 1.75mm Natural Translucent - 1KG](https://www.adafruit.com/product/2451)

Having a 3D printer without filament is sort of like having a regular printer without paper or ink. And while a lot of printers come with some filament there's a good chance...

<https://www.adafruit.com/product/2451>

Circuit Diagram



Wired Connections

The circuit diagram above shows how the components will be wired together inside the brick. This won't be 100% exact in the actual circuit but it's a very close approximation.

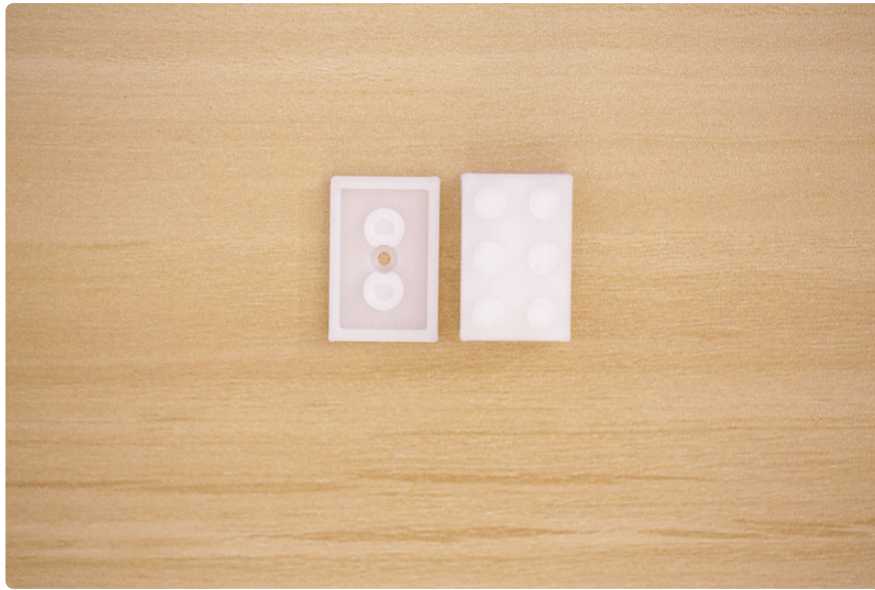
A push button will open and close the connection between the batteries to turn the LED on and off. When the button is held down, the LED stays on, and when it's released the LED turns off.

- Button to the + and - sides of the batteries
- - on the battery to - on the LED sequin
- + on the battery to + on the LED squin

Battery Power

The circuit will be powered by two small LR 41 coin cell batteries. The batteries are arranged in series to increase the voltage required to power the LED.

3D Printing



Download and 3D Print

You can 3D print the bricks using opaque filament on almost any desktop 3D printer. The 3D printed parts can be downloaded with the link below. If you don't have a 3D printer, the files are free to download so can send them to a 3D printing service.

Edit Design

You can easily update the size or add features by editing the Fusion360 designs. The sketches are all listed in the timeline, so it's easy to adjust the size to each component.

Edit Design

<https://adafru.it/19XE>

Download from Thingiverse

<https://adafru.it/uvb>

Download from Youmagine

<https://adafru.it/19eT>

Download from Pinshape

<https://adafru.it/19eT>

3D Printing Lego Bricks

The LED brick was designed in Autodesk Fusion 360 and designed to print in PLA filament. The parts were 3D printed using the BCN3D Sigma and Micro M3D. If you don't have access to a 3D printer, you could use a service like [3D Hubs \(https://adafru.it/jNb\)](https://adafru.it/jNb) to make it for you.

Diffusing LEDs

We found [Natural White PLA/PHA \(http://adafru.it/3059\)](http://adafru.it/3059) filament diffuses the LEDs the best. The soft diffusion illuminates the whole brick. You can also use [Translucent filament \(http://adafru.it/2451\)](http://adafru.it/2451) for a brighter light.

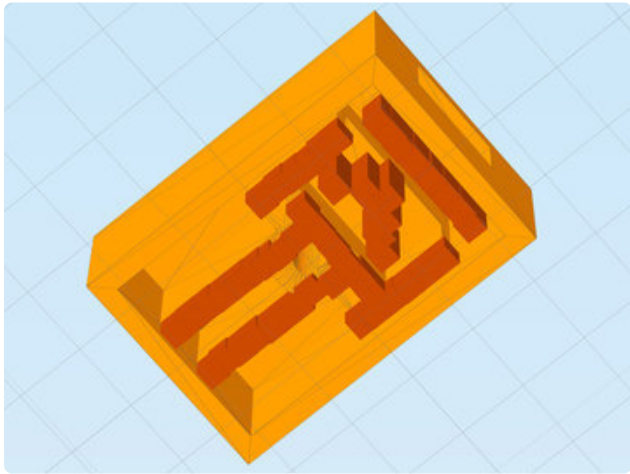
Slice Settings

Depending on your 3D printer, you may need to adjust the slice settings. We tested the enclosure on a BCN3D Sigma. The **legoBody.stl** part will **require support** materials. The parts are oriented to print "as is".

- Nozzle: 0.31mm
- Extrusion Multiplier: 1.0
- Extrusion Width: 0.39mm
- Layer Height: 0.2mm
- Nozzle Temperature: 225c
- Print Speed: 60mm/s
- Brim: 6mm

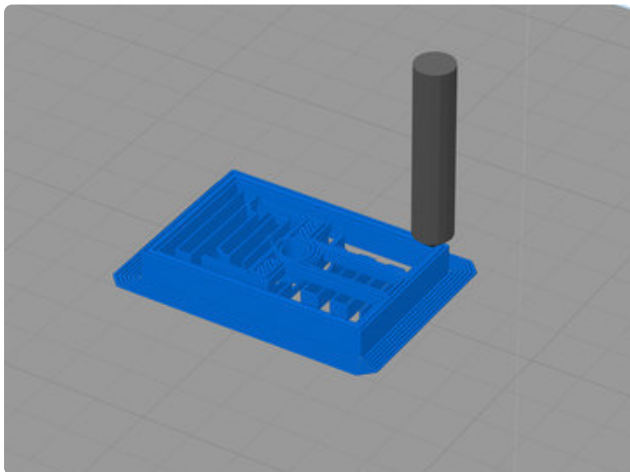
Supports, Brims & Walls

The **legoBody.stl** will require supports to support the LED, battery and screw mounts .



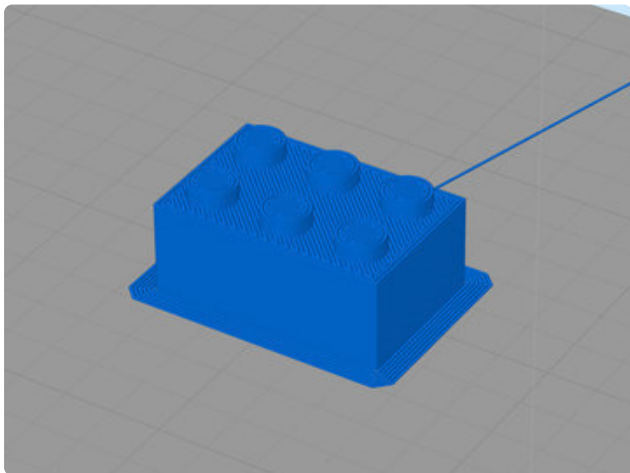
Make sure to disable "dense supports" and vertical upper and lower separation layers to make the supports easier to remove.

We added pillars with a resolution of **2mm** to the middle under the walls that hold the parts in place. Add the pillars so they can support the corners no the walls.



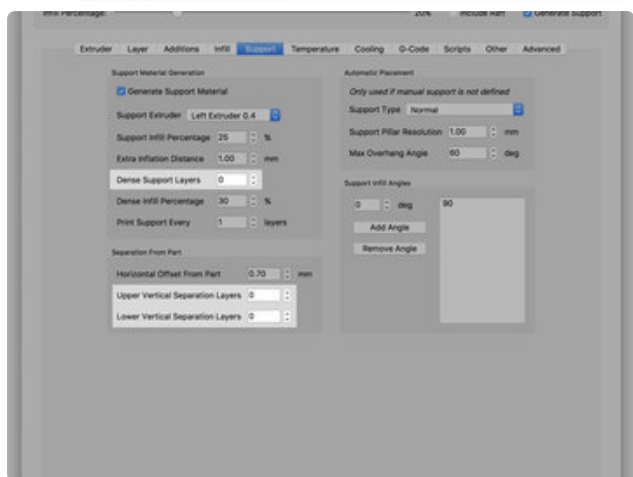
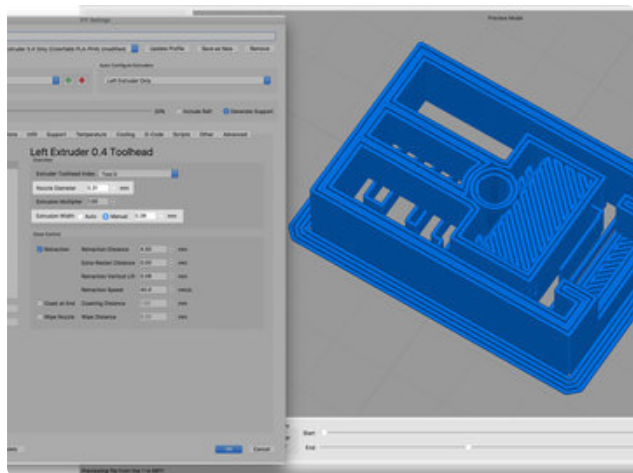
Brims

If you encounter lifting on the corners, we'll need to add a brim to hold down the part. We used no heat and blue painter tape and a 4 brim outlines around the part.



Wall Strength

We'll want the walls of the brick to be really strong by making sure gaps between them are solid (no zig zags inside the gaps). We had to adjust the nozzle diameter and extrusion width to make sure no "zig zag" paths are inside the wall gaps. Always preview tools paths before printing to insure no strange paths are created.





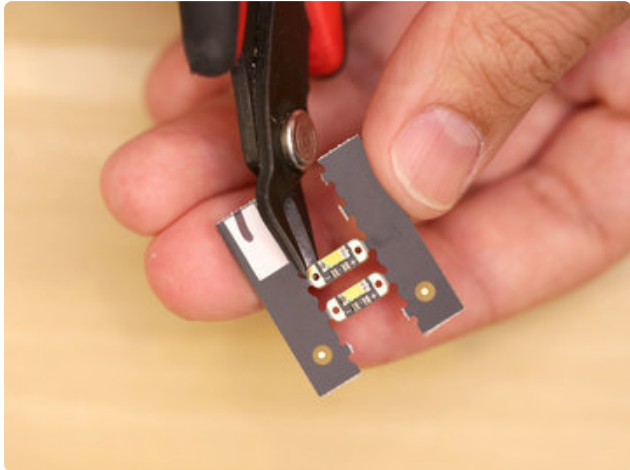
Support Removal

The 3D printed part will need supports to hold up the mounting walls, so we can use flat pliers to help remove them.



Position the pliers under the supports and lift up the pry off as one piece. Use a hobby knife to clean up the gaps between the walls.

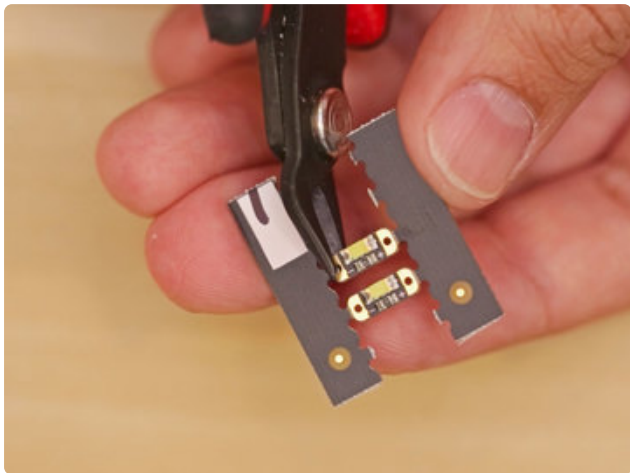
Assembly



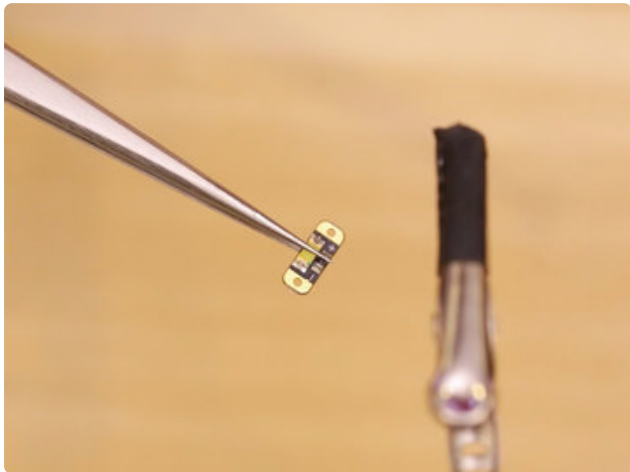
Prep LED Sequins

LED sequins come in a pack of five. Use flush diagonal cutters to break them away from the panel.

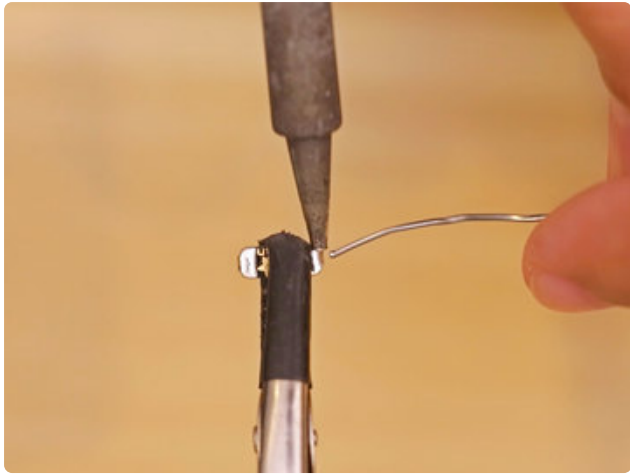
Cut close to the pads to avoid having to remove any perforations on the edges.

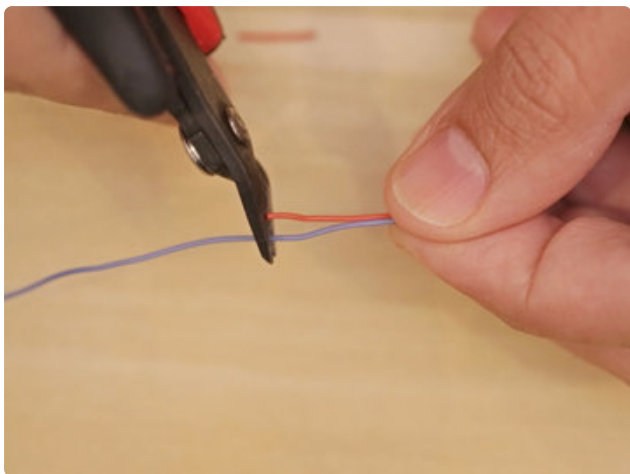
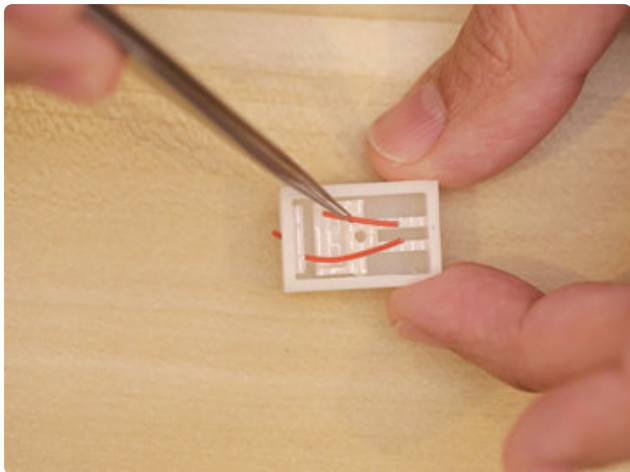


We'll need to connect wires to the LED sequin from the bottom of the PCB. You can tell which pad is positive and negative by looking at the adafruit logo – It's right next to the positive+ pad.



Use third helping hands to secure the LED sequin. Then, tin the positive and negative pads with a bit of solder.

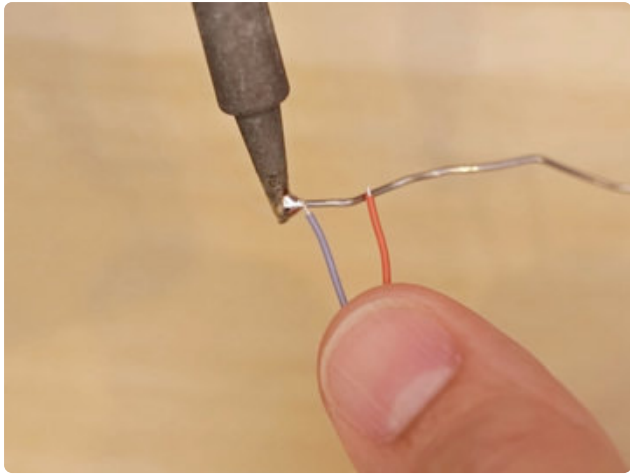


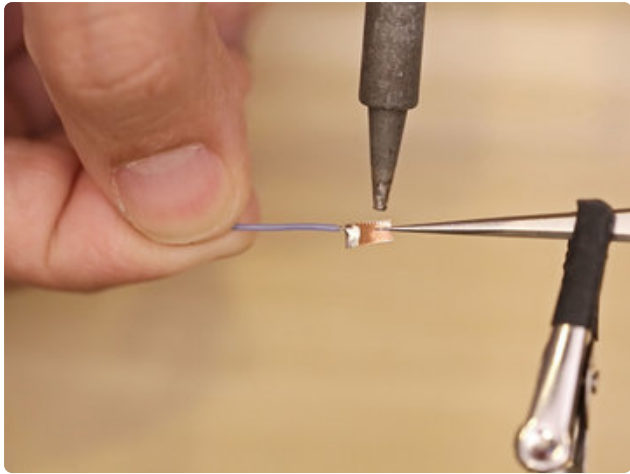


Measure and Tin Wires

Now we can measure the wires for the LED and the push button. For the push buttons we'll measure from the battery walls in the center, to the opening on the side of the brick. The LED will connect from the center cut away to the top of the two middle walls.

Match up the wire lengths for the opposite side and cut them to size. Tin all of the wires so they won't fray while soldering together. It's also a good idea use silicone coated wires since we'll need to flex the wires to fit inside the brick. Here we're using 30 gauge silicone coated wire to fit between the wall gaps.





Copper Tape

Now we can create the contacts for the coin cell by using pieces of copper foil tape. The tape has a sticky backing and we can solder wire directly to the tape.



Hold the pieces of copper foil tape with tweezers. Secure the tweezers to third helping hands to keep it sturdy while soldering. Tin one side of the piece of copper foil tape with a bit of solder. Then, solder the longer wires to the copper tape. Repeat this process for the second wire.

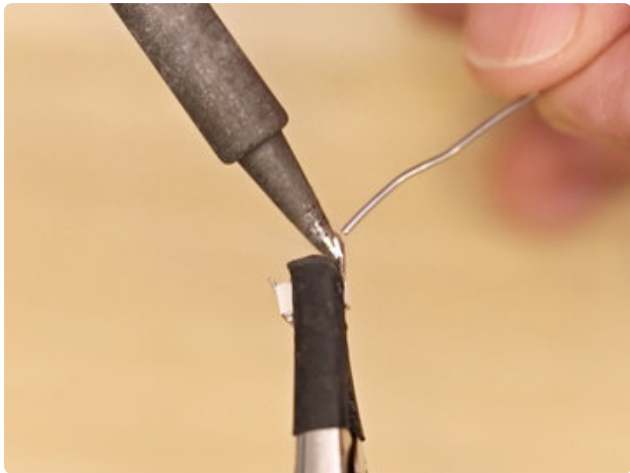


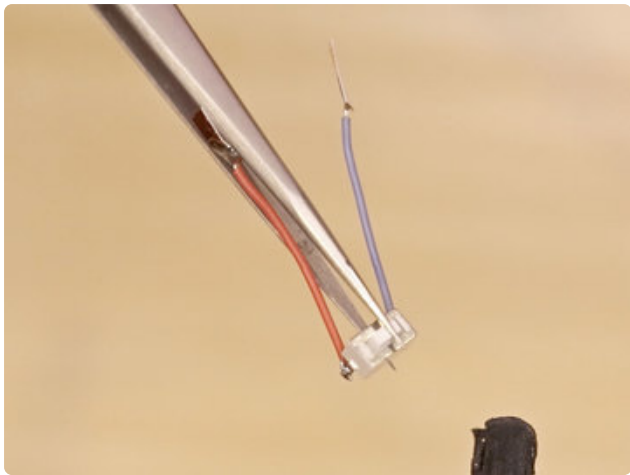
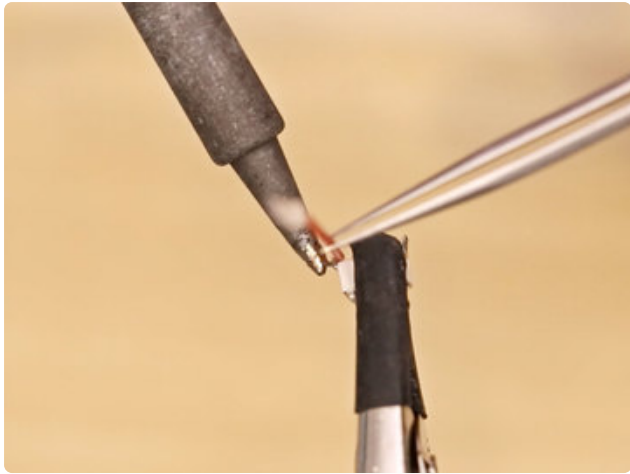
Button

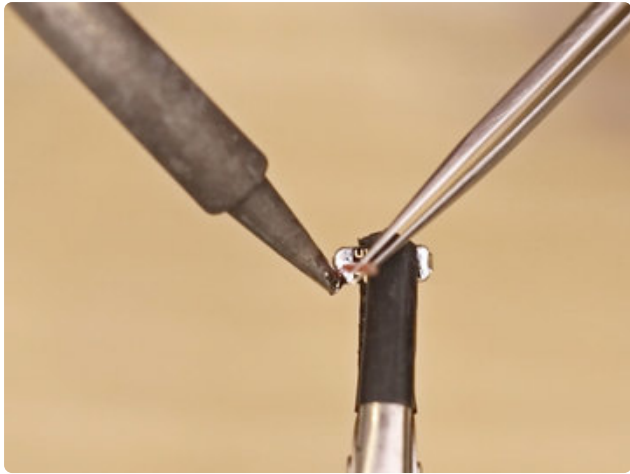
The longer wires will connect to the push button. To fit our button inside the brick, we'll first need to trim the two pins from the button short. Cut both pins using a pair of flush snips, just below where they bend. Secure the button to third helping hands. Then, tin the two short pins with a bit of solder.



Next, we'll connect the wires to the pins on the button. These should be positioned on the inner side of the pins at an up right angle. This way we can fit the button through the opening on the brick.



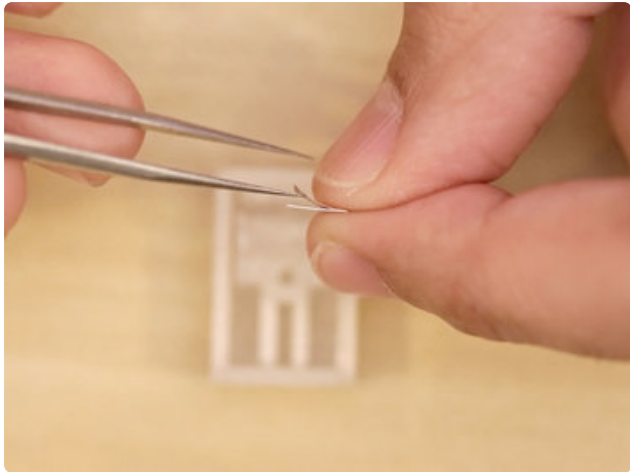




LED wires

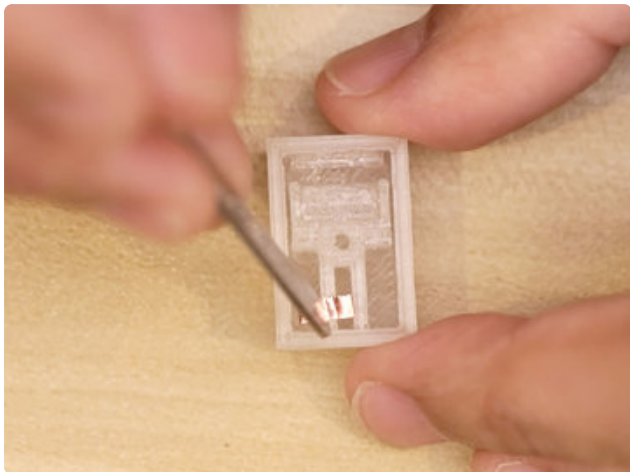
Now we can solder the two shorter wires to the pads on the LED sequin. Secure the LED sequin to third helping hands. To diffuse the brick, we'll need to position the LED face down. Then, solder the wires on the bottom of the PCB.



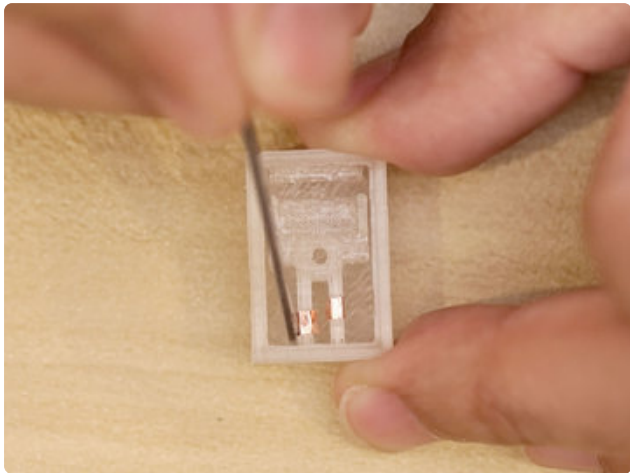


Copper Tape contacts

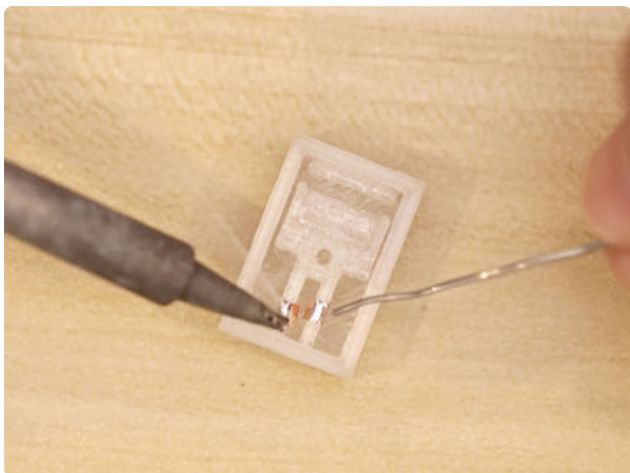
We'll need two more pieces of copper foil tape for connecting the batteries to the LED sequin. Use scissors to cut thin slices of copper foil tape. Then, remove the backing and stick them to the inside of the brick.

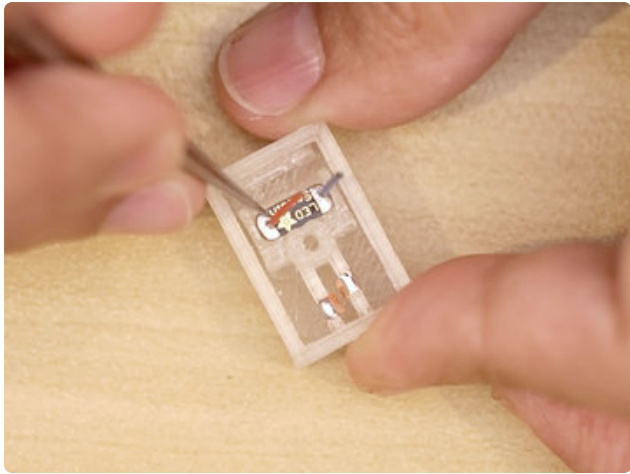


You can use tweezers to stick the copper foil tape to the inner lining of the brick. Use the flat end of the tweezers to evenly stick them to the walls. Follow the photo to reference the correct position.



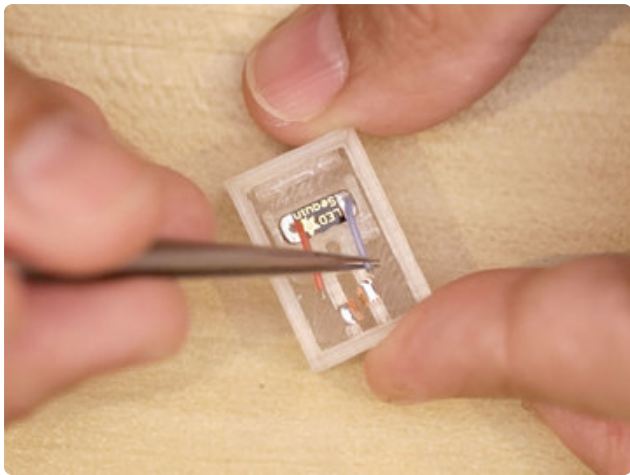
Next, tin the two pieces of copper foil tape with a bit of solder.





Mounting LEDs

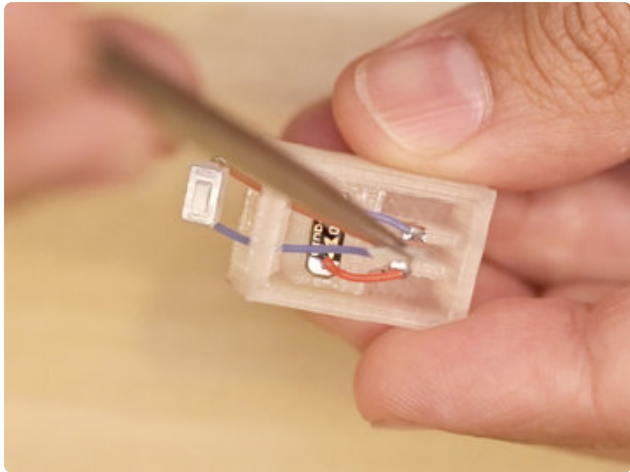
Now we can insert the LED into the brick, face down. It should press fit into place with the wire facing upright.



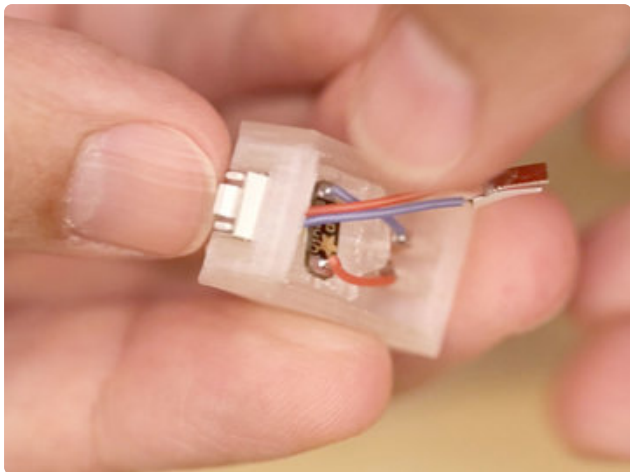
Next, position the wires toward the two pieces of copper foil tape.



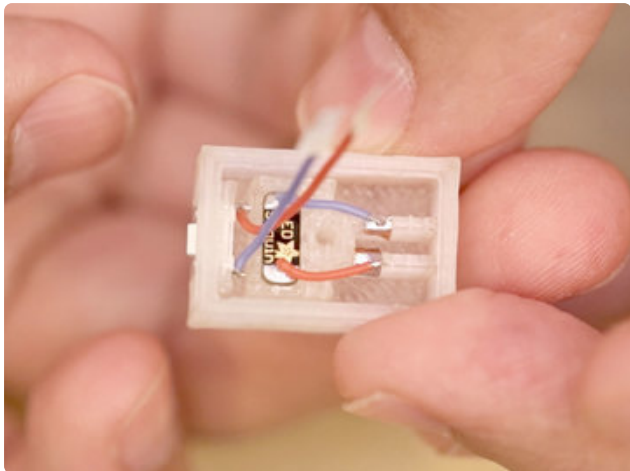
Hold the wire in place and carefully apply heat to solder each wire to the copper foil tape. Make sure your iron is clean so you can quickly solder the wires without melting the brick.



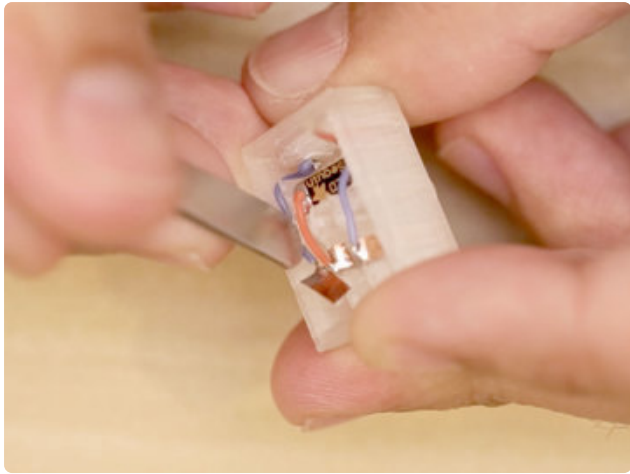
Mount Button



Now we can insert the push button into the brick with the wiring going through the opening first. Press the button in until it snaps into place.

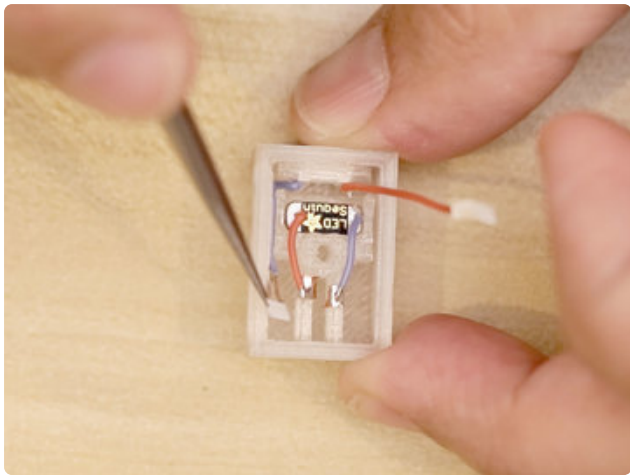


The pins should be short enough to push up against the wall. If the button stick out too much, you'll need to trim the pins until it fits.

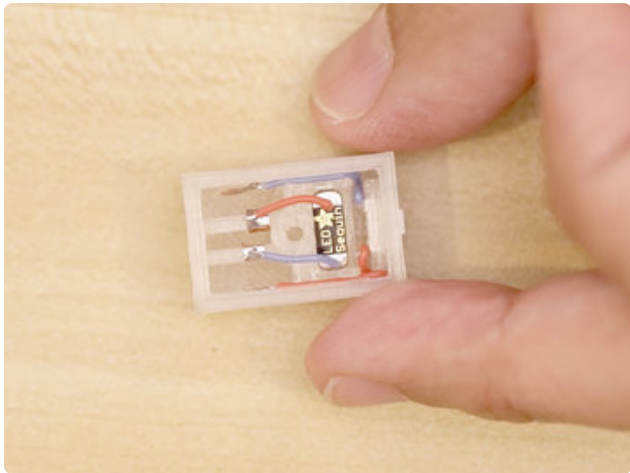


Wedge Wires

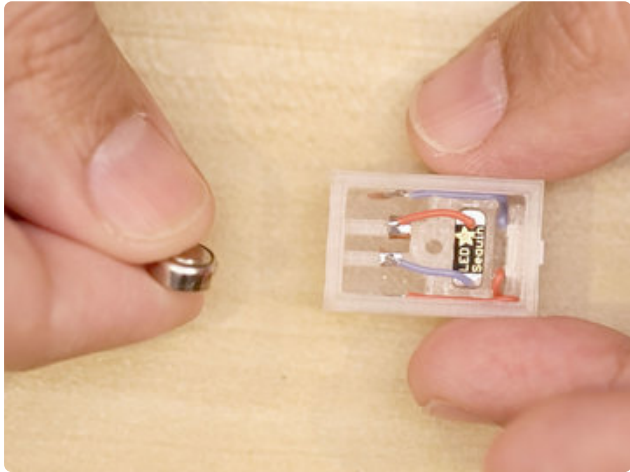
Now we can wedge both wires between the gaps in the walls. Use the flat end of the tweezers to help tuck the wires inside.



Remove the backing from the copper tape and stick it the inner side of the walls.



Insert Batteries

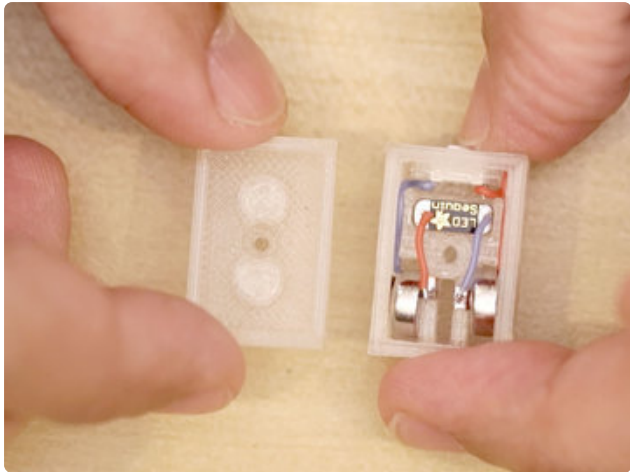


Next, insert the batteries in the brick. Line up the positive and negative contacts with the copper foil tape so they have matching polarities.



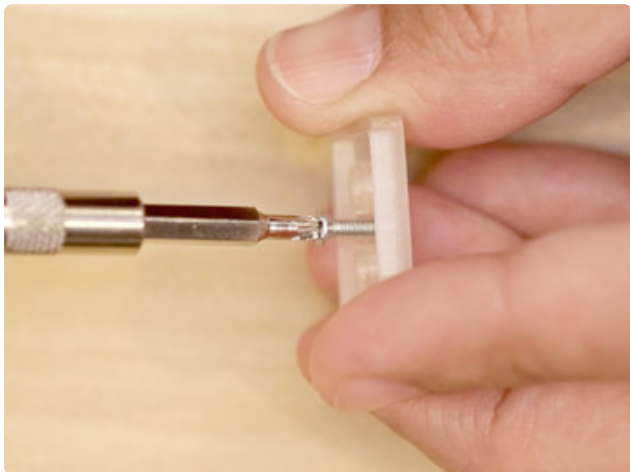
If the batteries are loose, you can add an additional piece of copper tape to help keep the batteries from moving around. Press the push button to check if the LED powers on.

If it doesn't power on, make sure the copper tape is making contact with the batteries.

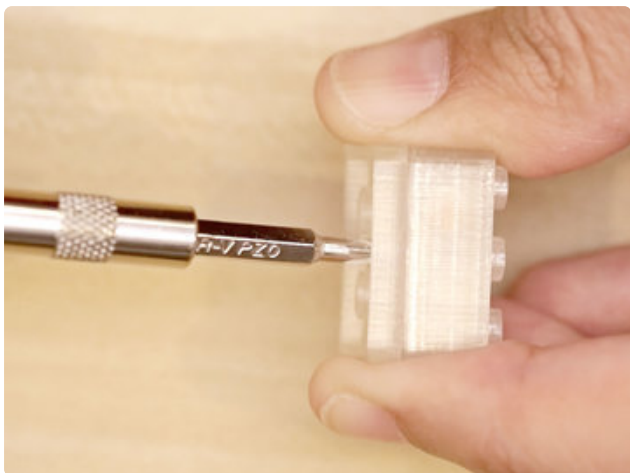
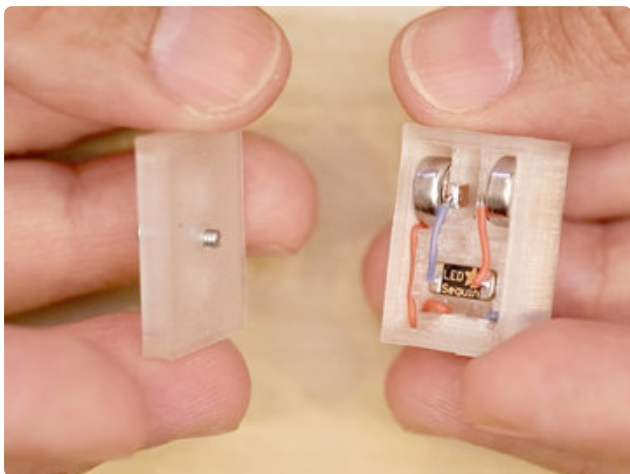


Attach bottom

Now we can secure the bottom cover to the brick. Use an M2 (or a #2-56) machine screw to mount the two parts together.



Fasten the screw through the bottom cover to create threads in the mounting hole. Try to keep the machine screw straight while fastening. Then, position it over the brick and fasten the screw until both parts are tightly mounted together.





Completed Bricks

And now we have a super bright DIY lego light brick!! Add these to light light up props in scenes or even add it to characters to give them a cool looking glow. You can of course combine these with original light bricks to create different light combinations.