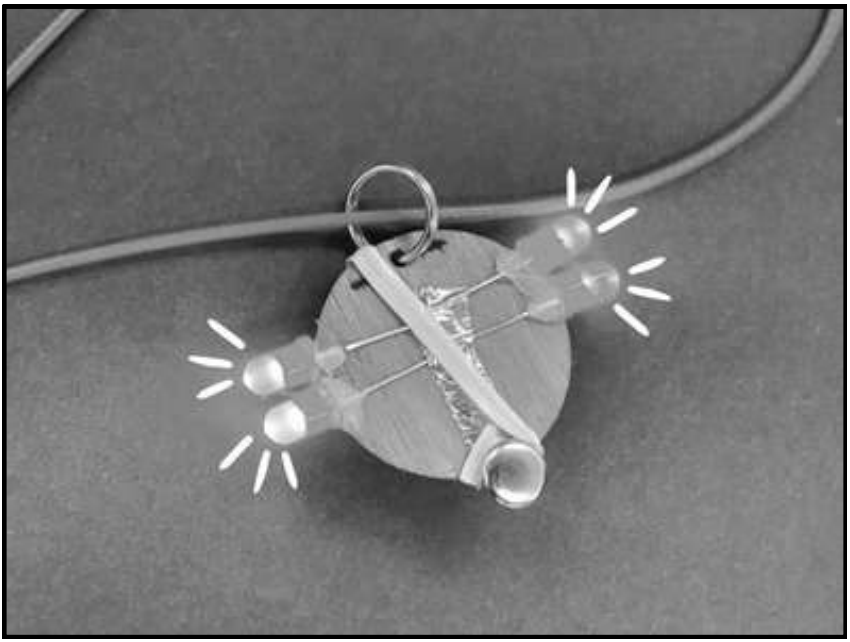
DIY LED Pendant

Instruction Guide



Presented by Windsor Hackforge
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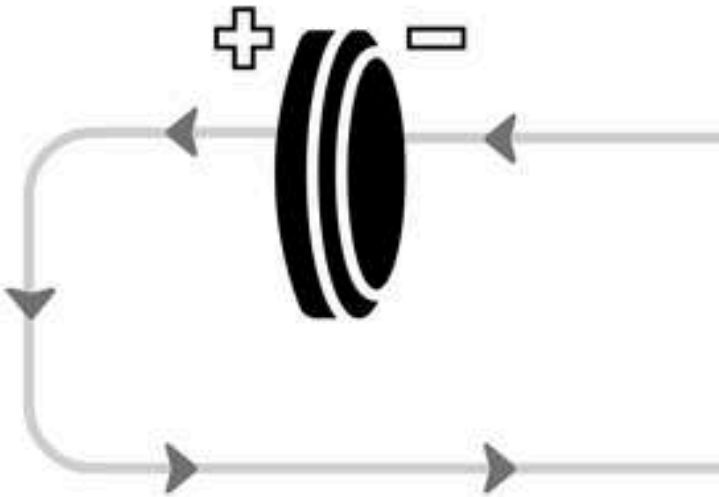
Electricity Basics

Electricity is the flow of tiny particles called **electrons.** These electrons are constantly moving, and as they do they power things like computers, speakers, and lights.

As they move (or **flow**), electrons are always going in the same direction - from **positive (+) to negative (-).**

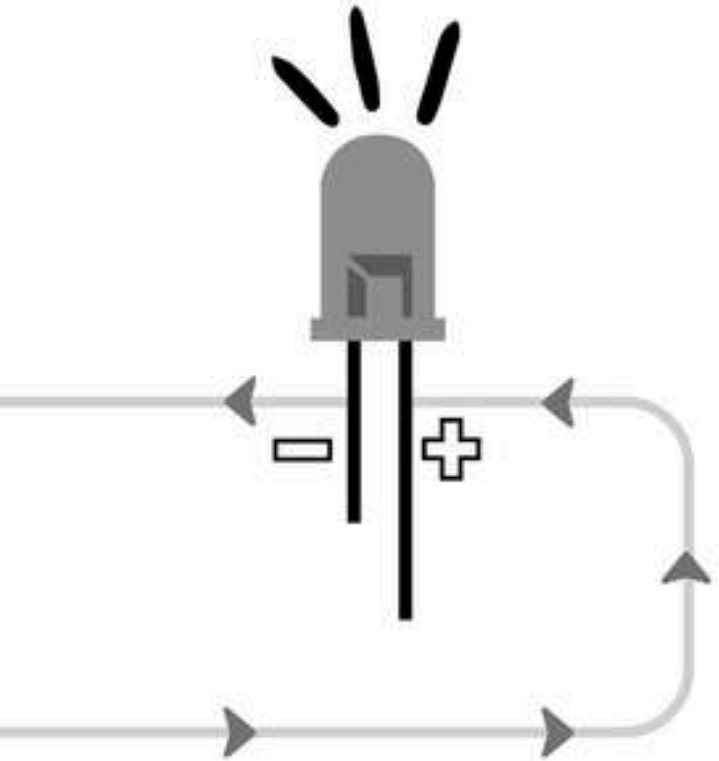
When conductors and insulators are used to direct electrons from the positive side of a battery, through a light, and back into the negative side of the battery, this is called a **circuit.**



By remembering this, and using the right materials, we can direct the electricity where we need it.

Conductors are materials that electrons can move through - like metal and water.

Insulators are materials that electrons can't move through - like plastic and wood.

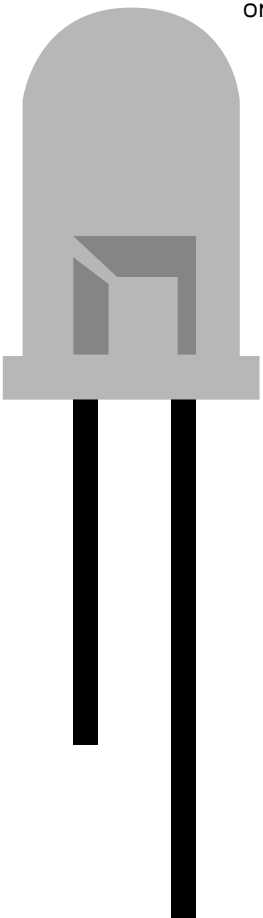


What is an LED?

An LED is like a one-way street for electricity. It only lights up when the current flows in the **correct direction.**

Under its plastic cover are special materials called **semiconductors.** When electrons pass through, they **release energy as light.** The type of semiconductor determines the color of the light—for example, red, blue, or green.

Unlike old-fashioned bulbs that glow by getting really hot, LEDs make light without heat, so they waste less energy and last much longer. That's why they're used almost everywhere, from the tiny light on your TV remote to the giant screen at a hockey game!



Another perk of LEDs is their ability to turn on almost instantly - much faster than a regular light bulb. That's why they're used in places where timing matters, like traffic lights and video screens.

The LEDs being used in this workshop are 5mm each, which is pretty small, but some LEDs are even smaller! One type is so tiny that thousands of them can fit on the tip op a pencil!

Safety Notice

General Workshop Safety

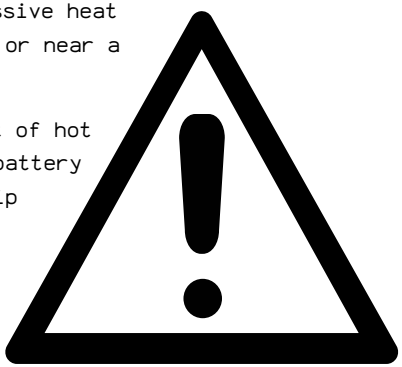
- Anyone under 15 must be supervised by their adult at all times during the workshop.
- Do not put any of the materials in your mouth, nose, or ears.
- Accidents can happen! Ask any Workshop Assistant for help immediately if you injure yourself.
- Assume all tools that can get hot, are hot, even if you think they might not be plugged in.

Hot Glue Gun Safety

- Only touch the handle of the glue gun, as the tip and melted glue can cause burns.
- Let the glue cool before touching your project - it hardens quickly but may stay hot for a few seconds.
- Avoid rubbing or touching your eyes immediately after using or touching the glue.
- Always place the glue gun on its stand or a designated safe surface when not in use.

Battery Safety

- Never put coin cell batteries in or around your mouth, nose, or ears. They can be dangerous if ingested or inserted.
- Do not expose batteries to excessive heat (like leaving them in a hot car or near a fire).
- It is safe to use a small amount of hot glue directly on the coin cell battery but do not leave the glue gun tip in contact with the battery for more than a few seconds.



Don’t hesitate to ask questions!

When your battery runs out, don't put it in the trash!

Be kind to the environment and bring it to a battery recycling centre.

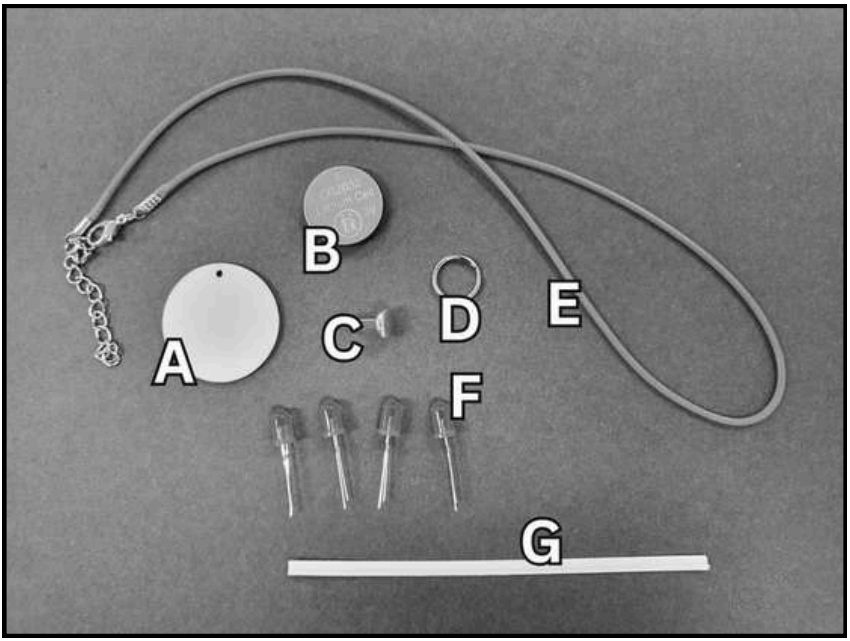
Many office supply, grocery, and hardware stores (such as Home Hardware, Superstore, and Staples) accept empty batteries.

Visit **RecycleYourBatteries.ca** (or scan the code to the right) for additional locations and information.

Materials

A. 30mm wooden pendant (x1)*
B. 3v coin cell battery (x1)*
C. Brass-coated split pin (x1)
D. 12mm split ring (x1)*
E. Necklace (x1)
F. 5mm LED (x4) **(all one colour)**
G. Paper-coated twist tie (x1)

* indicates items distributed by workshop assistants. All other materials can be found on tables.



Not Pictured:

- Hot Glue
- Copper tape
- Electrical tape
- Scissors
- Markers (Optional)
- Decorations (Optional)

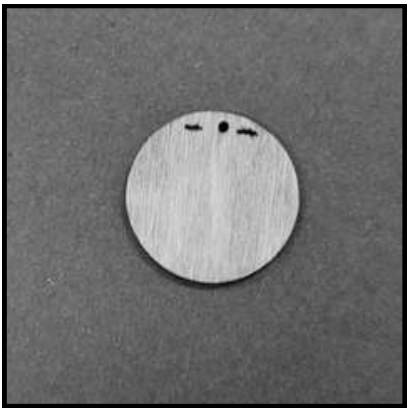
Prefer video instructions?
Scan the QR code!

Part 1: Preparation

Having these steps completed in advance will help your build to go smoother.

1. Use a pen or marker to label one side of the disc as positive (+) and the other as negative (-).

2. Colour the negative side of the pendant (optional).

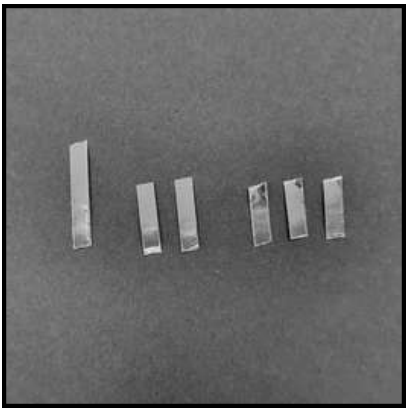


3. Attach the split ring through the hole of the wooden pendant.

4. Cut the following pieces of copper tape - **do not remove the paper backing at this point.**

    a. 5 pieces, each roughly 2cm long

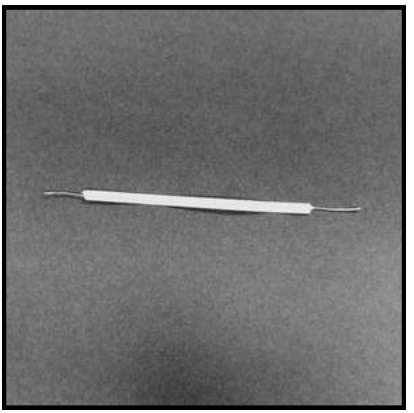
    b. 1 piece, roughly 3cm long



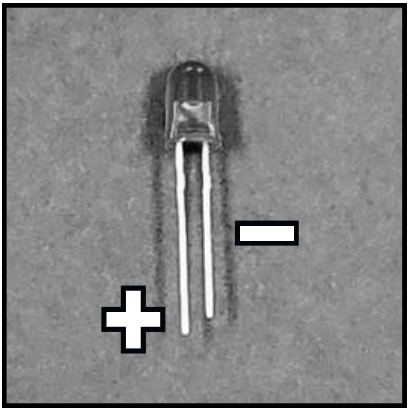
5. Strip about 2cm of paper from each end of the twist tie.

    a. Bend the twist tie at the 2cm mark to loosen the paper, then use your fingernail to scrape the paper off.

    b. Ensure that all paper is removed from these sections - a proper connection requires bare wire.



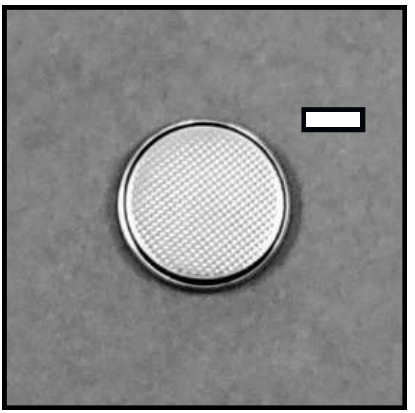
Get familiar with your lights and battery - and **make sure they work!** - by following these next few steps. Checking now to ensure that everything works will save troubleshooting and rework later on.



LEDs have 2 different sized legs - the **longer leg is positive** while the **shorter leg is negative**.

6. If the battery is still in its packaging, remove it now. Discard the packaging.

The battery features a textured side, and a smooth side with writing. The **smooth side is positive** and the **textured side is negative**.

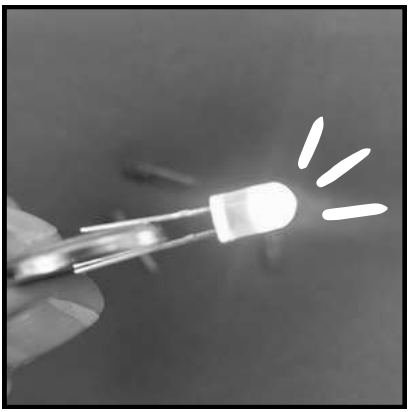


7. Ensure that all four LEDs are the same colour

8. Orient the battery so the **negative** (textured) **side** is facing **up**.

9. Orient one of the LEDs so the **negative** (shorter) leg is on **top.**

10. Maintaining these orientations, gently slide the LED onto the battery, with the negative leg of the LED in contact with the negative face of the battery, and the positive leg of the LED in contact with the positive face of the battery.



11. If both the battery and LED are operating and aligned correctly, the light will begin to glow.

12. Separate the battery and LED, and repeat for each of the three remaining LEDs.

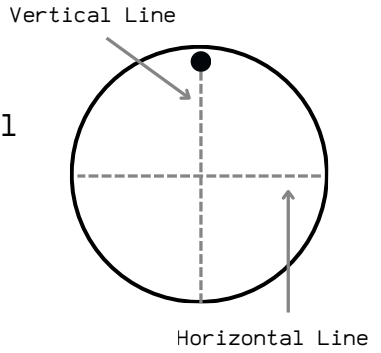
If **<u>one</u> of the four LEDs does not glow**, set it aside and replace it with another one (make sure its colour matches the other three!).

If **<u>none</u> of the four LEDs glow**, this is likely a battery issue. Speak to a workshop assistant to receive a new one.

Part 2: Attaching the Split Pin

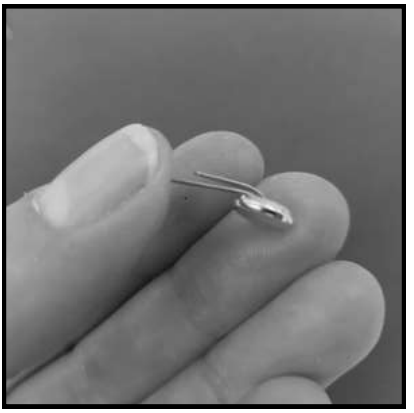
To help ensure proper placement of elements on the wooden pendant, imagine that it is divided into four equal sections, with the first line drawn straight down from the hole. The rest of these instructions will refer to this as the vertical line. The second line crosses the first at a right angle.

The rest of these instructions will refer to this as the horizontal line (**see the diagram to the right**). If it helps, you can even draw these lines onto your pendant.



The split pin will act as an anchor for our wire, and will ensure the wire is connected to the negative legs of the LEDs.

13. Bend the head of the split pin so it faces the same direction as its longer leg.



14. Flip the pendant so that the **positive side** is facing **up.**

15. Lay the pin on its face, so that the **short leg** is on **top.**

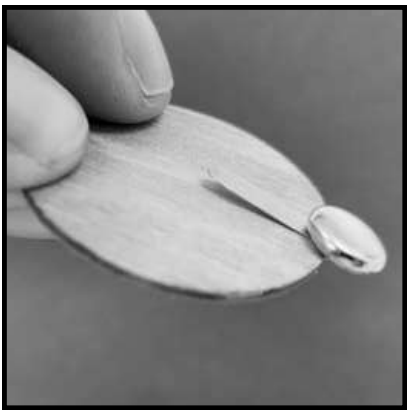
16. Place a small dab of hot glue along the ***vertical line***, directly opposite the hole in the pendant.

17. Slide the wooden pendant between the legs of the pin, with the short leg on the positive side (in the glue) and the long leg on the negative side.

a. The legs of the pin should align with the ***vertical line***.

b. The head of the pin should be facing out on the negative side of the pendant.

18. Once the glue is dry, hold the long leg of the pin flat against the negative side of the pendant. With your other hand, bend the head of the pin up towards the negative face. This will help the leg to lay flat against the pendant.



In the following steps, you will be insulating the positive side of the pin. This will prevent the pin from coming into direct contact with the battery (once it is added).

19. Flip the pendant so that the **positive side** is facing **up.**

20. Cut about **1cm** of electrical tape.

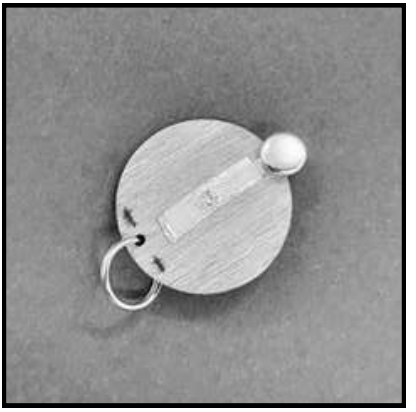
21. Cover the short leg of the pin with electrical tape.

    a. Do not let the electrical tape reach all the way to the head of the pin. It should stop at the edge of the pendant.

22. Flip the pendant so that the **negative side** is facing **up**.

23. Remove the paper backing from one of the **2cm** strips of copper tape.

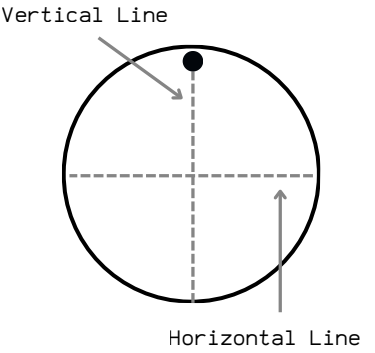
24. Lay the copper tape along the long leg of the pin, atop the ***vertical line***.



Part 3: Attaching the LEDs

Next you'll be adding the LEDs to your pendant. Pay close attention to the instructions to ensure the positive and negative sides of your pendant and lights are properly aligned.

(keep this diagram in mind when completing the next few steps)



25. Orient the pendant so that the **negative side** is facing **up**.

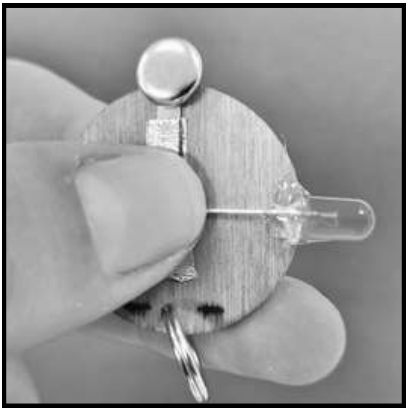
26. Orient one of the LEDs so the **negative** (shorter) **leg** is on **top.**

27. Maintaining these orientations, gently slide the LED onto the pendant, along the horizontal line.

    a. On the positive side of the pendant, the LED legs should cross the electrical tape, not coming into contact with the split pin.

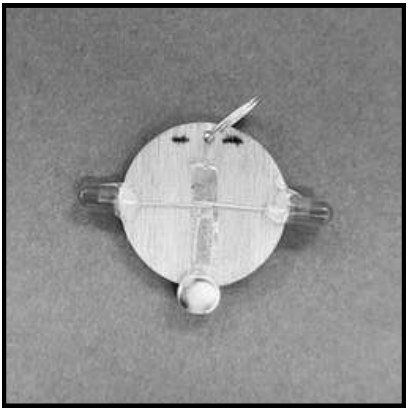
    b. On the negative side of the pendant, the LED legs must come into contact with the copper tape.

28. Once you've made sure the LED is properly placed on the pendant, hold the end of the negative leg against the pendant, and place a small drop of hot glue on top of the leg at the point where it meets the light casing, securing it to the pendant.

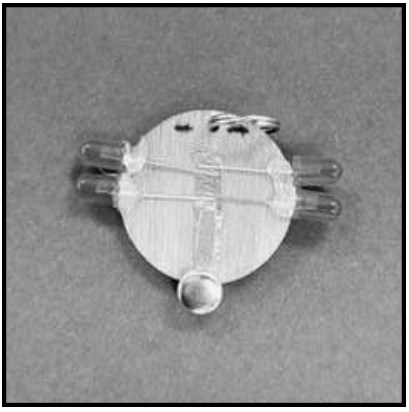


29. Allow the glue to dry for a few seconds.

30. Repeat steps 25 through 29, this time placing the LED **directly opposite** the first one.



31. Repeat steps 25 through 30, this time placing the third and fourth LEDs **directly beneath** the first and second, resulting in two rows of lights.



32. Flip the pendant so that the **positive side** is facing **up**.

33. Remove the paper backing from one of the **2cm** strips of copper tape.

34. Place the tape parallel over the legs of the top row of LEDs.

   a. Ensure that it is pressed down securely, in contact with both legs as well as the pendant.

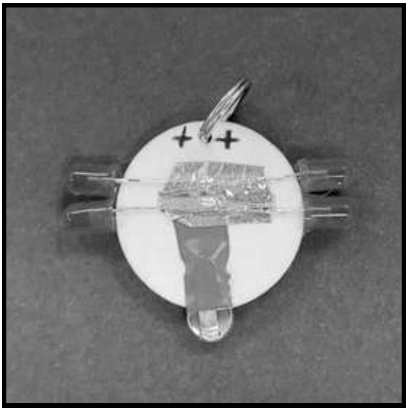
35. Remove the paper backing from another of the **2cm** strips of copper tape.

36. Place the tape parallel over the legs of the bottom row of LEDs.

   a. Ensure that it is pressed down securely, in contact with both legs as well as the pendant.

37. Remove the paper backing from a third **2cm** strip of copper tape.

38. Place this piece of tape between the two existing strips of copper tape, joining all three together.

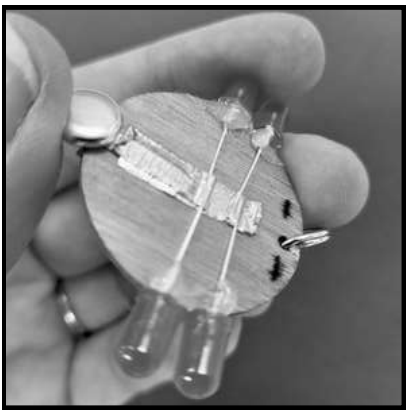


39. Flip the pendant so that the **negative side** is facing **up.**

40. Remove the paper backing from the final **2cm** piece of copper tape.

41. Place the copper tape along the vertical line, sandwiching the LED legs between the bottom layer of copper tape, and this new top layer.

42. Ensure that the tape is firmly connected to the LED legs and previous piece of copper tape.



Part 4: Battery Attachment

The battery needs to be secured to the pendant while constantly maintaining its connection to the positive legs of the LEDs. This step will use a strip of copper tape to create a "*hinged*" connection that is not interrupted by the hot glue that fuses the battery to the pendant.

43. Flip the pendant so that the **positive side** is facing **up.**

44. Place the coin battery **on top of the LEDs** with the positive side facing up.

45. Remove the paper backing from the **3cm** piece of copper tape.

46. Lay the copper tape over the existing tape, following the **horizontal line**, and onto the **positive side** of the battery.

a. This should result in the tape acting as a “hinge” between the battery and the pendant.

b. It should be possible to flip the battery over so it lays on top of the pendant, copper tape, and LED legs.

47. Draw a circle of hot glue around the edge of the battery’s **positive face.**

48. Fold the battery onto the pendant and hold it for a few seconds while the glue dries.

Part 5: Completing the Circuit

In this step you will use a twist tie to complete the circuit, causing all four lights to glow.

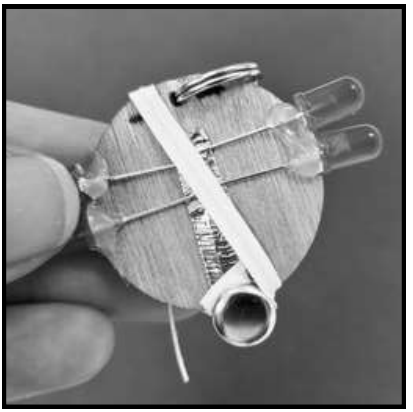
49. Insert one of the exposed ends of the twist tie between the head of the pin and the pendant.

50. Carefully fold the tip of the exposed wire over the legs of the pin.

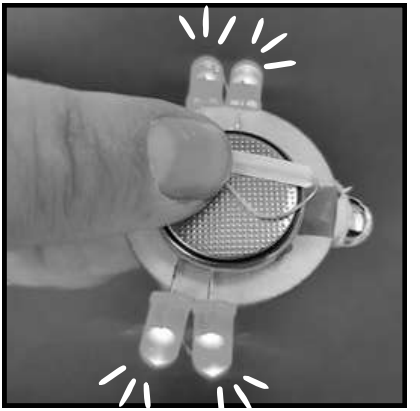
51. Wrap the twist tie one full loop around the pin.

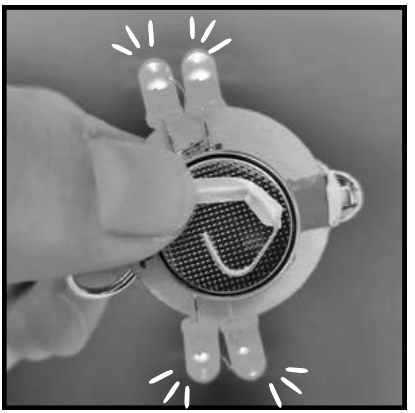
a. Once wrapped, none of the exposed wire on this end of the twist tie should be visible.

52. Wrap the twist tie across the face of the pendant so the remaining exposed end reaches the **positive side.**



53. When the exposed end of the wire comes into contact with the battery, all four LEDs should begin to **glow.**



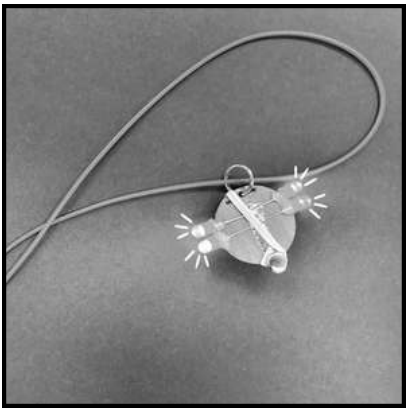


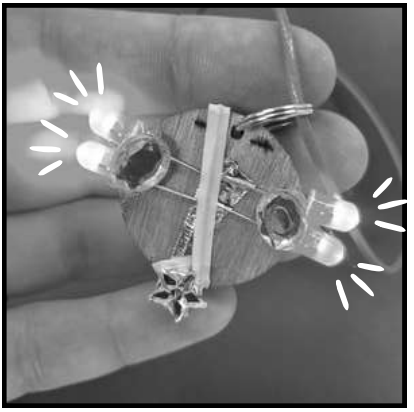
54. If necessary, bend the exposed wire so that it all fits on the back of the battery.

55. Cut roughly **2cm** of electrical tape.

56. Place the tape on top of the exposed wire, securing it to the battery.

57. Thread the necklace through the split ring to hang your pendant.





58. Optional: decorate the pendant using the provided materials.

To turn off the lights on your pendant, separate the wire from the battery.

Troubleshooting

Are all of your connections made, but the lights still won't glow? Try these basic troubleshooting steps:

- Gently wiggle each LED. Sometimes the connections just need a slight adjustment to be properly aligned.
- Check that the battery is properly oriented. The smooth, positive face should be in contact with the positive side of your pendant, and the textured, negative side of the battery should be visible.
- Is the split pin in direct contact with the battery on the positive side of the pendant? It should have an insulating material like electrical tape keeping them apart.
- Make sure the copper tape connects all four LED legs on each side of the pendant together. The electricity needs to be able to pass through all of them, so they need a conductor to join them.

If you need to, gently separate the pieces of your pendant to check your work.

You can even take the whole thing apart and start over!

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