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Light It Up!

Find Your Way To Wonder!

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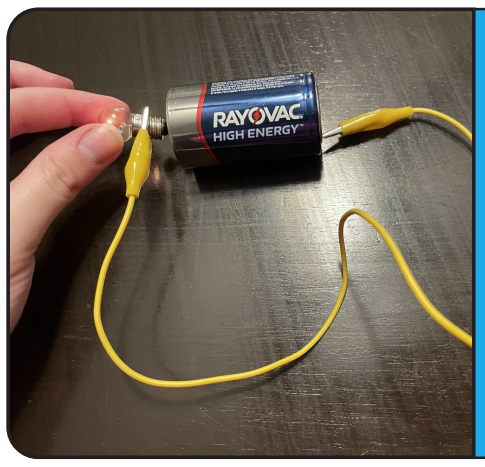
In December, we mark the winter solstice, the shortest day of the year. The day is still 24 hours, but the hours of daylight are the briefest. It gets dark early these days, and many celebrations this time of year acknowledge that with their traditions of using candles or electric lights to try to brighten spirits.

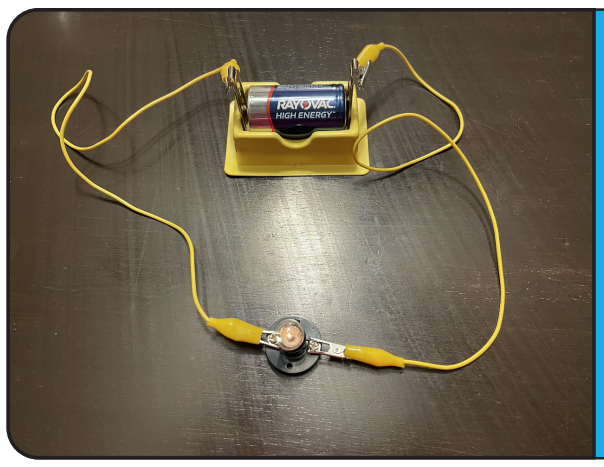
Electric lights are fairly simple to understand if you know a few basic concepts. First, we need to understand where electricity comes from. All things in this world are made of **matter**, and the smallest pieces of matter are called **atoms**. Atoms are made of three parts: **protons**, **neutrons**, and **electrons**. Protons are what determine what kind of atom we have, or what element the atom is made of (such as hydrogen, oxygen, or carbon). Protons hold a positive charge. Neutrons are in the same part of the atom as the protons, but they can vary in number without changing what the atom is, and they are neutral, or have no charge. Electrons exist in a cloud around the outside of an atom, and the number of electrons in an atom can change under certain conditions; electrons carry a negative charge.

If an atom has the same number of protons as electrons, it's considered to have a neutral charge. If an atom has fewer protons than electrons, it has a negative charge, and a higher number of protons than electrons yields a positive charge. Unlike protons and neutrons, the number of electrons in an atom might change because electrons can move between atoms. When electrons move, that's electricity!

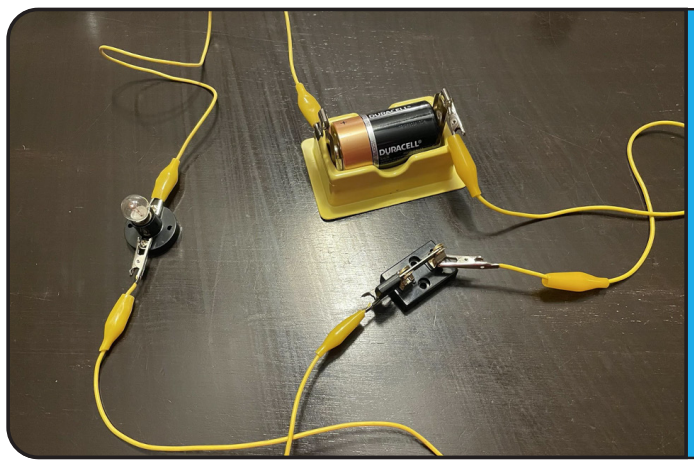
Sometimes electrons jump from one atom to another, going from a built-up charge to resuming neutral. If you've ever shuffled across a carpet and then felt a shock from a doorknob you touched, you've experienced this kind of **static electricity**. Sometimes electrons move from one place to another and keep flowing, which we call **current electricity**. This is the kind of electricity created by batteries or used by plugging something into a wall outlet. In order for current electricity to flow, there needs to be a closed loop called a circuit for it to follow. A circuit needs to be made with materials that let their electrons move easily, called **conductors**, like metal.



The most basic circuit includes a power source and something to connect it back to itself, like a battery powering a lightbulb. The battery can only power the bulb if there's a full loop for the electrons to flow from an area of negative charge to an area of positive charge (more electrons to a place with fewer electrons).

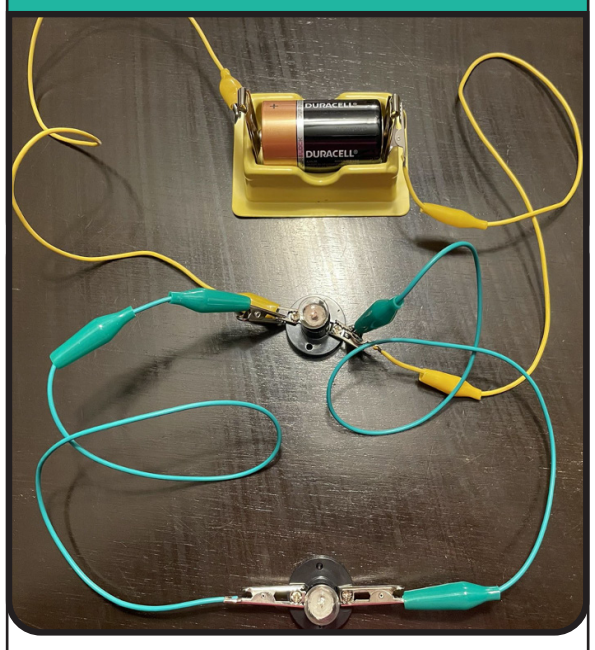


If you have equipment to do so, you can set up a circuit that holds itself together and includes additional hardware like more wires that allow your bulb to be in a different location than your power source.



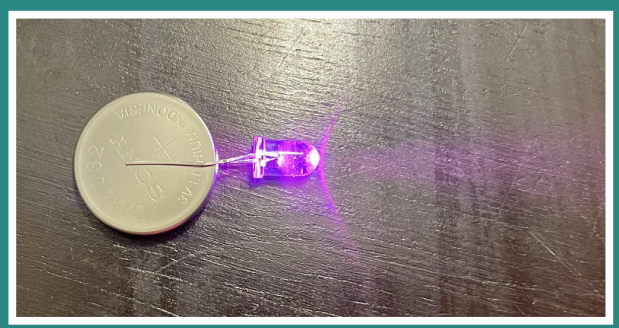
You can even build a switch into your circuit so you can open and close the connection that allows electrons to flow and power the bulb.

CIRCUIT TYPES



This kind of circuit is called a series circuit, which means that everything is connected by one path, and the electrons only have one way that they can flow to power it. In a series circuit, all lightbulbs are essential, and if one goes out, they all go out. The more common kind of circuit is a **parallel circuit,** where there are multiple paths for the electrons to take so one broken bulb or disrupted path doesn't mean that all of the other parts of the circuit fail. Which kind of circuit do you think you have powering the lights in your home or your school?

Make a Circuit!

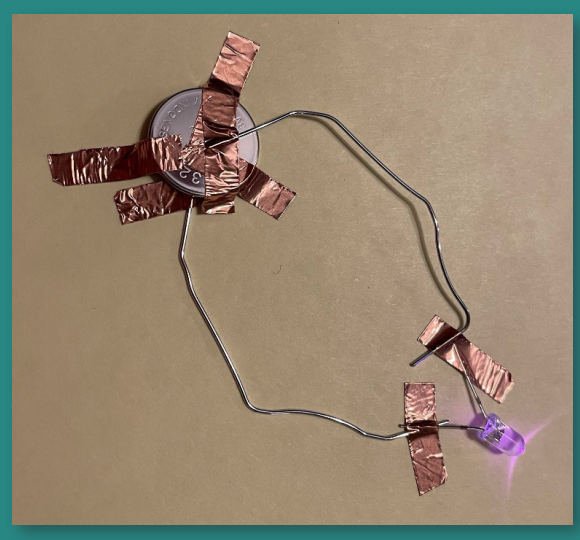


In this activity, you'll learn how to build a complete circuit to create your own winter night lights! You will need a watch battery (ideally 3 volt CR2032) and an LED bulb. You may also choose to use copper tape and paper clips to extend your circuit. You can use cardboard or cardstock as a base for your circuit.

Test your lightbulb by sliding its wires over each side of your battery. If it doesn't work, try flipping it around. Some bulbs can only permit power to flow in one direction so they need to be aligned with the way that the battery's power flows.

If you would like to build out your circuit, you can use paper clips to serve as "wires." The metal clips act as conductors and allow power to flow. Copper tape can be helpful for holding your "wires" together with your battery and your bulb, and also acts as a conductor that facilitates the movement of electrons.

Make sure that your battery has connections to both sides to let power flow. One side is the negatively charged side from which electrons flow to the other, positively charged side where there are fewer electrons.



See if you can use your new circuitry knowledge to build a holiday card that can light up!

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