Circuitry
Activity 1—Create a Simple Circuit

The library-provided kit includes all the items needed for this project except wire strippers or scissors.

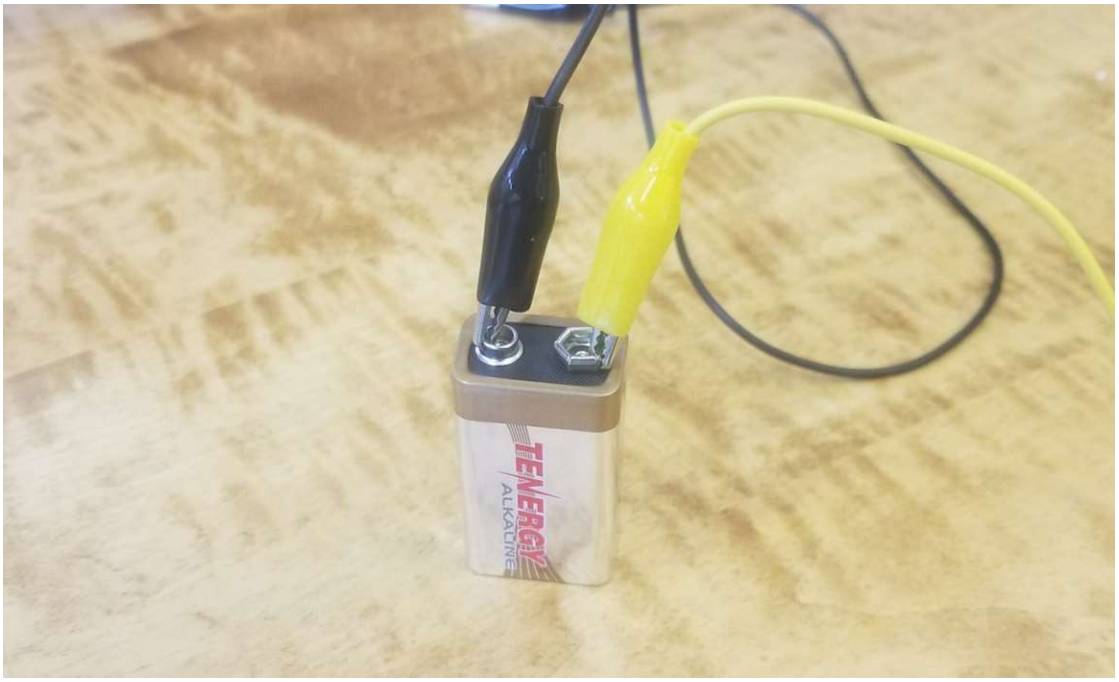
Materials Needed:

- knife switch (single pole, single throw)
- 9 Volt battery
- decorative lights (stripped ends to expose copper wire)
- 3 alligator clips of different colors
- scissors or wire strippers (optional, to strip cover off of light string to expose wire)

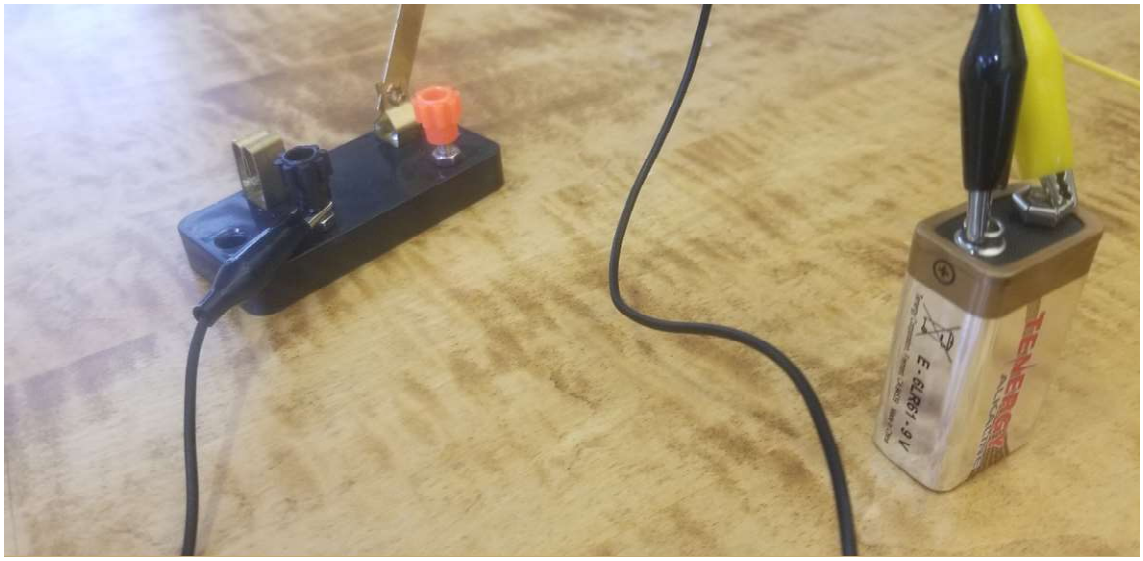
What To Do:

1. **Prepare your materials. It's always best to wear eye protection.** You will be working with very low voltages. Make sure your switch is in the open (up) position. Check for any cuts or kinks in your wires (the alligator clips and the string lights). **You can test your lights and the battery** by putting the two exposed copper wire ends into the terminals on the 9V battery.

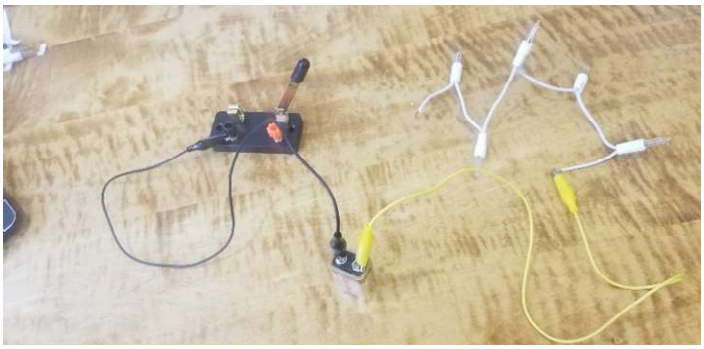
2. **Clip an alligator clips to each terminal of the 9V battery.** The smaller circular terminal is positive and is also called the "male" terminal, while the larger hexagonal terminal is negative, and is also called the "female" terminal. An alkaline 9V battery like in your kit is called a "primary" battery and is disposable. Use different colors of alligator clips so you can tell which one is going where more easily.

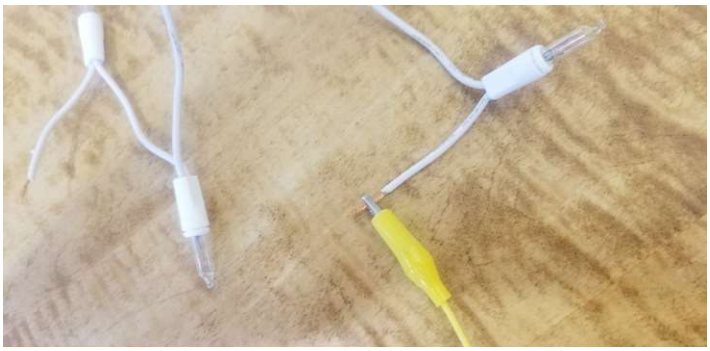


3. **Connect the other end of the clip attached to the battery's male pole to one of the terminals on the switch.** You will need to unscrew the plastic cover from the terminal to expose the metal bolt, but you don't need to fully remove it.

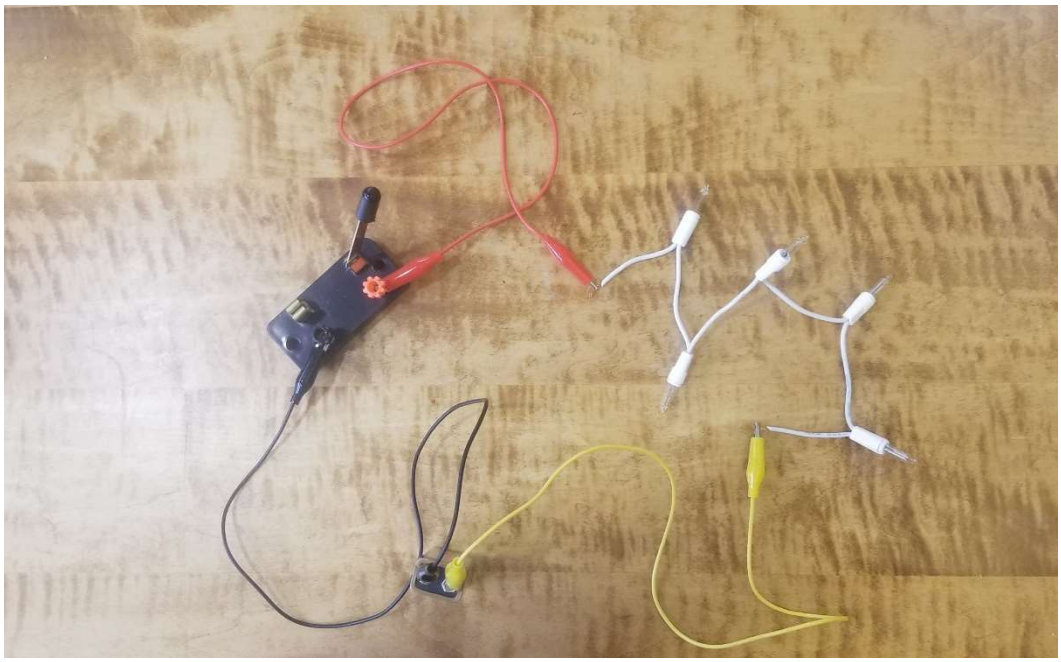


4. **Connect the other end of the alligator clip attached to the battery's female pole to one of the exposed copper wire ends of the light string.**

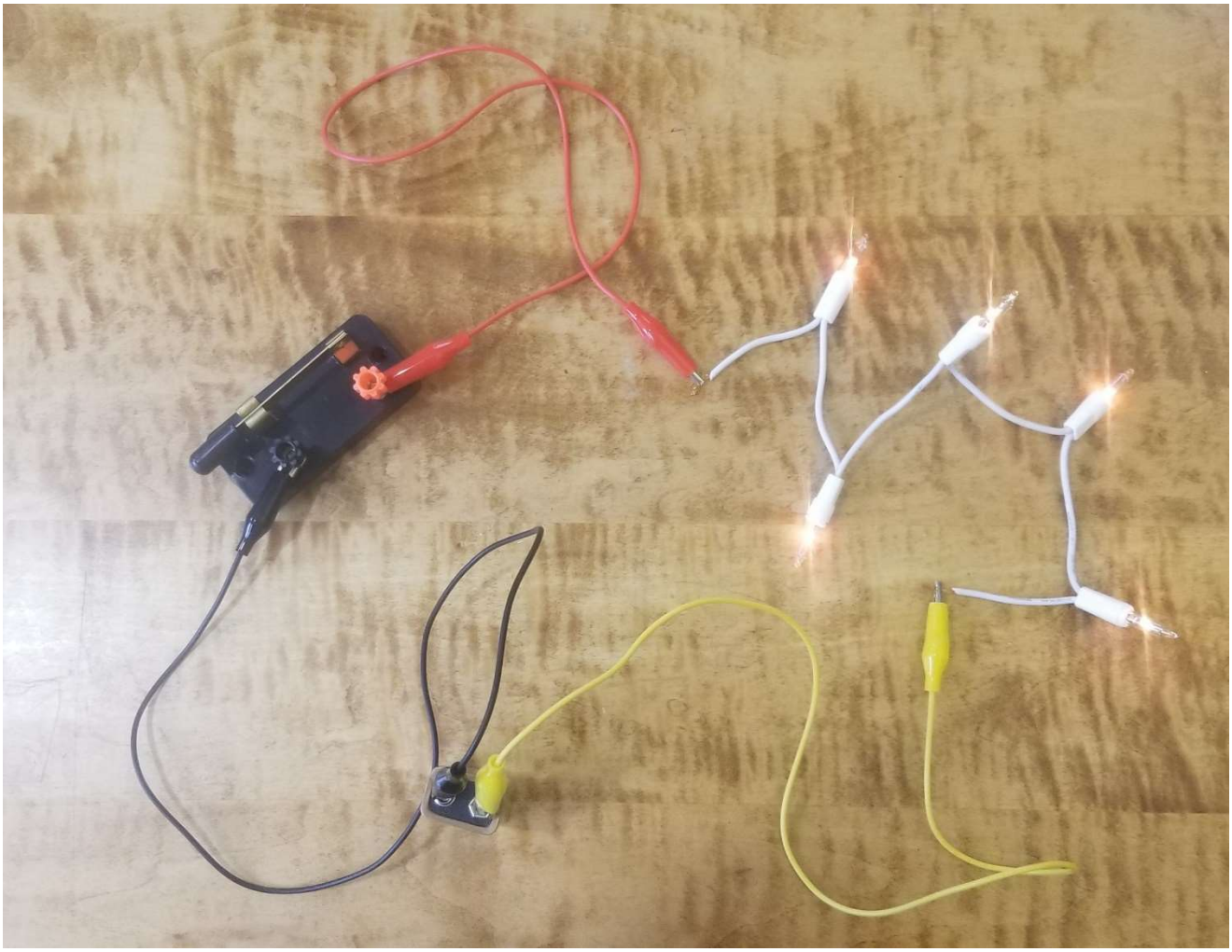




5. **Finally, connect a third alligator clip to the other end of the light string, and then attach it to the other silver terminal on the switch.**



6. **Now throw the switch!** Pulling the switch down ("closing" it) lets the battery's power reach the lights!



7. **(Optional—Grown-up needed) cut two of the decorative lights out of the string provided and strip the plastic coating away from the wire using scissors or wire strippers (14-gauge).** You can look at the pre-cut ends as an example to guide you. Be careful not to cut through the copper wiring, or your lights won't work! Notice: are the lights brighter when there are fewer of them in your circuit? **Caution: If you're experimenting with different numbers of lights, the 9V battery is too powerful for just one of these lightbulbs. It will become dangerously hot and may burn up!**

Troubleshooting:

If you find that your lights aren't lighting up, be sure to double-check for any damage to the wires. Also be sure your alligator clips haven't come undone at any point (they may be loose when you attach them).

STEAM Connections

This activity engages scientific and engineering concepts surrounding electricity and electronics.

When you pushed the switch down, you *closed* the circuit, completing it. When a circuit is closed, it means the *electrical current* flows through all the components in your circuit, giving power to your lights. The copper wires in the circuit *conduct* the electricity. When you tested your lights and the battery, that was also a closed circuit because the metal on both ends of the lights was touching the metal terminals on the battery.

Sometimes when a circuit doesn't work even though it looks like it's closed, it's a *short circuit*. This means something has gone wrong: the electrical current isn't going along the path it's supposed to, instead, taking a shorter path to *ground*. A wire could be damaged, interrupting the electrical current. Short circuits that send a very uneven electrical current to your power source (in this case, a battery) can cause a dangerous build-up of heat because the electrical current isn't being absorbed properly, so always check to make sure your wires are intact and not damaged!

Additional Resources

- How electricity works
- How does electricity flow?