



STEM @ HOME GUIDE: Lemon Battery

- **Aim:** To use lemons as the power source to light up an LED
NOTE: This activity may require some basic knowledge of simple circuits

- **Materials required:**

- ✓ 4 lemons
- ✓ 4 Pennies
- ✓ 4 Nickels or Galvanized nails/paper clips
- ✓ LED (light emitting diode)
- ✓ Knife
- ✓ Aluminum foil/ copper tape *
- ✓ 5 alligator clip leads *

NOTE: * You can use aluminum foil or copper tape, alligator clip wires or make your own using alligator clips and copper wire. *

- **Questions to think about before you start:**

- ✓ Why are we using lemons to build our battery?
- ✓ How do you need to set up the materials to make a circuit?

- **Instructions:**

Make sure to perform the experiment as a team (parent and student).

- **Parent:** Cut two small wholes in each lemon, 1-2 inches away from each other
- **Student:** Insert a penny halfway into the slit on the right side of each lemon
- **Student:** Insert a nail/nickel halfway into the slit on the left side of each lemon
- **Parent or Student:** Connect a lead wire from the first nail to the penny of the second lemon. Follow the pattern of connecting nail to penny for the lemons
- **Parent or Student:** Connect one end of a lead wire to the penny on the first lemon the other end will connect to the positive (+) longer leg of the LED
- **Parent or Student:** Connect one end of a lead wire to the nail/nickel on the last lemon the other end will be the last thing you connect. Once all the other lead wires are connected you will carefully connect to the negative (-) shorter leg of the LED. Now watch as your LED lights up!

- **Extensions Activities:**

- ✓ Try using other materials that conduct electricity to make your wires.
- ✓ What happens if you add more lemons, does the LED shine brighter?
- ✓ Try making your battery using other fruits or vegetables like limes, potatoes, apples or onions.
- ✓ What else can you get to light up with your battery?
- ✓ If you have access to a multimeter you can measure the voltage the battery has.

HELPFUL TIPS

Pennies made before 1982 have a higher zinc content and will work better than newer pennies. If using newer pennies, you may want to use 2 in each lemon instead of one.

Make sure you are connecting all the components in the correct order mixing up the positive and negative ends will fail to light up the LED.

spark. inspire. engage.

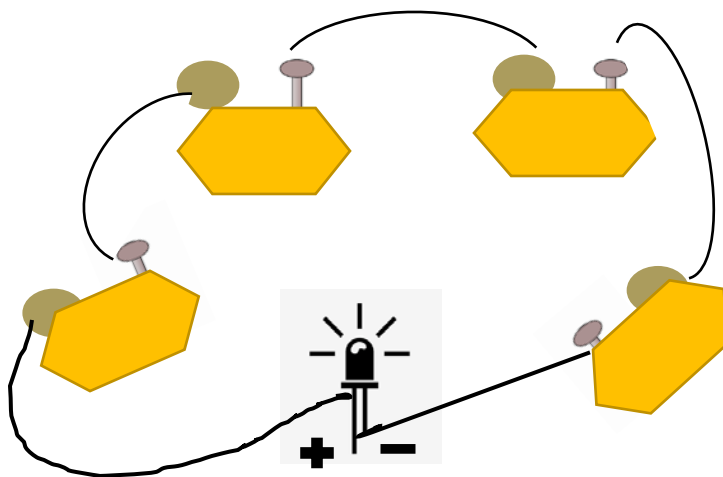


- The science behind the fun:** Lemon juice is acidic and very similar to the electrolytes used in other batteries to help conduct electricity. The pennies and nickels/nails act as positive and negative electrodes. These materials are made zinc(nickel/nail/paperclip) and copper (penny or copper wire) that when inserted into an electrolyte like lemon juice undergo a chemical reaction and produce electricity. The lemons combine to make a battery device that provides energy to power or run another device in this case our LED.
- Vocabulary:**
 - Conductor:** A material that electricity, heat or sound can move through easily.
 - Electrolyte:** A liquid solution that conducts electrical current, salts, acids and bases dissolved in water make good electrolytes.
- Real world application:** Batteries are used in many different technologies from cars, computers, cell phones and satellites. Knowing how to build more powerful and efficient batteries requires knowledge of chemistry and physics. Electrolytes are also found in humans, when you sweat a lot or get very dehydrated you may drink an electrolyte solution like Gatorade or Powerade to replenish the lost electrolytes in your body.

Did you know?

- Alessandro Volta made the first battery in 1799 using strips of copper and zinc in a jar of brine (saltwater).
- The World's largest lemon battery consisted of 1232 lemons.

Schematic Setup



Lemon Battery Photo Guide

Supplies: Alligator clips lead wires, pennies, nails and lemons



Set up each lemon by cutting a slit in and inserting a penny on the right side and sticking a nail into the left side.

Attach the wires from penny to nail across each lemon. The last two wires will connect to the LED. Connect the long leg of the LED to the penny. Connect the short leg of the LED to the nail.

