

18C – LEMON BATTERY

INQUIRY

What generates electricity in a battery?

MATERIALS

- Device with SPARKvue software
- Voltage sensor with red and black leads
- Alligator clip test leads
- Light emitting diode (LED)
- Metal Samples/Electrodes
- Steel wool or sandpaper
- Lemons
- Plastic knife



BACKGROUND

Energy cannot be created or destroyed, but it can be converted from one form to another. In this lab, you will look at one factor that affects how chemical energy is converted to electrical energy. You can create a battery with two metal pieces as electrodes and a lemon as a salt bridge, and you can determine the electrical voltage the battery generates.

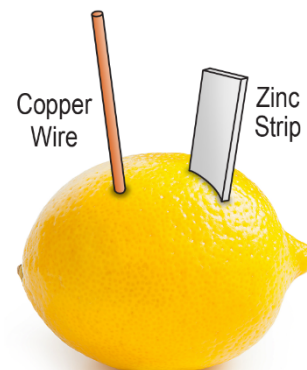
SAFETY

Follow these important safety precautions in addition to your regular classroom procedures:

- Wear safety goggles at all times.

PROCEDURE

1. Open SPARKvue.
2. Open the 18C Lemon Battery lab file in SPARKvue.
3. Use the Bluetooth icon to connect the Voltage sensor.
4. Roll the lemon on a table so that the juice inside can flow easily.
5. Use the plastic knife to make two small slits on the lemon about 3 cm apart.
6. Polish one piece of copper and one piece of zinc with sandpaper or steel wool.
7. Insert the piece of copper into one slit in the lemon the piece of zinc in the other slit.



Note: Push electrodes as far in as possible leaving enough metal exposed to attach an alligator clip. Electrodes must not directly contact one another and should not be pushed through the other side of the lemon.

PROCEDURE

- Use the alligator clip leads to connect the copper and zinc metal pieces to the voltage sensor.
- Start collecting data.

Note: The negative or positive sign of the voltage indicates the direction of the flow of electrons. If you have a negative voltage, simply switch the red and black clips to the other metal.

- When you have a positive voltage, you have made a battery. Record the voltage in Table 1 on your answer sheet.
- A battery has a positive (+) and negative (-) electrode. Electrons flow from the negative electrode (black) to the positive electrode (red). In Table 1, record the identity of the metal that makes up the positive electrode and the metal that makes up the negative electrode of your lemon battery.
- Test the voltage produced with as many combinations of metals as you can with the metals provided. Record the voltage and the identities of the electrode metals in Table 1.

ANALYSIS

Complete the analysis on your answer sheet.

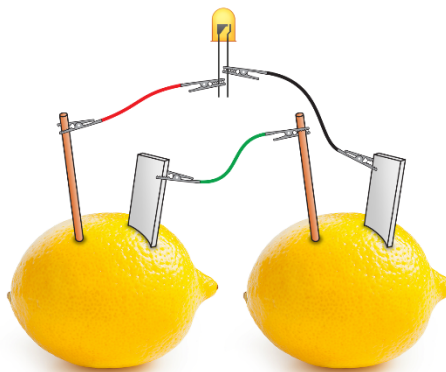
QUESTIONS

Answer the questions on your answer sheet.

EXTENSION

Engineering Challenge

- Create a battery or combine a series of batteries to light a small LED, as pictured. You may need to work with other groups to combine multiple batteries. In the space provided on your answer sheet, make note of the voltage at which the LED first lit up and describe how the battery was constructed.
- Create a battery or combine a series of batteries to generate the largest voltage potential possible. Record the voltage and describe how battery was constructed in the space provided on your answer sheet.



QUESTIONS

Answer the Engineering Challenge questions on your answer sheet.