### Required Training

UC Lab Safety Fundamentals

### Required PPE

Lab coat, safety glasses/goggles, nitrile gloves

### Equipment

Lemons or Oranges

House setup of Zinc/Copper electrodes

LED light, watch, or voltmeter to measure/visualize current

### Chemicals

#### Procedure:

1. Insert the Cu and Zn electrodes into the fruit.
2. Connect the metal clips to an LED light and see it glow (light is dim, so you may need to turn off the lights).
3. Clips may also be attached to a watch to see the seconds hand move or to a voltmeter to measure the voltage.
4. Increasing the number of fruit will create a high voltage.
5. Be sure to wipe down the electrodes with a paper towel after use.

### Discussion:

The current derives from the oxidation of Zn metal and the reduction on H$^+$ ions. Zn atoms dissolve in the acidic citrus juice leaving 2 negatively charged electrons (e$^-$) behind in the Zn anode.

$$\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$$

As Zn enters the solution, 2 positively charged H$^+$ ions pick up 2 electrons at the Cu cathode and form H$_2$ gas.

$$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$$

The electrons lost by Cu are replaced by 2 e$^-$ from the Zn anode that have traveled through the wire. The electrical current is produced by the movement of electrons in the circuit. During oxidation, Zn looses electrons to reach a lower energy state; the energy released provides the power to turn on the LED, start the watch, etc.
Hazards:
N/A

SOP
N/A

Disposal (by Storeroom)

Used lemons can be tossed in the trash.