Name

Batteries!

Purpose

To demonstrate how an electrical current can be generated using citrus fruits (such as lemons or limes) that is strong enough to power a small light bulb.

Additional information

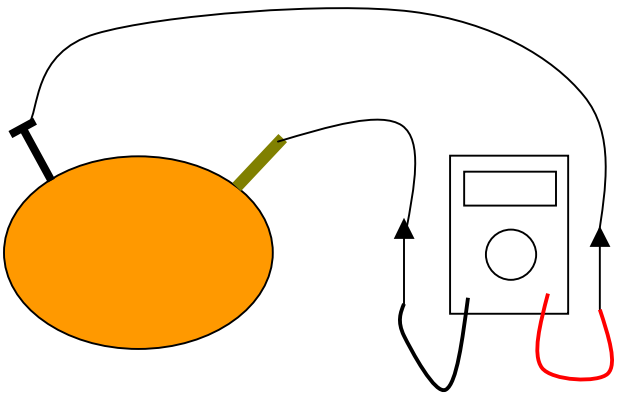
Batteries are devices that store chemical energy and convert it to electrical energy. Electrical current is the flow of electrons (movement) of an electrical charge. Conductive metals contain large population of free electrons, which are bound to the metal lattice and move around randomly due to thermal energy. When two terminals of a voltage source (battery) are connected via a metal wire, the free electrons of the conductor drift toward the positive terminal, making them the electrical current carrier within the conductor.

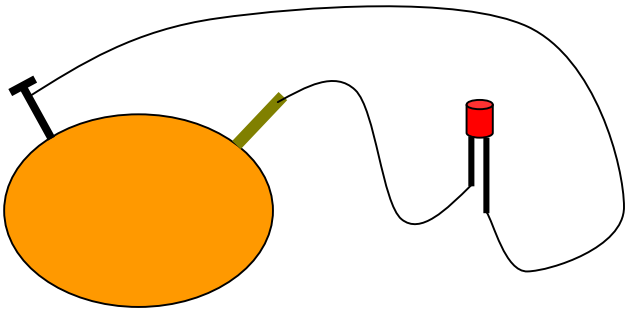
Materials

Citrus fruits, such as lemons, limes, grapefruits, or oranges.
Various metals, nails and coins.
Small colored or opaque LED light.
Crocodile (aka: gator) clips
Volt Meter

Step-By-Step Procedure

1. Prepare your fruit for the experiment by gently rolling it on the table with your hands. Make sure not to squeeze too tightly and break the skin! The idea is to soften the fruit enough so that the juices inside are flowing.
2. Insert your nails or wires into the fruit, approximately 2 inches apart from one another. The ends (sharp tips) of the nails should be in the center of the fruit, but not touching one another. Be careful not to pierce the nails through the opposite end of the fruit.
3. Take one of the gator clips and clip it around one nail or wire.
4. Take the other gator clip and clip it to the other nail or wire.
5 Connect the loose ends of the gator clips to a voltmeter and record the voltage.
6. It may take more than one lemon, but can you light a bulb?





Questions.

1) **Which combinations of metals or coins created a voltage you could read with the volt meter?**_____
_____
_____
_____
_____

2) **What was the maximum voltage you could measure?**
_____

3) **What combination of metals gave the highest voltage?**
_____
_____

4) **What was the minimum voltage you measured?**
_____

5) **What combination of metals gave the minimum voltage?**
_____
_____

6) **What combinations of metals allowed you to light the LED light?**
_____
_____

7) **What are the particles that cause the electrical current? (Hint, read the additional information)**
_____
_____
_____