POTATO BATTERIES

Direction Sheet

OVERVIEW: Batteries provide power for many everyday objects including cell phones, laptops, flashlights, watches, cars and much more. When we think about batteries, we probably think about AA or AAA batteries that we can just buy at the store. Did you know that you can make your own battery with items that you have at home? We just need a potato, a penny, a zinc-plated screw, and some wires in order to produce some electricity.

OBJECTIVE: Make a working battery from household items.

MATERIALS:

- l potato
- screw or zinc strip
- penny or copper strip
- wires / alligator clips
- multimeter (shared)
- small LED
- aluminum foil or strip
- sandpaper (this may be used to "clean up" the metal conductors)

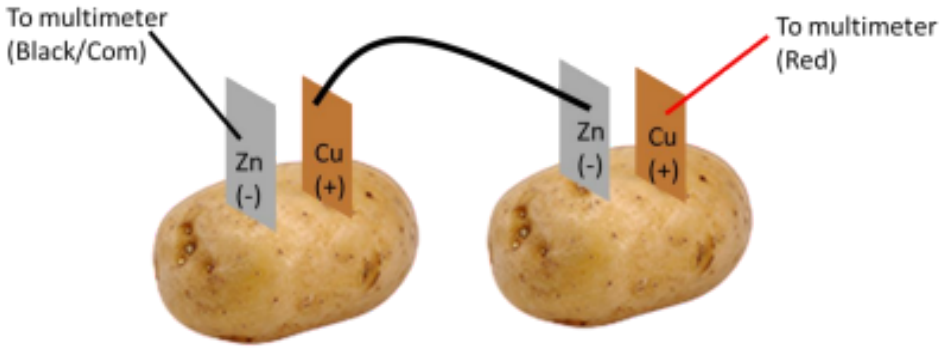
DIRECTIONS:

1. **Select two metal strips and place them inside your potato.** Congratulations! You have just made a battery.
2. **Measure the voltage of your battery.** Use a multimeter to measure and record the voltage of your battery. (Record this information on your "Notes and Observations" Worksheet).
    a. Tip 1 for using your multimeter – make sure the black wire from the multimeter is connected to "com" and the red wire is connected to "V mA uA" (Some multimeters have separate ports for voltage & current; connect the red wire to the port labeled voltage or "V"). When measuring the voltage of a battery that has a copper electrode – touch the red wire from the multimeter to the copper and the black wire to the other electrode. When measuring the voltage of a battery that has zinc and aluminum electrodes – touch the red wire to aluminum and the black wire to zinc. This will make sure you always have a positive voltage reading.
    b. Tip 2 for using your multimeter – please turn your multimeter off when you aren't using it. Most multimeters work on a battery themselves & easily run down when they are on and not in use.
    c. For comparison: AA batteries are 1.5V but some electronics need more than one if they require higher voltage.
3. **Try different combinations of metal strips in your circuit/battery. Measure and record the voltages for these new combinations.** (Record this information on your "Notes and Observations" Worksheet). You might need to punch a hole with another material in order to put the Al foil into the potato. You also might want to twist the Al foil into a roll before sticking it into the potato. What happens if you use the same metal for both electrodes? Do you get a voltage difference? Why/why not?

4. **Discuss and compare**. Looking at your results, which combination of metals had the highest voltage? Talk to a partner – did they get the same result? If not, note what is different. How do the voltages compare between when using the same metals? Which two metals produce the "best battery" (highest voltage)?

5. **Light up your LED.** Using the two metals which make the best battery, try connecting the long end of your LED to the positive end and the short end of your LED to the negative end. What happened? Did the LED light up? Note your observation.

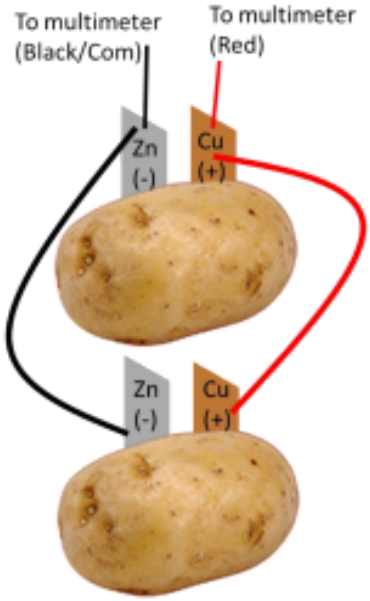
6. **Make your voltage higher.** Get a partner and connect your two potatoes in series. Measure the voltage of your two batteries in series. How does it compare to the voltage you previously measured? Now, try lighting up an LED with your two batteries in series. What happens?



Two Potatoes in Series

7. **Now combine with another group and wire your potato battery in series and measure the voltage.** Try lighting up the LED again with 4 batteries in series. Does it finally light up? What if you only use 3 potatoes? Is that enough to light the LED?

8. **Exploring series/parallel circuits:** Previously, you have connected several batteries in series and observed how the voltage changed. Now, try connecting two potatoes in a parallel circuit (see below) and measure the voltage of your system. How does this compare to a single cell and the voltage of your series circuit? Will this be enough to light up your LED?



Two Potatoes in Parallel

9. **Further exploration.** Now that you have hopefully lit up your LED, let's continue to explore these potato batteries. The goal of this final step is to be creative and design your own experiments. There are some suggestions below to help get you thinking.
    a. Can you use a combination of potatoes & metals to light up an LED? Which combinations work? What is the minimum voltage needed to light the LED?
    b. How can we get the LED to shine brighter?
    Hint: How can we get to even higher voltages?
    c. Can you find a way to light two LEDs at the same time with one circuit?
    Hint: you might need to combine series and parallel circuits.
    d. What if we don't use our "best" battery metals but instead use one of the other combinations from step 3 above. Now, how many batteries do we need in order to light the LED?