

Student's Card 2

Electrochemistry lab experiences with critical raw materials

Module 2

Objective: Potato galvanic cell construction

Introduction

This experiment aims to emulate a battery replacing it with potatoes that contain phosphoric acid, which act as the battery acid. It reacts with the zinc and copper metals in the nail and coin to start the electricity flowing. On one hand, the acid in the potato consumes the zinc metal that coats the galvanized nail, releasing negatively-charged electrons around it and thus becoming the negative end of the battery. On the other hand, the acid in the potato reacts with the copper metal that coats the coin, absorbing electrons from the copper. Electrons have a negative charge so, as they are removed from the copper, the coin becomes the positive end of the battery.

The reactions between the acid in the potato and the two metals create an imbalance in electrical charge: there are more negatively-charged electrons at the zinc end than at the copper end. The wires let these electrons flow quickly from the zinc to the copper to correct this imbalance, which creates an electrical current. Connecting several potatoes in series using pieces of wire adds the power of each potato to create a stronger battery.

Necessities

List of materials/tools

- 3 potatoes
- 3 galvanized nails (coated in zinc)
- 3 copper coins
- 3 crocodile clips
- Copper wire
- Butter knife and/or scissors
- 1 LED

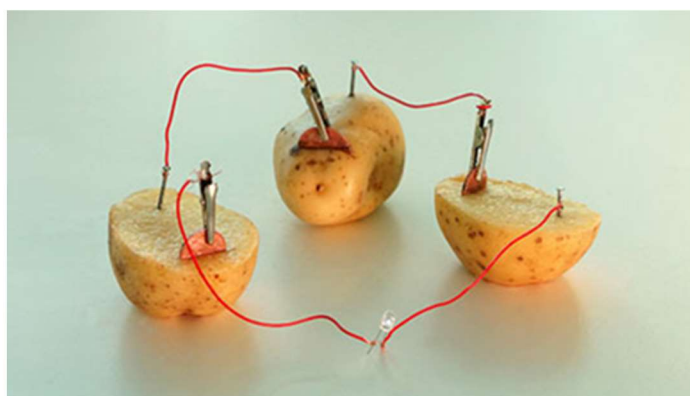
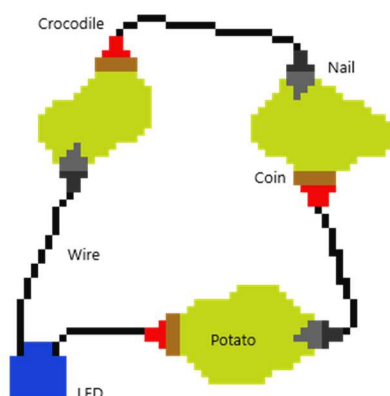
Lab Procedure

- First, we have to insert a copper coin into one end of the potato and a nail into the other end. We may need to use the knife to make a groove in the potato to insert the coin.
- Cut four pieces of wire, each about 15 cm long. With each piece of wire, use the scissors to remove the plastic covering on both ends of the wire. About 3 cm of covering should be removed on each side.

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- Wrap one end of the exposed wire around the crocodile clip. Make sure there is good contact with the metal of the clip and the copper. Attach the crocodile clip to the coin. Repeat with all three potatoes.
- Wrap the other end of the wire around a nail on a different potato. Make sure the exposed wire is in tight contact with the nail.
- Take the fourth wire and wrap one end around the last free nail.
- Wrap the free wire on the coin/crocodile end around the long leg of the LED. Wrap the nail wire around the short end of the LED, closing the circuit and making it light up.
- **Note:** You should make sure the copper wires do not touch each other. A LED needs at least 1.5 volts and 10 milliamps of current, and the potato battery supplies around 0.5 V, **so if you don't get enough voltage to illuminate it tell them to connect more potatoes in series.**



Questions/Quiz

Q1) Complete the gaps with: Zn or Cu

- ____ oxidizes in this process
- Electrons flow from the ____ end to the ____ end through the wire.
- ____ metal is the negative end of the battery, while ____ metal is the positive one.

Q2) What happens to current and voltage when we connect potato cells in series, as in the experiment?

Q3) How will current and voltage change if we connect potato cells in parallel instead of in series?