

West Side Science Club – Event # 7– “Lemon Batteries”

Original Presentation

Date: 23 February 2013
Time: 10 am to 12 pm
Site: West Side Science Club

Big Questions

- These questions are meant to frame the day’s event and might be written on the chalkboard
 - (1) How do batteries work?
 - (2) What do you need to make your own battery?

Concepts

- Concepts to cover from the “Work of CCI Solar” Mind Map: Electrochemistry- current, voltage, charge, electrons; Circuits- series/parallel, $V=IR$; Storage- batteries; Reaction- oxidation/reduction

Lesson Plan

Student Objectives

- Be introduced to electrochemistry reactions
- Be able to relate reactions and energy

Schedule/Agenda

- Review: Event # 6– “Precipitation Reactions” (10 min.)
- Warm-up Demo: Zinc nail in Cu solution (10 min.)
- Activity: Lemon batteries (1h 30 min.)
- Wrap-up (10 min.)

Materials

Warm-up Demo: Zn nail in Cu solution

- Zn nail
- Vial
- Solution of copper sulfate

Activity: Lemon Batteries (each)

- Penny
- Zinc Nail
- 2 alligator clips
- Multimeter
- Lemon

Safety

- While not actually dangerous, goggles and gloves are a good habit when doing experiments. Lemon juice in the eye is never pleasant!

Review of Previous Event: Precipitation reactions

- Recall the activity: Mixed solutions of different elements together. Sometimes precipitation occurred, sometimes other changes occurred from the reaction.

Facilitation Questions

- What can you learn about elements from the periodic table? Did you notice any trend from last week's experiments?
- How can you tell when a reaction occurred? What kinds of changes do you see?

Warm-Up Demo/Attention Grabber: Zinc nail in Cu solution

Procedure

1. Dip a large zinc nail in a vial of copper sulfate solution (or other copper salt)
2. Have the students observe what is happening. From far nothing will be happening.
3. Have the students gather closer and observe the surface of the nail
4. Remove the nail from solution and have them make more observations

Facilitation Questions and Advice to Mentors

- What is the black/brown stuff you see on the nail?
- How did it get there? What could have been reacting to form this precipitate?

Activity: Lemon Batteries

Procedure

1. Pass out the supplies to the students and have them think about how to connect everything
2. After discussion guide them through the correct assembly
3. Stick the penny and the nail into the lemon (dripping juice is ok!)
4. Connect the other end of the penny to one electrode of the multimeter using an alligator clip. Do the same with the nail and the other electrode.
5. Finally, turn the multimeter on and set it to measure direct current voltage
6. Adjust the setting to make a more or less sensitive reading to accurately record the voltage of the lemon battery
7. The power of the lemon battery is not high enough to power an LED on its own. Have the students experiment with connecting the batteries in series and parallel to increase current and/or voltage to power the LED
8. Allow the students to perform the same experiment with other acidic fruit or even potatoes

Facilitation/Concept Questions

- How is your lemon generating power
- What is the function of the zinc and copper?

Check for Understanding

- What kind of reaction is happening inside your lemon?
- Can you relate this reaction to the demo? To what you saw last time?

Wrap Up: Event #8 Preparation: Electroplating

- Students chose between 1) bristlebots, 2) electroplating, 3) color-changing water
- They chose electroplating because “we have no idea what it is!”