The National Science Center

Backpack Activity

Theme: Electricity

Title: Lemon Battery

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Backpack Activity

Theme: Electricity

Topic: Current Electricity

Title: Lemon Battery

National Standard: Content Standard A. Ability to do scientific inquiry (A.1)
Physical Science: Content Standard B. Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced.

Purpose: Backpack activities are designed for students to explore and play with science toys or objects commonly found in the home. The activity sheet can be copied for your students to enjoy the activity with little or no supervision. Building a lemon battery will enhance the student's conceptual understanding of electrochemical cells and batteries.

Recommended Level: 5-8

Time: Approximately 30 minutes

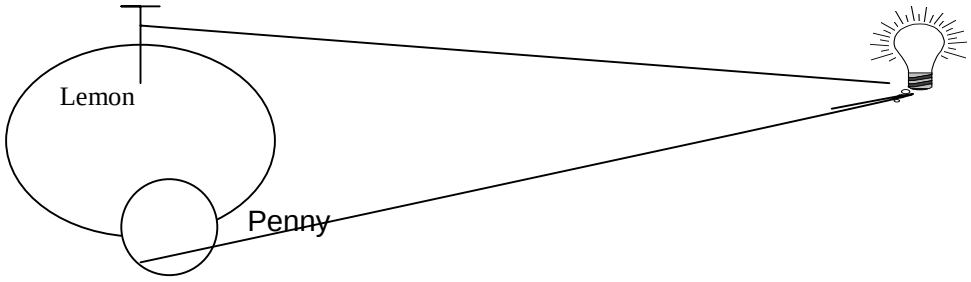
Materials:

Fruit (lemons, grapefruit, potatoes -- any acid fruit or vegetable)
Small light bulbs
Bulb holders
Shiny pennies or strip of copper metal
Galvanized nails (zinc coated nails) or zinc metal strips
Wire leads with alligator clips

Procedure:

1. Insert a galvanized nail into one side of a lemon and a shiny penny or copper strip into the opposite side of the lemon (see diagram).

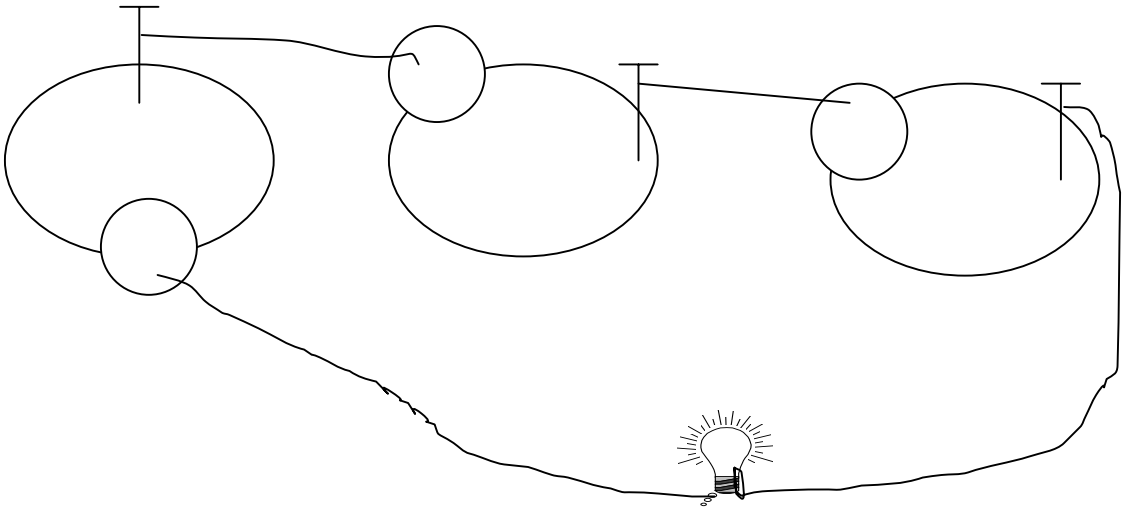
2. Attach a wire lead from the nail in the lemon to one terminal of the bulb holder. Attach a lead from the other terminal of the bulb holder and connect it to the penny in the lemon. What happens? (The bulb should light. If the bulb still does not light, use a smaller bulb or more lemons.



3. What was the source of the current? (A chemical reaction between the acid of the lemon and the zinc and copper strips releases electrons to produce an electric current.)

4. What happens when you connect two bulbs in series? (Depending on the size, number and acidity of the fruit, they may both light up, but will be dimmer than one bulb. There may not be enough current produced to light both bulbs.)

5. What happens when you use more pieces of fruit? (See diagram below.) Is the bulb brighter? (The bulb will be brighter when more fruit is added.)



Expected Outcome:

The fruit, zinc and copper in this activity act as an electrochemical cell. A battery consists of two or more electrochemical cells connected to each other. The zinc and copper react with the acid of the fruit in a chemical reaction called oxidation-reduction. The zinc atoms lose electrons in the reaction with the acid and become zinc ions. When a wire is attached to the zinc and copper, the electrons flow from the zinc to the copper. This flow of electrons is an electric current.

A system through which an electric current can travel is called an electric circuit. There are two main types of circuits: series and parallel. A series circuit is one in which there is only one path for the current. The circuits in this activity are all series circuits.

Links: Links used in this activity.

http://www.exploratorium.edu/snacks/hand_battery.html

http://www.nationalsciencecenter.org/FortDiscovery/CommunicationsGallery/MeasurementOfElectricity.htm

http://www.nationalsciencecenter.org/FortDiscovery/CommunicationsGallery/WheelOfVoltage.htm

http://www.zum.de/schule/earthquake/electric.html

http://www.mos.org/learn_more/cheapbook/glowpickle/index.html

References: Rhoades, et al. Physics is elementary. SEES. Atlanta