



The Six-Cent Battery

A battery is a device that converts chemical energy into electrical energy. Batteries are a convenient source of portable electrical power. Take a moment to think of the number of devices you use every day that use battery power.

A battery is a series of electrochemical cells connected together. An electrochemical cell consists of two different metals separated by a conducting solution (an electrolyte). The current produced by the difference in electrical potential can be used to do work. The first battery was constructed by Alessandro Volta. Volta used a stack of alternating metal disks separated by paper saturated with an electrolyte. In this activity, you will construct and test electrochemical cells and use them to make a simple battery.

OBJECTIVES

- **Construct** a working model of an electrochemical cell.
- **Evaluate** a series of metal pairs as sources of electrical energy.
- **Construct** a working model of a battery.

MATERIALS



pennies (4)
nickels (4)
dime
quarter
filter paper
scissors

thin-stem pipet
small rubber bands (4)
voltmeter (low range)
or galvanometer
connecting wires

PROCEDURE

Part 1: Making an Electrochemical Cell

1. Use scissors to cut filter paper into 24 circles slightly larger than a quarter.
2. Use a pipet to soak the circles with a solution of sodium chloride.
3. Sandwich two soaked filter-paper circles between a penny and a nickel, as shown in Figure A.
4. Secure the coins and filter-paper circles with a rubber band.

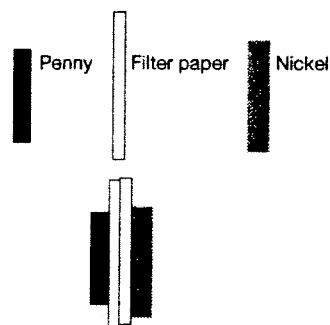


Figure A

5. Hold the cell on edge and carefully touch a voltmeter or galvanometer wire to each coin.
6. Record the voltage or galvanometer reading of the cell in the table under Data and Observations.
7. Repeat the procedure above using all other possible combinations of coins. Record each voltage or galvanometer reading in the data table.

Part 2: Making a Battery

1. Make a hypothesis about the size of the voltage that would be produced if four penny-nickel electrochemical cells were connected in series. Write your hypothesis under Data and Observations.
2. Make four separate penny-nickel cells as you did in Part 1, step 3.

- Place two soaked pieces of filter paper on the penny end of the first cell and set it on the nickel end of the second cell.
- Repeat step 3 until you have all four cells connected in a series. See Figure B.

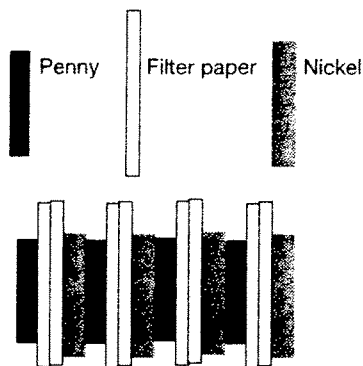


Figure B

- Hold the coins on edge and carefully touch the meter's connecting wires to the opposite ends of the assembly. You have now made a battery.
- Record the voltage or galvanometer reading of the battery in the data table.

DATA AND OBSERVATIONS

Hypothesis: _____

Voltages of Cells				
	Penny	Nickel	Dime	Quarter
Penny	X			
Nickel	X	X		
Dime	X	X	X	
Quarter	X	X	X	X
Voltage of battery _____ V				

Note: Nickels, dimes and quarters are 25% nickel.

Conclusion Questions:

- Write the two half reactions and balance them. In order to figure out which is oxidized and which is reduced use the table of reactivity in chapter 23 section 1.
- Combine the $\frac{1}{2}$ reactions for a balanced complete reaction.
- State which coin is the anode and which coin is the cathode.
- What is the purpose of the saturated filter paper?
- What drives this reaction?
- How did the voltage for the single cell compare to the 4 – cell battery?
- How does your hypothesis compare to the data.
- Have you ever chewed on a piece of aluminum foil from a gum wrapper. If you have fillings (part silver) in your teeth, it may have been annoying. Write the two half reactions.