

Hot Dog Clock

Voltaic Cells



Introduction

Demonstrate to students that a clock can run using a hot dog!

Concepts

- Electrochemistry
- Anode vs. cathode

Materials

Copper(II) sulfate solution, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, 1.0 M, 100 mL	Hot dog
Magnesium sulfate solution, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 1.0 M, 100 mL	Magnesium ribbon, 60 cm
Alligator cords, 2	Plastic spoon
Beaker, 150-mL, 2	Steel Wool
Clock, which requires one 1.5V AA battery	Support stand
Copper strip, 1.2×15 cm	

Safety Precautions

Copper(II) sulfate is slightly toxic by ingestion. Magnesium sulfate is an irritant to eyes and respiratory tract. Wear chemical splash goggles, chemical-resistant gloves and a chemical-resistant apron. Wash hands thoroughly with soap and water before leaving the laboratory. Follow all laboratory safety guidelines. Please review current Material Safety Data Sheets for additional safety, handling and disposal information.

Preparation

Prepare 100 mL of 1.0 M magnesium sulfate by dissolving 24.7 grams of magnesium sulfate heptahydrate in 100 mL of distilled or deionized water.

Procedure

1. Brush both the copper strip and the magnesium ribbon with steel wool to remove any tarnish that may be present.
2. Wrap the 60 cm of magnesium ribbon around a plastic spoon.
3. Display a sample electrical circuit to students. Trace the path of the current throughout the entire circuit.
4. Attach the alligator clips to the clock's terminals and display to the class.
5. Place the magnesium-wrapped spoon in the magnesium sulfate solution. Place the copper strip into the copper sulfate solution.
6. Tell students that it needs to be determined which metal is more reactive so that the proper metals are connected to the proper terminals.

7. Connect the magnesium to the negative terminal and the copper to the positive terminal. Look at the clock surprised that it has not started. Ask students “why it is not working?”
8. Explain that you need another wire to complete the circuit but do not have any more. Say you need something to complete the circuit that conducts electricity.
9. Pull out a hot dog and bend it to create a salt bridge between the two beakers and watch the clock begin to tick!

Tips

- Flinn Scientific offers The Two-Potato Clock demonstration kit, catalog no. AP1939. This demonstration kit is very similar to the Hot Dog Clock demonstration.
- Be sure to start the demonstration with the second hand on the downward side of the clock, between the 12 and the 3. Otherwise, it might be difficult to start the clock.

Discussion

An electric cell is a device that changes chemical energy into electrical energy. It consists of two different metals called electrodes that are dipped into a solution capable of carrying an electrical current called an electrolyte.

Any solution that contains moveable free ions (charged atoms or molecules) is capable of carrying an electrical current, e.g., saltwater, tap water, sulfuric acid (aq) and sodium hydroxide (aq). Solutions that do not contain moveable free ions and therefore cannot conduct an electric current are called non-electrolytes, e.g., alcohol, distilled water, glycerin, and sugar water.

Each element has its own voltage and the difference between two of these voltages is called potential difference. The potential difference between two elements is the value of the voltage produced if those two elements were put in an electrochemical cell. The values of these voltages can be found and their potential differences can be calculated using a table of electrochemical series. Remember, the voltage is the unit measuring the push of electrons in an electric current, and an electric current is produced by a flow of electrons.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

- Systems, order, and organization
- Evidence, models, and explanation

Content Standards: Grades 5–8

- Content Standard B: Physical Science, transfer of energy
- Content Standard E: Science and Technology

Content Standards: Grades 9–12

- Content Standard B: Physical Science, interactions of energy and matter
- Content Standard E: Science and Technology

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Hot Dog Clock* activity, presented by Jeff Bracken, is available in *Voltaic Cells* and in *Open House Demonstrations*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.

Materials for *Hot Dog Clock* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP1939	The Two-Potato Clock
C0182	Copper, Strips
M0139	Magnesium, Ribbon
M0018	Magnesium Sulfate, 500 g
C0246	Copper (II) Sulfate Solution, 1.0 M, 500 mL
AP6652	Alligator Cords