

19.1 Daniell's Cell (simple Zn, Cu, Ag voltaic cells)

Subject: Electrochemistry, voltaic cells

Description: A simple voltaic "Daniell's cell" is presented.

Materials:

1M Zinc sulfate‡

1M Copper sulfate‡

1M Silver Nitrate‡

Zinc electrode

Copper electrode

Silver electrode (1 in test tube)

Alligator clips

Voltmeter (also small buzzers, timers, etc. in separate box)

Porous cup

500 mL beaker

‡Solutions are located in the solution storage cabinets.

Pre-Class Preparation:

1. Soak the porous cup in DI water overnight before the demo.

Procedure:

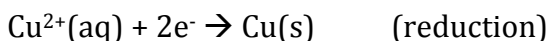
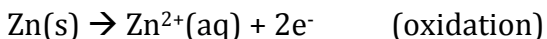
To set up the Daniell's cell:

1. Fill the porous cup with copper sulfate solution and place a copper electrode in the cup.
2. Place the porous cup in a 500 mL beaker.
3. Add zinc sulfate solution to the beaker.
4. Place the zinc electrode in the zinc solution.
5. Attach the anode to the zinc electrode and cathode to the copper electrode.
6. Measure the voltage.

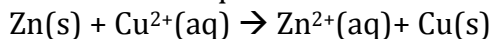
Alternatively, set up the cell with silver and copper or silver and zinc.

Discussion:

In the Daniell's cell, the zinc electrode is immersed in the zinc solution and the copper electrode is immersed in the copper solution. The zinc electrode is the anode and this is where the oxidation takes place. The zinc metal is being oxidized to zinc ions, which go into solution. The copper electrode is the cathode, where reduction takes place. The copper ions in solution receive the electrons to produce copper metal, which deposits onto the electrode. The two half reactions are as follows:



The net ionic equation is shown below:



Electrons produced at the anode travel through the external circuit to the cathode, creating an electric current. The porous cup allows transfer of ions to balance charge.

Disposal: Dispose of solutions in appropriate aqueous waste containers.

References:

1. B.Z. Shakhashiri; *Chemical Demonstrations: A Handbook for Teachers of Chemistry*; Wisconsin 1992; Volume 4;
2. Fun Science Gallery website:
http://www.funsci.com/fun3_en/electro/electro.htm#3