

Galvanic Cell

The galvanic cell, named after Luigi Galvani, consists of two metals connected by a salt bridge between the individual half-cells. It is also known as a voltaic cell and an electrochemical cell.

History

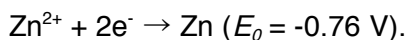
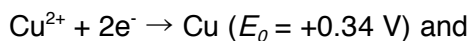
In 1780, Luigi Galvani discovered that when two different metals were connected together and then both touched to different parts of a nerve of a frog leg at the same time, they made the leg contract. He called this "animal electricity." The Voltaic pile, invented by Alessandro Volta in the 1800s, is a similar concept. These discoveries paved the way for all electrical batteries.

A common example of a galvanic cell is the copper/zinc Daniell cell, invented by British chemist John Frederic Daniell in 1836.

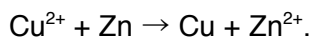
Electric potential of a Galvanic cell

The electrode potential of a cell can be easily determined by use of a standard reduction potential table. The first step is to identify the two metals reacting in the cell. Then one looks up the standard reduction potential E_o (in volts) for each of the two half reactions. The anode, or negative electrode, is the electrode with the more negative reduction potential. It is the site of the oxidation reaction where electrons are lost as electrode metal atoms are ionized and move into solution. The cathode, or positive electrode, is the electrode with the more positive reduction potential. It is the site of the site off the reduction reaction where metal ions in solution gain electrons and are deposited onto the electrode as solid metal. The electric potential for the cell is equal to the cathode potential minus the anode potential.

In the Daniell cell, the solutions are CuSO_4 and ZnSO_4 . Each solution has a corresponding metal strip in it, and a salt bridge connecting the two solutions and allowing SO_4^{2-} ions to flow freely between the copper and zinc solutions. In order to calculate the electric potential one looks up copper and zinc's half reactions and finds that:



Thus the net ionic reaction is:



The electric potential is then $+0.34 \text{ V} - (-0.76 \text{ V}) = 1.10 \text{ V}$.

Modified from Wikipedia entries on the Galvanic Cell and Daniell.

