**Relative Cell Potential: Creating Microvoltaic Cells**

**(NOTE: I have recreated this from memory from a lab originally published by Vernier.)**

The traditional galvanic cell can be reproduced in microscale by using a piece of filter paper as the container and small amounts of several different metals and solutions which contain their cations. A salt bridge can be created by using a salt solution which contains none of the metals being investigated.

**Materials Needed (per lab group):**

1 sheet of round filter paper

Scissors

Voltage Measuring Device (Vernier voltage probe, volt meter, potentiometer, or any multimeter will do)

Small pieces of metals you wish to test (Suggestions: copper, iron, zinc, lead, and silver work well)

1. M solutions of the cations of each metal (e. g. CuSO4, Fe(NO3)3, ZnCl2, Pb(NO3)2, AgNO3)

1.0 M salt solution such as NaCl or NaNO3

Ceramic Tile or other non-conducting, non-porous surface to set the filter paper on.

Procedure:

1. Divide the piece of filter paper into spokes, according to how many metals will be tested, and cut out wedges between these spokes. (See diagram.)

Cu/Cu2+

Fe/Fe3+

Ag/Ag+

Zn/Zn2+

Pb/Pb2+

1. Label each spoke with the symbol of the metal/cation that spoke will be used for.
2. Lay the filter paper on a non-porous, non-conducting surface.
3. Put about 10 drops of each solution near the end of its corresponding spoke on the filter paper.
4. Place a small (about 1 cm or less) piece of each metal on top of the drops of each corresponding solution.
5. Using the salt bridge solution, make a trail of drops a few mm apart leading from each spoke to the center of the filter paper.
6. Select one metal as your “standard” electrode for comparison. (Suggested standard is copper.) Touch one lead of the voltage meter to the piece of metal on this spoke, and the other lead, successively to the metals on each of the other spokes. Record voltage readings in a data table. Remember that the sign (+/-) that the meter reads will change if you switch the leads, and that one goal of this step is to figure out which half cell in each pairing has a greater reduction potential. (**NOTE:** These cell potentials typically fall in the 0.2 v to 0.9 v range. Be sure that you have chosen the appropriate setting on your meter, if it is not an autoranging meter.)
7. Create a second data table to list the metals in order from the highest reduction potential to the lowest and list the readings taken with the voltage meter. Assign a value of 0 volts to the electrode chosen as the standard in step 7.
8. Create a 3-column table. In the first column, list all the possible combinations of electrodes that you have not already tested. (NOTE: In step 7, you checked 4 of the possible combinations. There should be 6 more possible pairs.) In the second column, predict the cell potential for each of these combinations. Then check your predictions using the voltage meter and record the measured values in the third column.

**Follow up questions;**

1. Which metal tested showed the greatest reduction potential?
2. What happens when you touch the opposite leads to the same two metals? How can you tell from this comparison, which one of the two metals has the greater reduction potential?
3. Why might it be necessary to add more drops of solution as time passes in this experiment?
4. How do your cell potentials compare to those calculated using a published reference table of standard reduction potentials? Explain any discrepancies your might observe.