South Pasadena • AP Chemistry

Name _____
Period ___ Date ___/___/___

17 • Electrochemistry

ACTIVITY OF METALS

Introduction:
Since metals are characterized by mobile electrons, it is often useful to rate metals in terms of how well they hold (or don't hold) onto these electrons. An "active" metal is one that easily loses electrons. That is, they are easily oxidized and are not used as structural materials unless they are protected. On the other hand, chemists also rate metal ***ions*** according to their reduction potential, the tendency to gain electrons ($Cu^{2+} + 2e^- \rightarrow Cu$). The reduction potential list is important in making batteries and other electrochemical cells.

In Part I of this lab you will determine an "activity series" of some metals. In Part II, you will rate the metals according to their reduction potential.

Part I
Using a 24-well plate, place 10-20 drops of a metal ion solution in a well and add a piece of metal (freshly cleaned with steel wool) to the well. Wait at least 5 minutes, but no more than 10 minutes and record any reactions that take place. Darkening of the metal surface is considered a reaction. There are four metals and four 1.0 M nitrate solutions to work with.

Data:

Well #	Ion Sol'n	Metal	Reaction?	Net Equation (if reaction occurred)
1	lead(II)	Cu		
2	lead(II)	Mg		
3	lead(II)	Zn		
4	zinc	Cu		
5	zinc	Mg		
6	zinc	Pb		
7	magnesium	Cu		
8	magnesium	Pb		
9	magnesium	Zn		
10	copper(II)	Mg		
11	copper(II)	Pb		
12	copper(II)	Zn		

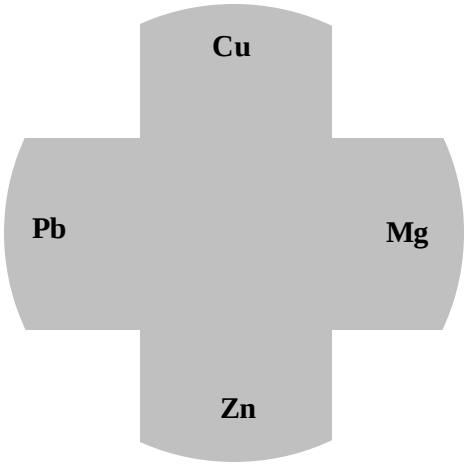
Based upon your observations, rank the metals according to their activity.
Most active metal _____
_____
_____
Least active metal _____

Justify your ranking of these metals based on your observations.

Write equations for the reactions that occurred in the wells. How would you classify this type of reaction (double replacement, single replacement, synthesis, or decomposition)? _____

Part II

Obtain a piece of filter paper small enough to fit in the bottom of the petri dish (or trim it to fit). Cut the paper as shown and place in the petri dish. Place 1-2 drops of the indicated metal ion solution (1.0 M) on each arm. Place small pieces of the indicated metal atop the wetted arms. The metal pieces should be sanded so as to have a shiny spot on top and bottom. The shiny spot should be in contact with the solution. Keep the top side of the metal dry.



Use a voltmeter to determine the potential of any two of the metals. If no potential is measured, what is missing from this electrochemical cell?

Add a few drops of 1.0 M $NaNO_3$ solution to the center of the filter paper to provide the missing salt bridge. Be sure that the filter paper is sufficiently wetted with $NaNO_3$ to provide a moist connection between all of the arms of the paper.