NAME _____ PREF ____ SECTION SC_____ DATE _____

EXPERIMENT 31: RELATIVE ACTIVITY OF METAL IONS

Equipment: 3 test tubes, rack, gloves

Materials: 15 mL $Cu^{+2}_{(aq)}$, 15 mL $Pb^{+2}_{(aq)}$, 15 mL $Ag^{+}_{(aq)}$, 3 strips each of Cu, Pb and Zn, sand paper

In this experiment you will learn how Table N in the Reference Tables was set up.

A. Pour about 1 inch (25 mm), 5 mL of Cu^{+2} ion solution into a clean test tube (label it #1), 5 mL of Pb^{+2} ion solution into another (label it #2) and 5 mL $Ag^{+}_{(aq)}$ ion solution to a third (label it #3). Add a strip of polished Zn to each test tube.

Do not allow the solutions to completely cover the zinc strip. After 4 minutes, examine each Zn strip.

1. In which solutions do you find deposits on the Zn strip? _____
2. Identify the solid deposited and record your observation in the table below. If there was no deposit write none.
3. For the reaction occurring in test tube #1, write an equation showing how copper ion changes to copper metal. (Reduction half reaction)

   _____
4. Where did the electrons used in the reduction of copper ion come from? _____

   Write an equation to illustrate your answer. (Oxidation half reaction) _____
5. Combine the equations you wrote above to obtain a net redox equation for the reaction which took place in test tube #1. _____

   What is the spectator ion? _____ Why is it not included in the net redox equation? _____
6. Use this information to fill in the table below.

B. Apply 1 through 6 above to the reactions in test tubes 2 and 3. Enter your equations and observations in the Table of Results.

C. Repeat procedure A substituting strips of Cu° for Zn° and test tubes containing solutions of Zn^{+2}, Pb^{+2} and Ag^{+}. Enter your equations (if reactions took place) in the Table of Results.

D. Repeat procedure A using strips of Pb in test tubes containing solutions of Cu^{+2}, and Zn^{+2} and Ag^{+}. Complete the Table of Results in cases where a reaction occurred.

SAFETY NOTE: **BE SURE YOUR HANDS ARE THOROUGHLY WASHED BEFORE LEAVING THE LABORATORY !**

SOL'N	METAL ADDED	METAL DEPOSITED	REDUCTION HALF-REACTION	OXIDATION HALF-REACTION	NET REDOX REACTION
Cu^{+2}	Zn				
Pb^{+2}	Zn				
Ag^{+}	Zn				
Zn^{+2}	Cu				
Pb^{+2}	Cu				
Ag^{+}	Cu				
Zn^{+2}	Pb				
Cu^{+2}	Pb				
Ag^{+}	Pb				

EVALUATING THE RESULTS

1. Which metal ions can take electrons from Zn° ? _____

2. Which metal ions can take electrons from Cu° ? _____

3. Which metal ions can take electrons from Pb° ? _____

4. Based on your answers to questions 1, 2, and 3 above, rank the metal ions Pb^{+2}, Cu^{+2}, and Zn^{+2} in decreasing order of ability to take electrons (oxidizing agents). _____

   How does your ranking compare with their relative order on Table N? _____

   _____

SUMMARY QUESTIONS

1. When Zn is placed in a solution of HCl, $H_{2(g)}$ is produced. Use Table N to identify four metals which will not react with hydrochloric acid to produce hydrogen gas.

   _____

2. The best taker of electrons (oxidizing agent) is _____ and it is located at the

   _____ (top, bottom), (left, right) of the N Table.

3. The best donor of electrons (reducing agent) is _____ and is located at the

   _____ (top, bottom), (left, right) of the N Table.

4. An ion or molecule on the left side of the N Table will react with any ion, atom, or molecule on the right side if that particle is (above, below) _____ it.

