Constructing An Electrochemical Cell (Battery/Voltaic Cell)

Introduction:

Electrochemical cells (batteries) can be made from a combination of metals and salt solutions. There are literally thousands of ways to make batteries. In a battery there is a flow of electrons between different materials as a result of oxidation and reduction taking place. The element that is oxidized loses its electrons to an element that gains them. We can measure the flow of these electrons by using a voltmeter. In this lab, you will construct a battery made up of two half cells. You will connect the half cells with a salt bridge and a voltmeter to see what kind of voltage your battery produces.

Safety: SAFETY GOGGLES AND APRONS MUST BE WORN AT ALL TIMES. Carefully follow all instructions, both written and oral. Report any accident (spill, breakage, etc.) or injury (cut, burn, etc.) to the instructor immediately, no matter how trivial it may appear.

Materials:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Quantity/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CuSO₄ (s)</td>
<td>250mL beaker for NaCl solution and soaking</td>
</tr>
<tr>
<td>ZnSO₄ (s)</td>
<td>paper towel</td>
</tr>
<tr>
<td>H₂O (l)</td>
<td>graduated cylinder</td>
</tr>
<tr>
<td>Cu metal strip</td>
<td>stirring rod</td>
</tr>
<tr>
<td>Zn metal strip</td>
<td>scoopula</td>
</tr>
<tr>
<td>NaCl (s) (for making salt bridge)</td>
<td>paper towel (for making salt bridge)</td>
</tr>
<tr>
<td>(2) 250mL beakers (for use with half cells)</td>
<td>voltmeter and connecting wires</td>
</tr>
</tbody>
</table>

Procedure: Construct a Zinc/Copper Battery

1. Create 100mL of a 0.1M solution of ZnSO₄ in one 250mL beaker.
2. Place your Zn strip in the solution.
3. Create 100mL of a 0.1M solution of CuSO₄ in the other 250mL beaker.
4. Place your Cu strip in the solution.
5. Create a 100mL saturated solution of NaCl in the 250mL beaker (assume room temperature is 25°C Celsius). Use Reference Table G to see how much to add.
6. Soak your paper towel in the saturated NaCl solution to make a salt bridge.
7. Connect your electrodes to the voltmeter wires and determine the voltage of your battery.
8. Set voltmeter dial to 20 on the left.
QUESTIONS:

1. Mass of one mole of ZnSO₄

2. Mass of ZnSO₄ placed in beaker
   With 100mL of water to create 0.1M solution

3. Mass of one mole of CuSO₄

4. Mass of CuSO₄ placed in beaker with
   100mL of water to create 0.1M solution

5. Mass of NaCl needed to create a saturated
   solution in 100g of water at 25°C Celsius.
   Table G

6. Voltage of your Copper/Zinc Battery

7. Which of the two metals is the one that
   loses electrons?

8. Oxidation ½ Reaction:

9. Reduction ½ Reaction:

10. Net Reaction:

11. Which electrode loses mass?

12. Which way do the negative ions
    migrate in the salt bridge?
13. Draw and label your battery/voltaic cell:
   a. In the space below draw and label all parts of your battery.
   b. Show what the electrodes are made of and if they are + or —.
   c. Label the ANODE and CATHODE.
   d. Show what ions are in the solutions.
   e. Draw the salt bridge and indicate its ions.
   f. Show the direction that electrons flow in the external wire.