Activity I: Mini Lab Exploring Metal Reactivity

Background
In this lab we are going to explore the reactivity of different metals in single-replacement reactions by mixing various metal and aqueous metal solutions. Particular attention will be paid to which combinations will produce a reaction where the solid metal is oxidized and reduces the solution metal cation into its neutral, solid form.

Objective
The objective of this lab is to explore the reactivity of silver, zinc and copper to determine their relative reactivity in single replacement reactions. The goal is to discover the relative ease of oxidation of the three metals in their solid, neutral form and the relative ease of reduction of the three metals in their cation form.

Safety
- Always wear safety goggles when handling chemicals in the lab.
- Wash your hands thoroughly before leaving the lab.
- Follow the teacher’s instructions for cleanup of materials and disposal of chemicals.

Procedure
1. Add a 1 cm piece of each metal (Ag, Zn, and Cu) to appropriate cell of the well plate that matches the data table shown below.
2. Add 2-3 drops of the solution at your station to the appropriate row in your well plate
   a. If AgNO₃ (aq) solution (source of Ag⁺) add to each metal in the first row of your well plate
   b. If ZnSO₄ (aq) solution (source of Zn²⁺) add to each metal in the second row of your well plate
   c. If CuSO₄ (aq) solution (source of Cu²⁺) add to each metal in the third row of your well plate
   **CAUTION:** For each test be careful not to let the dropper you are using to add each aqueous solution touch the reaction solution or you will contaminate it for the next group!
3. Record if a reaction occurs by either writing “Yes” or “No Reaction” in the appropriate location in the table.
4. When prompted by your teacher, move to the next station and repeat steps 1-3 for the solution at that station.
5. When prompted by your teacher, move to the next station and repeat steps 1-3 for the solution at that station.
6. Clean-up:
   a. When you have completed all of the tests, remove any remaining metal pieces from your well plate and put them in the trash.
   b. Gently wash the contents of your well plate down the sink drain.
   c. Rinse and wash your well plate.
   d. Wash your hands.
Data
Copy the following table into your lab notebook. You will use it to record your observations during the lab.

<table>
<thead>
<tr>
<th>Metal Reactivity</th>
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Metal (s) | Zn (s) | Cu (s) |
---|---|---|
Ag (s) | Zn (s) | Cu (s) |
Ag + (aq) | Zn^{+2} (aq) | Cu^{+2} (aq) |

Analysis
1. Based on your observations, rank the three metals in order of reactivity from most easily oxidized to least easily oxidized.

2. Based on your results, rank the three metal cations in order of ease of reduction from most easily reduced to least easily reduced.

3. After each group has completed the activity, we will discuss how we can predict ease of oxidation/reduction for a particular metal.