Laboratory Investigation Name _____

Chemistry: Form L5.5A Date _____ Period _____

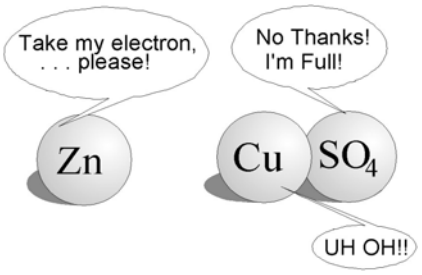
Observing Single Replacement Reactions

PROBLEM

When can an element replace another element?

INTRODUCTION

During a single replacement reaction, one element takes the place of another in a compound. Many compounds, such as the copper II sulfate pictured to the right, consist of two parts, a metal (copper) and a nonmetal (sulfate). When a metal such as zinc is dropped into a solution containing copper II sulfate, its natural tendency is to combine with the sulfate by giving electrons to it. The sulfate's outer shell is already full, however, because it has already gained electrons from the copper. As a result, however, the copper has room for zinc's electrons. If zinc can force copper to take its electrons, zinc can become a cation and take copper's place in the compound. Whether or not the zinc can take the copper's place depends upon which metal has the greater tendency to lose electrons. In this laboratory investigation, you will test the ability of several metals to take copper's place in a compound.

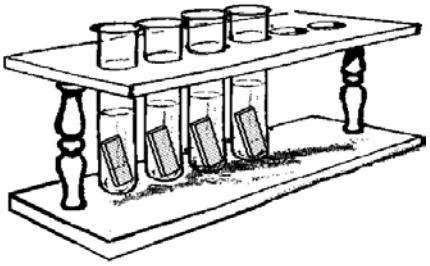


MATERIALS (*per group*)

Aluminum metal; Bunsen burner; copper II chloride solution; copper II sulfate solution; evaporating dish; 10 mL graduated cylinder; iron metal; magnesium ribbon; ring stand and iron ring; safety goggles; steel wool; test tube rack; test tubes (5); wire gauze; zinc metal

PROCEDURE

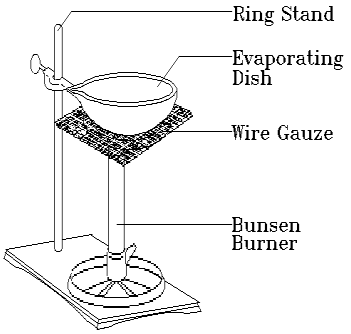
1. Set up four test tubes in a test tube rack as shown below. Using a graduated cylinder, add 5 mL of copper II chloride solution to each.



2. Polish a small piece of aluminum , iron, magnesium, and zinc using steel wool. Drop each into a separate test tube. Note the color of the solution and the appearance of the metal. Record your observations in the data table on the next page at five minute intervals for 15 minutes starting immediately.

3. Using a graduated cylinder, add 5 mL of copper II sulfate solution to a test tube. Drop in a piece of mossy zinc. When the color of the solution changes, decant the clear liquid into an evaporating dish.

4. Set up a ring stand and wire gauze as shown in the diagram to the right. Put on safety goggles and light your Bunsen burner. Evaporate the liquid in the evaporating dish. Note whether any residue remains. Record your observations on the next page.



OBSERVATIONS

Time (in minutes)	Appearance of:	METAL			
		Aluminum	Iron	Magnesium	Zinc
0	Metal				
	Solution				
5	Metal				
	Solution				
10	Metal				
	Solution				
15	Metal				
	Solution				

Did any residue remain after evaporating the liquid? . . . . . _____

CONCLUSIONS

1. For each of the metals listed below, write a balanced equation showing the reaction with the copper II chloride solution if it occurred. If there was no reaction, write "NONE":

   [a] Aluminum _____

   [b] Iron _____

   [c] Magnesium _____

   [d] Zinc _____

2. Which metals reacted fastest? Which reacted slowest? Which did not react? _____

   _____

3. Based on your observations, rank the metals (including copper) from most active to least active. _____

4. What is the residue remaining in the evaporating dish after zinc reacts with copper II sulfate? Write a balanced equation showing how the residue was formed. _____

   _____

5. When can one element replace another? _____

   _____

6. Compound "AB" reacts with metal "C." The reaction is a single replacement reaction. Write the general equation for the reaction between "AB" and "C." _____

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