Honors Chemistry Hour\_\_\_\_\_ Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
Dr. Wexler  
Lab: Observing a Precipitate-Forming Double Replacement Reaction  
Date \_\_\_\_\_\_

**Objectives:**1. To understand the parts of a chemical equation.  
2. To observe a double-replacement reaction  
3. To understand how to use the Law of Conservation of Matter to balance chemical equations.

**Background:**   
1. When two clear, colorless solutions are mixed, a chemical reaction may occur, in some cases resulting in the formation of a precipitate. A precipitate forms when a product of a chemical reaction is insoluble in water, precipitating out of solution as a solid material.

Chemical equations represent chemical reactions. They show the reactants and products formed. An arrow is used to indicate the direction of the reaction, from left to right.

2. A double-replacement reaction involves the exchange of ions between two compounds. It takes the general form of:  
 **AX + BY 🡪 AY + BX**

An example of a double-replacement reaction is:  
 **2NaOH(aq) + CuCl2(aq) 🡪2NaCl(aq) + Cu(OH)2(s)**  
  
In the above reaction, sodium hydroxide reacts with copper chloride to form sodium chloride and copper hydroxide.   
NaOH and CuCl2 are the reactants. NaCl and Cu(OH)2 are the products.   
 •The symbol (aq) means aqueous, which means dissolved in the solvent (“in solution”).  
 •The symbol (s) means solid, which means not dissolved in the solvent (“not in solution”, or “precipitated”).  
 •The numbers in front of each compound are “coefficients”. These indicate the molar ratio of each reactant and product to each other. In this case, we say that “Two moles of NaOH react with one mole of CuCl2 to form two moles of NaCl and one mole of Cu(OH)2.”

3. The coefficients of a chemical equation are determined by balancing the equation. This is done by counting the number of each type of element on the left and right sides of the equation. If they are not equal, then the coefficients are adjusted until they are.  
  
Given the “skeleton equation” (unbalanced): NaOH + CuCl2 🡪NaCl + Cu(OH)2:  
 The Na and Cu are in balance (one Na and one Cu on each side of the equation).  
 However, O, H, and Cl are out of balance, which violates the Law of Conservation of Matter (matter cannot be   
 gained or lost)  
 Using the “Inspection Method”, it is easy to see that doubling the NaOH and NaCl restores the balance of   
 matter. There is a more foolproof way of balancing complex chemical equations called the “Algebraic Method”

**Special Materials:**NaOH (lye, caustic soda)   
MgSO4 (Epsom salts)

Caution! NaOH is hazardous and will burn skin (it is the active ingredient in drain cleaner). Use gloves and safety glasses when handling either the solid form or concentrated solutions.

**Pre-lab Questions:**1. List the two reactants from **Special Materials** above:  
A.  
  
B.  
  
2. List the two monoatomic metallic ions among these two reactants. Include their charges.  
A.  
  
B.  
  
3. List the two nonmetallic polyatomic ions among the reactants. Include their charges.  
A.  
  
B.  
  
4. List the two products of this reaction, given that a double replacement occurs. Be sure to write their chemical formulas correctly (they must be charge balanced).  
A.  
  
B.  
 **Procedure:**  
1. Place 4g NaOH into a beaker. Add 50mL distilled water and stir until completely dissolved.  
2. Place 6g MgSO4 into a beaker. Add 50mL distilled water and stir until completely dissolved.  
3. Slowly pour the MgSO4 solution into the NaOH solution without stirring. **What do you observe?**

4. Now stir the solution. **What do you observe?**  
**Post-lab Question:**Note: both reactants separate into positive ions (cations) and negative ions (anions) in aqueous solution. This allows the double replacement to occur. Also, most sulfate compounds are soluble, which should help you figure out which product is the solid precipitate.  
Write a **balanced** chemical equation for the reaction between NaOH and MgSO4.   
In your equation, indicate the physical state of each reactant and product using the symbols (aq) and (s).