Chemistry Hour\_\_\_\_\_ Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
Dr. Wexler  
Lab: Stoichiometry of a Chemical Reaction – A Mole Ratio (HS-PS1-7; HSN-Q.A.1)  
Date\_\_\_\_\_\_\_

**Introduction:**   
Iron reacts with copper(II) sulfate in a single replacement reaction. In excess copper(II) sulfate, knowing the mass of iron that reacts and the mass of copper metal produced, you can calculate the ratio of moles of reactant to moles of product. This mole ratio can be compared to the ratio found in the balanced chemical equation.

**Objectives:**Observe a single replacement reaction.  
Measure the masses of iron and copper.  
Calculate the moles of each metal and determine the experimental molar ratios  
Compare your results with the molar ratios of the balanced chemical equation.

**Special Materials:**Iron filings (Fe)  
Copper(II) sulfate pentahydrate (CuSO4·5H2O)  
Wood tongue depressor  
250mL beaker  
Plastic cup  
Ceramic pad

**Procedure:**  
1. Weigh out 1.00g of iron filings in a zeroed weigh boat.   
2. Add 25mL saturated copper sulfate solution to a 250mL beaker. Warm the beaker over a Bunsen burner. Remove from the heat just before it starts to boil and place on a ceramic pad.  
3. Add the iron filings to the beaker.   
4. Swirl for 15 minutes.  
5. Slowly decant (pour off) the waste liquid into the plastic cup – Careful! Do not to lose any of the copper.  
6. Add about 25mL water to the copper solid and swirl to wash the copper. Decant as before. Repeat once more. This is necessary to remove unreacted copper sulfate as well as iron sulfate produced in the reaction.  
7. Dry the copper in the beaker over the Bunsen burner. Allow the beaker to cool on the ceramic pad.  
10. Use the wood tongue depressor to scrape the copper product into a zeroed weigh boat on the digital scale.

**Results:**

|  |  |
| --- | --- |
| A. Mass of iron filings | 1.00g |
| B. Mass of dried copper product |  |

**Analysis:**1. What was the major physical change you observed that indicated a chemical reaction had occurred?

2. Write a balanced chemical equation for the single-replacement reaction that occurred. (Hint: ignore the water in the copper sulfate formula)

3. What was the mass of iron you added as a reactant? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_g  
4. What is the molar mass of iron? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g/mol  
5. Calculate **the moles of iron added**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_moles  
Hint: mass/molar mass

6. From your data, what was the mass of copper produced? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_g  
7. What is the molar mass of copper? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g/mol  
8. Calculate the **moles of copper produced**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ moles  
Hint: mass/molar mass

9. Calculate the experimental iron:copper molar ratio (expressed as a single number): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
(moles iron ÷ moles copper)

10. What was the theoretical (predicted) iron:copper molar ratio from the balanced chemical equation?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
(coefficient of Fe ÷ coefficient of Cu

11. Calculate the % error: http://upload.wikimedia.org/math/6/c/9/6c9379b6b8bfee0800888af6cdaacec6.png