***Introduction:*** In this lab, you and your lab partners will determine the unknown ionic compound produced in a chemical reaction. This ionic compound is either iron (II) sulfate or iron (III) sulfate. To do this you will, for homework, first write balanced reactions for each of the possibilities; then you will use stoichiometry to determine how much of each product could be produced by the reaction. Next, in class, you and your partners will conduct the experiment and based on the amount of copper produced, you will determine which equation applies to the reaction you run.

***Prelab Homework:*** Failure to complete this homework prior to the beginning of the lab will result in you not being able to perform the lab and therefore receiving a zero for the activity.

The unbalanced chemical reaction that you will perform is either: [*(aq)* means aqueous/dissolved in water, and *(s)* means solid].

***RXN #1:*** Copper (II) sulfate *(aq)* + iron *(s)* 🡪 copper *(s)* + iron (II) sulfate *(aq)*

\_\_\_\_CuSO4 *(aq)* + \_\_\_Fe *(s)* 🡪 \_\_\_Cu *(s)* + \_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ *(aq)*

***RXN #2:*** Copper (II) sulfate *(aq)* + iron *(s)* 🡪 copper *(s)* + iron (III) sulfate *(aq)*

\_\_\_\_CuSO4 *(aq)* + \_\_\_Fe *(s)* 🡪 \_\_\_Cu *(s)* + \_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ *(aq)*

1. Using your ion sheet, determine the chemical formula for the two possible ionic compounds made by this reaction. Write the formulas on the lines above.
2. Now balance both chemical equations.
3. Stoichiometry calculations: You will use 2.0 grams of iron (Fe) in this reaction. How much Copper metal will be produced by the two possible reactions? Show your work below:
   1. RXN #1:
   2. RXN #2:
4. Read the procedure for the lab before coming to class.

**Supplies:**

*Group Supplies*: one 150 mL beaker; stir rod; ring stand with wire gauze; Bunsen burner; 100 mL graduated cylinder

*Shared Supplies*: wash bottle filled w/ distilled water; balance

**Safety:** Safety glasses must be worn throughout the lab procedure. It is recommended that you wear a lab apron as well. Gas flames will be used, secure all loose clothing and hair. Hot beakers look the same as cool beakers, use beaker tongs or gloves made for picking up hot glassware.

**Procedure:**

1. Put on safety glasses.
2. Get your supplies, clean them with tap water, and then rinse them with distilled water. You must dry the inside and outside of the beaker with a paper towel.
3. Acquiring your chemicals and get setup:
   1. Place your 150 mL beaker on a balance. What is the mass of the empty beaker? \_\_\_\_\_\_\_\_\_\_\_\_\_ grams. Hit the tare (zero) button. Into this beaker, measure out approximately 11.5 grams of Copper (II) Sulfate hydrate.
   2. Place a weigh paper on the balance and hit the tare (zero) button. Measure out exactly 2.00 grams of iron (Fe) filings.
   3. Measure approximately 50 mL of water into a graduated cylinder and add it to the beaker containing the copper (II) sulfate.
   4. Set up the beaker according to your instructor’s example.
4. Light your Bunsen burner and place it under the beaker. Adjust so your beaker is near the hottest part of the flame.
5. Heat the beaker (**Do not boil the solution)**, stirring occasionally, until the copper (II ) sulfate is dissolved. Turn off and remove the Bunsen burner from under the beaker.
6. While stirring, slowly add the iron filings. Record your observations here: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Allow the beaker to cool for 10-15 minutes.
8. Carefully, without loosing any copper into the sink, decant (pour off) as much liquid as you can.
9. Using a wash bottle, add a small amount of distilled water to the beaker, swirl and let the copper settle to bottom. Decant water. Repeat.
10. Place beaker back on stand. Relight burner and lightly heat beaker until remaining water bubbles. Remove heat and let remaining water evaporate.
11. Allow the beaker to cool. Return all other supplies to their drawers.
12. Once cool, measure the mass of the copper and beaker together. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ grams.
    1. What is the mass of the copper? \_\_\_\_\_\_\_\_\_\_\_\_\_\_ grams
13. Scrape the copper into the waste beaker provided by your teacher. Clean up your beaker and return the beaker to its drawer. Return to your seat and complete the questions below.

***Questions:***

1. Which of the possible ionic compounds was produced? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   1. Explain fully how you came to this conclusion.
2. Did you produce exactly the same amount of copper as you had predicted in your stoichiometry calculations? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   1. If not, what could you do differently that could possibly recover more of the expected product?
3. Review the definitions for “Limiting Reactant” and “Excess Reactant”. In this reaction…
   1. The Limiting Reactant is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. The Excess Reactant is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Why do you think that the copper metal you produced was washed with water in procedure step 9?