Chemistry
Lab Makeup

Name _____
Date_____Block___

Read the introduction to this lab to understand the background. Then, using the theoretical data provided, answer the questions.

Stoichiometry and Limiting Reagent Copper (II) Sulfate Lab

In this lab activity, you will work with metallic iron and ionized copper. The metallic iron is in the form of steel wool. The ionized copper is in the compound copper (II) sulfate. In the course of the chemical reaction, the iron is ionized as copper metal is produced. In this experiment, you will measure the amounts of reactants and products and will be able to determine the quantitative relationships between the moles of metallic iron (a reactant) and moles of metallic copper (a product). Both qualitative and quantitative data tables appear on the following page. All items must be filled in and it is IMPORTANT to SHOW WORK ON ALL CALCULATIONS. Not showing work will result in the loss of points.

Qualitative Data Table – Observations you can make using your five senses

	Observations
$CuSO_4$ (aq)	**Solid blue crystals of copper (II) sulfate were added to water. All of the solid dissolved and the aqueous solution was blue in color.**
Addition of Fe to $CuSO_4$	**Solid iron, which is gray in color to begin, starts to turn salmon color. The solution becomes hot.**
Solution after reaction	**The solution has a faint blue tint (not as crystal blue as before).**
Product in solution	**Finer salmon-colored pieces remain in solution.**
Filtered product	**Salmon color.**
Product after drying	**"Copper" color, but not shiny or metallic looking.**

Quantitative Data Table – Measured Data

	Data	**Calculations**
Mass of dry beaker	***Not needed***	
Mass of beaker and $CuSO_4$	***Not needed***	
Mass of $CuSO_4$	**11.25 g**	
Mass of Fe	**3.00 g**	
Mass of filter paper	**0.91 g**	
Mass of dry product + filter paper	**4.21 g**	
Mass of product		

Data Analysis – upon completion of the lab, answer the following questions.

1. Write a chemical equation for this reaction. Include the states of each reactant and product and balance the equation.

2. Write the total ionic and the net ionic equation for this reaction. (**Honors only**)

3. What is the solid residue created in the reaction?

4. Determine the number of moles of iron that reacted.

5. Using the mass of the dry copper product, determine the number of moles of copper produced.

6. Determine the experimental mole ratio of moles of Fe to moles of Cu. Divide the moles of Fe by the moles of Cu to obtain a decimal number.

7. What is the theoretical mole ratio of moles of Fe/moles of Cu? Explain how you determined this.

8. Which reactant was the limiting reagent? Which is the excess reagent? Show both fence posts to support your response to the limiting/excess reagent. ***Remember solid copper was your product!***

9. How much excess reagent is left over?

10. What evidence did you observe that would suggest some ionized copper remained dissolved in the water? How could you remove all the dissolved copper from the solution

11. What mass of copper did you calculate you would produce (**theoretical yield)**?

12. What mass of copper did you actually produce (**actual yield)**?

13. What is the **percent yield** of copper?