Chemistry

Scarsdale High School

Iron – Copper (II) Chloride Reaction

Objective:
Determine the moles of iron and copper that react. From this data, determine the net balanced equation and percent yield for the reaction

Task:
Perform the attached lab.

Materials:
1. See lab procedure

Lab Report:
PRESENTATION COUNTS
1. Correct File Name
2. Abstract
3. Pre-Lab Data Table, Calculations and Balanced Reaction
4. Results, Observations, Calculations
    a. Reaction as listed in handout with mole value coefficients
5. Conclusion
6. References (MLA Format)
    a. Must include lab handout

Due Date:
1 week after the completion of the lab

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Iron – Copper Chloride Reaction

Introduction

In this experiment you will let iron (in the form of a nail) react with a copper chloride solution. After observing the results of this chemical reaction, you will determine the mass of the iron consumed and the mass of the product formed. By calculating the moles of iron consumed and the moles of copper produced, the relationship between the starting materials and the resulting materials can be compared. With this data, a balanced chemical reaction can be created.

As you perform the experiment, record your observations and data accurately and neatly. Take special care to record the units as an important part of each measurement. Express each measurement using the correct number of significant figures.

Pre-Lab Calculations

A student wishes to study the chemical reaction in which metallic copper reacts with a solution of silver nitrate to form silver crystals and a solution of copper (II) nitrate. The student weighed a sample of silver nitrate, dissolved it in water and added a weighed piece of copper wire. All mass readings were accurate to ± 0.01 g.

Mass of silver nitrate	3.01 g
Mass of copper wire	2.86 g
Mass of copper wire after reaction	2.30 g
Mass of sliver crystals formed	1.92 g

Calculate:

1. The number of moles of copper reacted:

2. The number of moles of sliver produced:

3. The ratio: $\frac{moles\_silver}{moles\_copper}$

   (Express your answer as a decimal to the correct number of significant figures.)

4. The number of moles of silver nitrate reacted

5. The ratio: $\frac{moles\_silver}{moles\_silver\_nitrate}$

   (Express your answer as a decimal to the correct number of significant figures.)

6. Using the results from the ratio's calculated above, write the whole number coefficients in the following statement:

_____ mole copper + _____ mole silver nitrate solution ➔

_____ mole silver + _____ mole copper (II) nitrate solution

Procedure

Perform 3 trials of this procedure

1. Weigh an empty, clean, dry beaker. Add between 1.00 and 1.50 g of iron to the beaker. Record the mass of the iron in your notebook.

2. Add approximately 8.5 grams of copper (II) chloride hydrate to the beaker. Record the mass of the salt to the nearest 0.01 g.

3. Add about 50 ml of distilled water to the beaker. Stir the mixture until all of the crystals have dissolved.

4. Let the solution stand for about 20 minutes or until it is clear that all of the iron has reacted.

5. Carefully decant the solution from the reddish-brown material remaining in the beaker. Be careful! Do your best NOT to lose any solid in the bottom of the beaker.

6. Wash the remaining solid with about 25 ml of distilled water and decant again. Repeat the washing and decanting procedure 4 or 5 times. Be careful! Do your best NOT to lose any solid in the bottom of the beaker.

7. Next wash the solid with about 25 ml of 1 M HCl solution. Decant and wash with distilled water.

8. After the final washing, the solid must be dried. Label your beaker and place it under the heat lamp set up in the classroom.

9. After the solid is dry, allow the beaker to cool to room temperature. Once you are sure that the solid is dry, weigh the beaker and dry solid. Determine the mass of the solid.

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Data Table

	Trial 1	Trial 2	Trial 3
Mass of clean, dry beaker			
Mass of beaker and copper (II) chloride hydrate			
Mass of the initial iron sample			
Mass of beaker plus dry product			

Calculations

1. Determine the mass of the iron that reacted and the number of moles of iron that reacted.
2. Assuming your dry product to be pure copper, determine the number of moles of copper produced.
3. Determine the ratio: $\frac{moles\_iron}{moles\_copper}$

   (Express your answer as a ratio of whole numbers.)
4. Using only your experimental results and calculations above, write the balanced reaction with proper coefficients.
5. Based upon your starting materials, determine the percent yield for your reaction.
6. Write a laboratory report that includes the elements listed on the first page.