Chemistry 1 Laboratory Name: _____

Moles of Iron and Copper

The mole is a convenient unit for analyzing chemical reactions. The mole is equal to 6.02×10^{23} particles or Avogadro's number of particles. More important, however, than the number of particles in a mole is the mass of a mole of any compound or element. It is the mass in grams corresponding to the molecular, formula or atomic mass. Simply stated, the mass of one atom of copper is 63.5 amu; the mass of one mole of copper atoms is 63.5 grams. Similarly, the mass of molecule of water is 18.0 amu; the mass of one mole of water is 18.0 grams.
In this experiment, you will observe the reaction where iron replaces the copper in copper (II) chloride solution. You will also determine if one of the products is iron (II) or iron (III) chloride.

O B J E C T I V E S

1. Determine the number of moles of copper produced and the number of moles of iron used in the reaction of iron with copper (II) chloride.
2. Calculate the number of moles of iron used to the number of moles of copper produced.
3. Infer the formula and name of the iron chloride product.

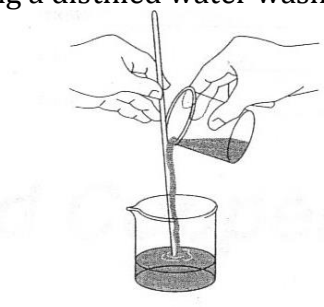
MATERIALS

APPARATUS
2 - 250mL beakers
Stirring rod
Crucible tongs
Hot plate

REAGENTS
copper II chloride
2 iron nails
1M HCl squirt bottle
distilled water (wash bottle)

P R O C E D U R E

1. Read the entire laboratory assignment and the relevant pages in your textbook. Answer all pre-lab questions before beginning the lab.
2. Put on safety goggles. Wear them whenever chemicals or danger to your eyes is present at your lab table.
3. Choose a beaker. Make sure the nails in step three will lie flat in the bottom of the beaker. Find the mass of the beaker to the nearest 0.01 gram. In the beaker mix approximately 2 grams of copper (II) chloride with 30mL of distilled water. Stir with stirring rod until dissolved.
4. Obtain two clean dry nails. Record your observations about the nails and the starting copper (II) chloride solution. Find the mass of the nails and record it in your report sheet.
5. Place the nails in your copper (II) chloride solution and leave them undisturbed for 20 minutes. Complete Pre-Lab Questions during this time.
6. Observe any changes to the copper (II) chloride solution. Using the crucible tongs, carefully pick up the nails one at a time. Record your observation of the nails. Using a distilled water wash bottle wash as much copper off the nails as possible back into the beaker. If necessary you can also use the stirring rod to scrape copper off the nails.
7. Place the nails on a paper towel to dry. When the nails are dry, mass the nails and record their mass.
8. Decant means to pour off only the liquid from a container that is holding both liquid and solid. Carefully decant the liquid from the solid. Do not pour the liquid down the drain right away. Instead pour



When decanting, it is helpful to direct the liquid into the second beaker along a stirring rod, as shown here.

the liquid into a second beaker in case you over pour, so you can still recover the solid.
9. After decanting, rinse the solid again with about 25 mL of distilled water. Decant again. Repeat this step two more times.
10. Next, wash the solid with about 25 mL 1.0 M Hydrochloric acid. Decant again. Rinse the solid again with about 25 mL of distilled water. Decant again.
11. After the final washing with water, place the beaker on a hot plate medium heat and thoroughly dry copper.
12. After the copper is completely dry, find the mass of the beaker plus the copper. Record this on the report sheet.
13. Clean up all materials, bench and hands before leaving the lab.

Pre-Lab questions

1. How many moles are present in a 34.0 g sample of iron metal?

2. How many atoms are present in 2.00 moles of copper?

3. What is the molar mass of copper (II) chloride?

4. Why is it necessary to wash the copper several times?

5. Define decant.

Name _____ Date_____

Moles of Iron and Copper - Report Sheet

Data

Before the Reaction Observations about the nails: Mass of Empty Dry Beaker _____ Mass of Copper(II) Chloride added _____ Mass of two iron nails _____	After the Reaction Observations about the nails: Mass of the dry iron nails _____ Mass of Beaker plus dry copper _____
Observations about the CuCl2 Solution:	Observations about the solution after the reaction:

Calculations

Find the following masses (show all work)

Mass of iron used in the reaction _____

Mass of copper produced _____

Find the following moles (show all work)

Moles of iron used in the reaction _____

Moles of copper produced _____

Find the following atoms (show all work)

Atoms of iron used in the reaction _____

Atoms of copper produced _____

Synthesis:

1. Was there any evidence to indicate that the copper (II) chloride had not all reacted?

2. If you started with 5.00 grams of copper (II) chloride and it had all reacted:

   a) How many moles of copper would have been produced?

   b) How many atoms of copper would have been produced?

   c) How many grams of copper would have been produced?

3. What was the purpose of the HCl acid wash?