Moles of Iron and Copper

Name - _____

Partner - _____

Introduction

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 importantly, however, the mass of a mole of any compound or element is the mass in grams that corresponds to the molecular formula, or atomic mass. Simply stated, the atomic mass of copper is 63.5 u, which means that the mass of one mole of copper atoms is 63.5 g. Likewise, the molecular mass of water is 18.0 u, and the mass of one mole of water molecules is 18.0 g.

The mole is the common language in chemical reactions. In this experiment, you will observe the reaction of iron nails with a solution of copper(II) chloride and determine the number of moles involved in the reaction.

Iron and copper, along with gold, silver, lead, and antimony, were known in very early times. Iron and copper occur naturally in the earth's crust as oxides or sulfides. Chemical analysis and calculation of ore content is vital to the mining industry. Today an ore containing 3–4% copper is considered high-grade, while iron producers are little interested in ores containing less than 20–30% iron.

Pre-lab Questions –

1.) How many moles are present in a sample of $34.0\ grams$ of iron metal?

2.) How many grams of copper do you have if you have $2.779\ moles$ of the metal?

3.) How many atoms of iron metal do you have in $1.03\ moles$?

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

5.) Why is the washing of the copper necessary in this experiment?

6.) Define the term <u>decant</u>.

7.) What is the other name for mole (6.022×10^{23})? _____

8.) In today's market, a copper containing ore of _____% copper is considered high grade.

9.) Two chemicals in this lab pose significant health risks, what are those risks?

a.) Copper (II) Chloride -

b.) Hydrochloric acid -

<u>Procedure</u> – follow the procedure as outlined on your lab handout (duotangs) and record your observations below.

1.) Mass of clean and dry $250\ mL$ beaker. _____ g

2.) Mass of beaker with copper (II) chloride added. _____ g

4.) Mass of two cleaned nails _____ g

5.) Record what you see happening during the first few minutes after the nails are added to the copper (II) chloride solution.

7.) Mass of nails after reaction with the copper (II) chloride solution. _____ g

12.) Mass of beaker with copper metal. _____ g

Calculations

1.) Calculate the mass of iron consumed in the reaction.

_____ g

2.) Calculate the mass of copper metal produced in the reaction.

_____ g

3.) Convert the mass of iron consumed into moles of iron consumed. Show your work.

_____ mol

4.) By dividing moles of Copper produced by the moles of iron consumed, you can calculate the ratio of copper:iron used in this reaction. Simplify your answer to a whole number ratio.

_____

5.) What evidence is there in your beaker that some contamination of the copper remained after the experiment?

6.) If unlimited copper (II) chloride is available to react with $34.0\ g$ of iron, how many grams of copper metal would be produced?

_____ g