# Determination of Moles of Copper and Iron in Reaction

## Introduction

In this activity you will perform a single replacement reaction between copper and iron. Using the masses of iron used and copper produced, you will be able to calculate the number of moles involved in the reaction.

## Materials

- 2 iron nails
- sand paper
- balance
- 250 mL beaker
- wax pencil
- copper(II) chloride
- distilled $H_2O$
- tongs
- squirt bottle of distilled $H_2O$
- stirring rod
- large beaker for decanting
- 1 M HCl
- drying oven
- goggles

## Procedure

Day 1

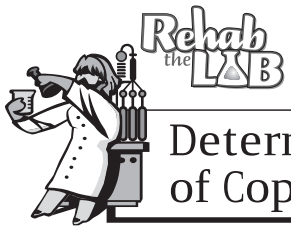
1. Put on goggles. Over a paper towel, clean 2 iron nails with a small piece of sandpaper until they are shiny. Carefully wad up the paper towels with sandpaper residue and throw away. Find the mass of the 2 iron nails and record.
2. Label the 250 mL beaker with your initials using the wax pencil. Find the mass of the beaker and record.
3. Add about 2.0 g of copper(II) chloride and find the mass of the beaker with the copper(II) chloride and record.
4. Add about 50 mL distilled $H_2O$ to the beaker and gently swirl to dissolve the copper(II) chloride.
5. Carefully put the nails in the copper(II) chloride solution and then place the beaker in a safe location to allow the reaction to proceed overnight. Clean up as directed by your teacher and wash your hands.

Day 2

6. Put on goggles. Using tongs, carefully pick up the nails from the bottom of the beaker. With the squirt bottle of distilled $H_2O$, rinse any copper clinging to the nails back into the beaker.
7. Place the nails on a paper towel labeled with your names. Allow the nails on the paper towel to dry in a safe place overnight. A drawer or cupboard will work well.
8. Decant the liquid in the 250 mL beaker into another large beaker. Use a stirring rod to help guide the liquid into the large beaker.
9. Add about 25 mL distilled $H_2O$ to the copper formed in the 250 mL beaker and swirl to rinse. Decant into large beaker. Repeat the rinsing / decanting procedure 3 more times. Dispose of the decant down the sink and flush with excess water.
10. Next add about 25 mL 1 M HCl to the copper and swirl. Decant into large beaker. Dispose of HCl decant as directed by your teacher.
11. Finally, add about 25 mL distilled $H_2O$ and swirl. Decant.
12. Place clean copper in labeled 250 mL beaker in oven to dry for several hours. Clean up as directed by your teacher and wash your hands.

Day 3

13. Put on goggles. Find the mass of your 2 iron nails and record. Find the mass of the 250 mL beaker with dry copper and record. Clean up as directed by your teacher and wash your hands.

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## Data

(A) Initial mass of 2 iron nails: _____g

(B) Mass of empty 250 mL beaker: _____g

(C) Mass of 250 mL beaker plus copper(II) chloride: _____g

(D) Final mass of 2 iron nails: _____g

(E) Mass of 250 mL beaker plus dry copper: _____g

## Analysis and Calculations

1. Find the mass of iron used from the nails. _____g

2. Find the mass of copper produced in the 250 mL beaker. _____g

3. Find the moles of iron used from the nails. _____moles

4. Find the moles of copper produced. _____moles

5. What is the ratio of moles or iron used to moles of copper produced?

6. Write a balanced equation for this reaction.