

Limiting Reagent Lab

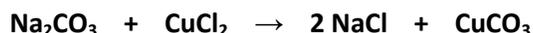
Introduction

Purpose

To determine the limiting reagent of the reaction between sodium carbonate and copper (II) chloride.

Background

In this experiment, you will be performing a double replacement reaction in which one of the two products is a precipitate. Precipitates are easily recognizable because they are a solid product of two aqueous mixtures. They often give the solution a cloudy or grainy appearance. The reaction in this lab is represented with the following equation:



The coefficients in a chemical equation indicate the exact amount of moles of reactants that will form moles of products. If the mole ratio of reactants indicated by a chemical reaction is not obeyed, then one of the reactants will limit the amount of products formed. The limiting reagent determines the amount of product formed. In this experiment, equal masses of the reactants will be added to a reaction flask. The solid copper (II) carbonate precipitate will be collected via filtration, and massed. By calculating the number of moles of CuCO_3 produced, the number of moles (and mass) of reactants that reacted can be determined. By comparing the initial amount of the reactants added to the reaction flask and the calculated amount that reacted, the limiting reagent can be determined.

Procedure

1. Obtain two clean, dry, 100 mL beakers. Label the first beaker Na_2CO_3 and the second CuCl_2 .
2. Add 1.00 g of sodium carbonate to the first beaker. Record the mass.
3. Add 1.00 g of copper (II) chloride to the second beaker. Record the mass.
4. Dissolve each of the solids in approximately 25 mL of distilled water. Stir.
5. Note the color of the two solutions.
6. Add a few milliliters of the copper (II) chloride solution to the beaker containing sodium carbonate.
7. Slowly add the remaining copper (II) chloride solution to the sodium carbonate (a few milliliters at a time).
8. Rinse remaining traces of the copper (II) chloride solution into the flask with approximately 5 mL of distilled water. Repeat a second time to ensure all the CuCl_2 is transferred to the beaker.

9. Stir the reaction mixture for a few minutes. Obtain a piece of filter paper and determine its mass. Filter the solution and precipitate. Add 10 mL of distilled water to the reaction mixture remaining in the beaker and filter. Remove the filter paper and allow to dry overnight.
10. Record the mass of the dry filter paper and copper (II) carbonate.

Data

Mass of NaCO_3	_____
Mass of CuCl_2	_____
Mass of filter paper	_____
Mass of filter paper + CuCO_3	_____
Mass of CuCO_3	_____

Calculations

Complete the following calculations on your own sheet of paper.

1. Calculate the moles of sodium carbonate and copper (II) chloride used.
2. Determine which reactant is the limiting reactant.
3. How many moles of copper (II) carbonate was produced? What mass is produced?
4. Calculate the percent yield of copper (II) carbonate.
5. Was the yield 100%? Why or why not?
6. From your observations of the color of the reactant solutions and the filtrate, is it possible for you to qualitatively determine the limiting reagent? Explain.