Stoichiometry: Predicting Yield

Reminder – Goggles must be worn at all times in the lab

PRE-LAB DISCUSSION:

The actual weights of substances used in a chemical reaction are proportional to the formula weights of the same substances. It is therefore possible to predict the number of grams of a given product that will be formed from a known weight of any one of the reactants.

In this experiment you will start with a known weight of $CuCO_3 \bullet Cu(OH)_2$ (dibasic cupric carbonate) and determine the weight of copper(II) oxide obtained when the compound is decomposed by heating. You will then calculate from the equation for this reaction the THEORETICAL yield of cupric oxide which should be formed from the initial starting amount of basic cupric carbonate. The difference between the actual yield obtained from the experiment and the theoretical CALCULATED yield from the equation is used to determine the error.

The equation for the reaction is:

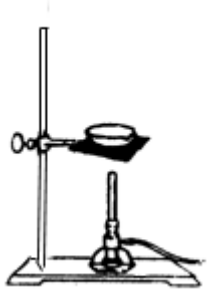
$$CuCO_3 \bullet Cu(OH)_2 \xrightarrow{\triangle} 2CuO + CO_2 + H_2O$$

CLAIM:

We can use the mathematical technique of stoichiometry to predict the mass of a product from a chemical reaction.

PROCEDURE:

1. Clean and dry your evaporating dish.
2. Prepare the ring stand set up as shown in the diagram at the right.
3. Weigh your evaporating dish and record its mass in the Observations and Data section, *remembering to record the mass to three places past the decimal.*
4. Add 1.000 grams of dibasic cupric carbonate to your evaporating dish and record this new mass in the Data section.
5. Place the evaporating dish on the wire gauze supported on the ring stand and heat until all the cupric carbonate has been converted to black copper(II) oxide. The material may be stirred during the last part of the heating process provided that you are careful not to allow any of the CuO to adhere to the stirring rod.
6. After the compound is totally black, turn off the heat and allow the evaporating dish to cool.
7. Weigh the dish and its contents and record this value in the Data section.



RESULTS:

Data

1. Mass of the evaporating dish _____g
2. Mass of the dish + basic cupric carbonate _____g
3. Mass of cupric carbonate used _____g
4. Mass of dish + CuO after heating _____g

Calculations (Show your work!)

1. Calculate the theoretical yield of CuO that should have been formed had you done everything perfectly. This process involves stoichiometry, which you have already learned! I have included the balanced equation for the reaction from the top of this lab.

$$CuCO_3 \bullet Cu(OH)_2 \xrightarrow{\triangle} 2CuO + CO_2 + H_2O$$

2. Calculate your actual yield of copper(II) oxide from the data recorded during the experiment.
3. Calculate your Absolute error - the difference between your ACTUAL yield and THEORETICAL yield. Remember that this is ABSOLUTE error, so it cannot have a negative value.