**Experiment #1: “Stoichiometric Determinations”**

**Chem1411.P01**

**General Chemistry I**

**Spring 2019**

**For: Dr. Karlos X Moreno**

**By: Charles J. Brown**

**Objective**

Stoichiometric measurements are among the most important in chemistry, indicating the proportions by mass in which various substances react. In this experiment, the reaction of sodium carbonate, Na2CO3, with hydrochloric acid, HCl, was investigated.

**Introduction**

Stoichiometry is important in chemistry. We can do calculations with it.

**Materials & Methods**

Sodium carbonate

3 M HCl (aq)

methyl red indicator

DI water

Crucible

ring stand

ring clamp

wire gauze

watch glass

disposable pipet

graduated cylinder

Bunsen burner

hot plate

250-mL beaker.

Clean a 50-60 mm-diameter casserole dish with soap and water. If any solid material in the casserole cannot be removed with simple washing, consult with the instructor about other methods for cleaning. Rinse the casserole with distilled water and wipe dry with a towel.

On a wire gauze on a ringstand, heat the casserole on a low flame for 5 minutes to dry it. Move the flame occasionally during the heating so that all portions of the casserole are heated. Allow the casserole to cool completely to room temperature.

Weight the casserole to at least the nearest 0.01 g and record. Reheat the casserole on the gauze for an additional 5 min and reweigh after cooling completely. If the second mass determined for the casserole differs from the first mass by more than 0.02 g, reheat and reweigh until constant mass is achieved (within 0.02 g).

Add about half a teaspoon of sodium carbonate to the casserole and reweigh (to the nearest 0.01 g). Record. Calculate the mass of sodium carbonate taken.

Moisten the sodium carbonate with 4-5 mL of distilled water and add 2 drops of methyl red indicator (the mixture will become yellow). Cover the casserole with a watch glass to catch any material that may spatter. Obtain about 25 mL of 3.0 M hydrochloric acid in a clean beaker.

Based on the mass of sodium carbonate taken, calculate the volume of 3.0 M HCl that should be required to react with the sodium carbonate.

Transfer the calculated volume of 3.0 M HCl from the beaker to a graduated cylinder.

When adding HCl to the sample in the casserole, use a medicine dropper, and add the HCl down the pouring spout of the casserole without removing the watch glass. The sodium carbonate will froth and fizz as carbon dioxide is generated, and the watch glass will prevent loss of solid. Begin adding 3.0 M HCl dropwise to the casserole from the portion measured in the graduated cylinder.

Continue adding HCl with the dropper from the graduated cylinder until there is approximately 1 mL remaining in the graduated cylinder. During the initial addition of the HCl, the indicator may change to red. This may not signal completion of the reaction, however, because some carbon dioxide may remain in solution at this point, thereby affecting the pH of the mixture.

Transfer the casserole to the wire gauze/ringstand and heat with a low flame until the mixture just begins to boil. This heating is only to drive off carbon dioxide: Do not attempt to boil off the water from the mixture at this point. As carbon dioxide is evolved on heating, the mixture should turn yellow again.

Add additional HCl dropwise from the graduated cylinder until the mixture in the casserole turn a permanent pale red.

Use a stream of distilled water from a plastic wash bottle to rinse any solids that may have collected on the bottom of the watch glass into the casserole.

Set up a 400 or 600 mL beaker that can accommodate the casserole on the wire gauze/ringstand, add about 300 mL of tap water, and bring the water to boiling to provide a steam bath.

Place the casserole in the mouth of the beaker of boiling water and begin heating to evaporate water. The evaporation of water will take a considerable amount of time. Replace the water in the beaker as needed to maintain the steam bath.

After the solid in the casserole is almost completely dry, remove the casserole from the steam bath. Begin heating the casserole directly with a very small flame.

If the casserole begins to spatter, not enough water has been evaporated and the casserole should be returned to the steam bath for additional slow heating. If not spattering occurs, continu heating the casserole directly with a small flame for 5 minutes.

Increase the size of the flame somewhat, and continue heating the casserole for an additional 5 minute period to remove all moisture. Let the casserole cool completely to room temperature.

When the casserole has cooled completely, determine the mass of the casserole and contents. Calculate the mass of sodium chloride in the casserole. Determine the theoretical yield and percent yield.

**Discussion/Analysis**

I saw water evaporating from the dish when heating with a flame. When the acid was added I saw that the solution became a rose or pink color. After I heated it with a flame, it became yellowish. I added the remaining acid until the solution stayed pink. Some of my solid jumped out of the dish when I heated it with the flame. I only saw a small amount of solid formed.

**Results**

Mass of sodium carbonate: 0.70

HCl needed: 4.4 mL

Sodium chloride: 0.65

Percent yield: 84.4 %

**Conclusion**

At the end of the experiment I got 0.65 g of sodium chloride. This was a 84.5 % yield. This means I got a bad result. It still has impurities in it.