Name_____
Name_____
Date Due_____

CHEMISTRY

EXPERIMENT: Mass Relations in Chemical Reactions

Purpose: The purpose of this experiment is to determine experimentally and theoretically how much sodium chloride can be prepared in the reaction of sodium hydrogen carbonate, baking soda, with hydrochloric acid.

Background: In this experiment, the sodium hydrogen carbonate will be the limiting reagent. An excess of hydrochloric acid will be used. The limiting reagent limits or determines the amount of product that will form. The amount of product that should form if the limiting reagent reacts completely is called the theoretical yield. The amount of product obtained (actual yield) is always less than the theoretical yield for several reasons. Some of the product is "lost" in the procedure used in the experiment itself. And not all reactions will go to completion. In this experiment an excess of hydrochloric acid is used to drive the reaction to completion. Once the actual yield has been determined by carrying out the reaction in the laboratory and the theoretical yield has been determined by calculations, the percent yield can also be determined using the following relationship: **Percent yield = (actual yield/theoretical yield) x 100**

Materials:

Safety goggles
1 50-mL graduated cylinder
1 125-mL Erlenmeyer flask
1 plastic wash bottle
1 glass stirring rod
hot plate
1 crucible tongs
balance
1 glass-marking pencil
sodium hydrogen carbonate
1 M hydrochloric acid
blue and red litmus paper
distilled water

Procedure:

1. Put on your safety goggles. Label a clean, dry 125-mL Erlenmeyer flask with your name. Determine the mass of the flask to the nearest 0.01 g. Record this mass in the data table.
2. Add about 2 g of sodium hydrogen carbonate to the flask. Measure the mass of the flask and sodium hydrogen carbonate to the nearest 0.01 g. Record this mass in the data table. Note the appearance of the sodium hydrogen carbonate and record your observations in the observation table under Procedure 2.
3. Use the 50-mL graduated cylinder to measure out about 30 mL of distilled water.Add the distilled water to the flask and swirl the flask gently to completely dissolve the sodium hydrogen carbonate. Dip a stirring rod into the solution and transfer a small drop of the solution to a piece of red litmus paper. Note the color change of the paper. This color change is an indication that the solution is basic. Record your observations in the observation table under Procedure 3.
4. Again, use the 50-mL graduated cylinder to measure out about 30 mL of 1 M hydrochloric acid. Slowly add the hydrochloric acid to the flask in 5-mL increments. Gently swirl the flask after each addition of the acid. Record your observations in the observation table under Procedure 4. Stop the addition of the acid when the addition of 5 mL causes no further gas evolution. Dip the stirring rod into the solution and transfer a small drop of the solution to a piece of blue litmus paper. Note the color change of the paper. The color change is an indication that there is an excess of hydrochloric acid and that all of the sodium hydrogen carbonate has reacted. Record your observations in the observation table under Procedure 4.

CALCULATIONS: (Show ALL Work)

1. Write a balanced equation for the reaction. The products of this reaction are water, carbon dioxide, and sodium chloride.

2. Calculate the actual mass of sodium hydrogen carbonate used in this experiment.

3. Calculate the molar mass of sodium hydrogen carbonate.

4. Calculate the number of moles of sodium hydrogen carbonate used in this experiment.

5. Calculate the mass of sodium chloride actually recovered in this experiment. (This is the actual yield of sodium chloride.)

6. Calculate the mass of sodium chloride that should have been produced in this experiment. (This is the theoretical yield of sodium chloride.)

7. Calculate the percent yield of sodium chloride in this experiment.

8. List two sources of error that could have contributed to a percent yield of less than 100%.