CHEMISTRY EXPERIMENT: MASS: MASS RELATIONSHIPS

In this experiment, you will allow sodium bicarbonate (baking soda) to react with hydrochloric acid for the purpose of obtaining sodium chloride as a product.

\[
\text{NaHCO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2(g)
\]

In this experiment you will use an accurately measured mass of NaHCO$_3$ and an excess of HCl to completely react with it. You will isolate the NaCl from the other products and determine its mass. Then you will determine the theoretical yield by utilizing the mole and mass ratios obtained from the balanced equation of this reaction. The theoretical yield will then be compared with the experimental yield and a percentage yield will be calculated. By utilizing this process, you will gain a better understanding of mass relationships in chemical reactions.

PROCEDURE:

1. Clean and dry an evaporating dish and watch glass and mass the combination with a wire screen to the nearest 0.01 gram. **RECORD** the information in the data table.

2. The instructor will place ABOUT 1 grams of sodium bicarbonate into the evaporating dish. Mass the dish, contents, cover and screen and **RECORD** this on your data table.

3. Cover the dish with the watch glass with the convex side down. Carefully add the dilute HCl in a dropwise manner so that the acid rolls down the side of the dish. Be careful that none of the contents of the dish roll out. After several drops, gently swirl the contents of the dish so that all of the solid comes in contact with the liquid. **CONTINUE THIS PROCEDURE UNTIL NO MORE REACTION TAKES PLACE WHEN A DROP OF ACID IS ADDED. DO NOT ADD TOO MUCH HCl.** See the teacher when you think that the reaction is complete.

4. The teacher will rinse the underside of the watch glass with distilled water using only a few drops at a time, collecting all of the drippings in the evaporating dish.

5. Heat the evaporating dish, contents, and cover over a low flame until all of the salt is **COMPLETELY** dry. If the contents of the dish pop and spatter, reduce the flame. **THE TEACHER WILL DEMONSTRATE HOW TO SET UP THE APPARATUS FOR THIS PART OF THE EXPERIMENT.**

6A. Allow the dish to cool for a few minutes and mass it along with the cover and screen and **RECORD** the mass on the data table. If time permits, continue on to step 7. If not, place your dish and cover on a piece of paper with your names on it and store it where the teacher instructs. You will resume the experiment at step 6B tomorrow.

6B. Place the dish, cover, and screen back on the balance that you used yesterday. Check it’s mass. Are they the same? If yes, move on to step 7. If not, please see the teacher.

7. Repeat steps 5 and 6A to be sure that a constant mass has been obtained. The masses must be within 0.01 grams before you are finished. If the masses do not agree, repeat this step until they do.

8. Once the masses are within 0.01 grams, you are finished. Clean the dish and cover and return them to where you picked them up.
CHEMISTRY: MASS: MASS RELATIONSHIP QUESTIONS

1. Which product created during the reaction caused the effervescence (bubbling) which you used as an indication of the progress of the reaction?

2. What commercial medical product produces this type of effervescence and uses it as its MAIN selling point? EXPLAIN how it works and EXPLAIN why the effervescence so important to its success?

3. How can you be sure that the product NaCl was completely dry?

4. List three (3) of the sources of error which may have influenced your results. (Calculation errors do not count)

5. Using the following equation, answer the following questions. Show all calculations and units. Be sure to balance it first.

\[ \text{Ag(s) + HNO}_3^{(aq)} \longrightarrow \text{AgNO}_3^{(aq)} + \text{NO(g)} + \text{H}_2\text{O(l)} \]

a. What compound made up the effervescence that would be seen in this reaction?

b. What does the (aq) stand for when it is used in conjunction with the AgNO$_3$?

c. Find the number of moles of the silver nitrate produced when 6.0 moles of silver reacts with excess nitric acid (HNO$_3$).

d. Find the number of grams of silver nitrate produced when 107.9 grams of silver reacts with excess nitric acid.

e. Find the number of grams of NO produced when 107.9 grams of silver reacts with excess nitric acid.
CHEMISTRY: MASS:MASS DATA TABLE

* REQUIRES CALCULATIONS. SHOW DIRECTLY BELOW NUMBER ON THIS DATA TABLE.

1. NUMBER OF BALANCE: _______________

2. MASS OF EVAPORATING DISH, COVER, AND SCREEN _______________

3. MASS OF DISH, COVER, SCREEN, AND NaHCO₃: _______________

*4. MASS OF NaHCO₃: _______________

5. MASS OF DISH, COVER, SCREEN, AND PRODUCT NaCl AFTER 1ST HEATING: _______________

6. MASS OF DISH, COVER, SCREEN, AND PRODUCT NaCl AFTER 2ND HEATING: _______________

ARE THE MASSES IN 5 AND 6 WITHIN 0.01 GRAMS? ______ IF YES, YOU ARE FINISHED. IF NO, THEN CONTINUE THE LAB AT STEP 7.

7. MASS OF DISH, COVER, SCREEN, AND PRODUCT NaCl AFTER 3RD HEATING: _______________

ARE THE MASSES IN 6 AND 7 WITHIN 0.01 GRAMS? ______ IF YES, YOU ARE FINISHED. IF NO, THEN CONTINUE THE LAB AT STEP 7.

8. WRITE AND BALANCE THE EQUATION:

*9. EXPERIMENTAL MASS OF NaCl: _______________

*10. THEORETICAL MASS OF NaCl: _______________
    THIS REQUIRES A MASS: MASS CALCULATION

*11. PERCENTAGE YIELD: _______________