I. Stoichiometry Lab: Vinegar and Baking Soda

II. Purpose: To predict the amount of Carbon Dioxide gas that should be produced in a chemical reaction; then calculate the % yield.

$HC_2H_3O_2 + NaHCO_3 \rightarrow NaC_2H_3O_2 + H_2O + CO_2$

III. Prelab:

1. What type of reaction?
2. Name the reactants.
3. Name the products.
4. What is the formula for calculating % yield?
5. Predict what you will see in the reaction.
6. Does baking soda behave like a LR or a ER?

IV. Materials: Baking soda ($NaHCO_3$), Vinegar ($HC_2H_3O_2$), and 2 plastic cups, scale

V. Procedure:

1. Find and record the mass of cup A. With cup A still on the balance, add approximately 5.0 g of baking soda to the cup. Carefully record your result.
2. Place cup B on the balance, weigh and record approximately 25.0 g of vinegar. Carefully record your results. Add 2 drops of bromothymol blue and record the color.
3. Using a clean dropper pipette, stir, and slowly add vinegar to cup A until the reaction has stopped. **DO NOT** add all of the vinegar, just enough to complete the reaction. Reweigh and record both cup A and B. Calculate the mass of CO_2 that escaped.

VI. Data:

Qualitative Data: After set 2:

After set 3:

Quantitative Data:

a) Mass of Cup A _____g
b) Mass of Cup A and Baking soda _____g
c) Calculate mass of baking soda (b-a) _____g
d) Mass of Cup B with vinegar _____g
e) Mass of Cup B after reaction _____g
f) Calculate mass of vinegar poured into Cup A (d-e) _____g
g) Mass of Cup A after reaction _____g
h) Calculate mass of product after reaction (g-a) _____g
i) Calculate baking soda + vinegar (c+f) _____g
j) Calculate mass of CO_2 lost (i-h) _____g

VII. Calculations and Discussion Questions:

1. Using the mass of the baking soda, calculate the mass of CO_2 you would expect (theoretical) (hint: g-> mol-> mol->g)

2. How does this compare to the amount of CO_2 produced?

3. Calculate the percent yield

$$\frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100\% = \text{percent yield}$$

4. Calculate percent error

$$\frac{|(\text{actual yield} - \text{theoretical yield})|}{\text{Theoretical yield}} \times 100\% = \text{percent error}$$

5. Does baking soda behave like a limiting reagent or excess reagent? How do you know?

6. What are some possible sources of error that can contribute to your percent error (think of at least 3 or 4)? What could be done to reduce the percent error?

7. Matter is not created or destroyed during a reaction. Does this apply to this lab, even if the mass of the products was less than the mass of all the original compounds? Explain your answer.

VIII. References: Cut and paste your URLs here. Use appropriate citations.