REGULAR LAB 07d: Limiting Reactant & % Yield

Aim To investigate the stoichiometry of the reaction between sodium hydrogen carbonate and ethanoic acid. The reaction is;

$$NaHCO_{3(s)} + CH_3COOH_{(aq)} \rightarrow CH_3COONa_{(aq)} + H_2O_{(l)} + CO_{2(g)}$$

Apparatus Four 125 mL Erlenmeyer flasks, graduated cylinders, filter papers, electronic balance

Chemicals Sodium hydrogen carbonate, ethanoic acid

Method

1. Weigh five, 3.50 g samples of sodium hydrogen carbonate, onto five different filter papers.

2. Using a graduated cylinder, measure 10.0 mL of ethanoic acid. Pour the acid into a clean, 125 mL Erlenmeyer flask. Rinse the graduated cylinder with a **small** amount of water and pour this rinse water into the flask. Measure the mass of the flask and contents.

3. Pour one of the 3.50 g samples of sodium hydrogen carbonate into the flask and swirl to mix the contents **until no more bubbling occurs** (this may take a few minutes). **Do not allow any of the contents to splash out**.

4. **When all bubbling has ended**, determine the mass of the flask and contents and record in the results table. Pour out the contents, wash and dry the flask.

5. Repeat steps #2 through #4, four more times, using 30.0, 50.0, 70.0 and 90.0 mL of ethanoic acid respectively instead of 10.0 mL.

Results

		EXPERIMENT				
		1	2	3	4	5
A	**Mass of $NaHCO_3$ in g**	3.50	3.50	3.50	3.50	3.50
B	**Molar mass of $NaHCO_3$ in $gmol^{-1}$**	84.0	84.0	84.0	84.0	84.0
C	**Moles of $NaHCO_3$ in mols**					
D	**Volume of CH_3COOH in mL**	10.0	30.0	50.0	70.0	90.0
E	**Moles* of CH_3COOH in mols**					
F	**Excess Reagent**					
G	**Limiting Reagent**					
H	**Theoretical Mass Loss in g**					
I	**Mass of flask + acid + water in g**					
J	**Mass of flask + acid + rinse water + $NaHCO_3$ in g**					
K	**Final mass of flask + contents in g**					
L	**Actual Mass Loss in g**					
M	**% Yield**					

* The ethanoic acid is a solution that has a concentration of 0.837M (or 0.837 moles per liter of solution). Moles of the acid can be calculated using moles = (concentration) x (volume in L).

Conclusion/Calculations:

1. Make a graph of your data, using mass loss on the y-axis with moles of ethanoic acid on the x-axis. Use (0,0) as the origin.

2. Why did the flasks lose mass?

3. Is there a point at which adding more ethanoic does not increase the mass loss? Explain.

4. Is there a limit to the quantity of gas that can be produced from 3.50 grams of sodium hydrogen carbonate? Explain.