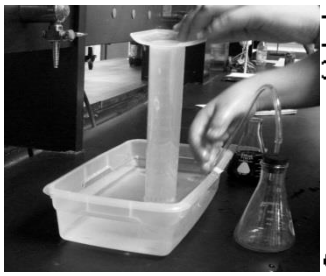
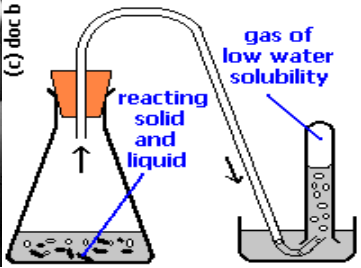
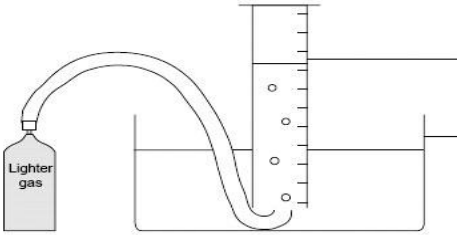
Honors Chemistry Lab 13: Limiting Reactant Exploration

Introduction: As you have learned, the limiting reactant of a reaction is the reactant that would run out first if all the reactants were to be reacted together. Once the limiting reactant is completely consumed, the reaction would cease to progress. The theoretic yield of a reaction is the amount of products produced when the limiting reactant runs out. You have recently viewed a podcast on how to determine the limiting reactant and calculate the theoretical yield of a chemical reaction. You will be applying this knowledge using a reaction between acetic acid and sodium bicarbonate. In this reaction you will combine acetic acid with sodium bicarbonate to yield carbon dioxide, water and sodium acetate. You will be using a method that we have used previously in the Double Density Lab and the stoichiometric rocket demonstration, which is the method of water displacement. The purpose of this lab is to explore the concepts of limiting reactants to help you to understand how stoichiometry can be used to calculate and predict the amounts of reactants and products in chemical reactions.

Procedure: Use the following suggested procedure to help you design your own procedure for this lab. 1). place 0.50 g of sodium bicarbonate into a paper towel 2). measure the appropriate amount of acetic acid into the flask (see date table) 3). Set-up the apparatus (see diagrams below) and mix the two compounds. 4). record the amount of CO_2 collected and be sure to account for the meniscus. 5). Design your own limiting reactant experiment using these same chemicals and use the above procedure as a guide to help you plan and carry out an investigation.







Data Table: Suggested format for data collection (create your own for your investigation):

	Amount of $HC_2H_3O_2$	**Amount of $NaHCO_3$**	**Volume CO_2**
1	10 mL	0.500 g	
2	20 mL	0.500 g	
3	30 mL	0.500 g	
4	40 mL	0.500 g	
5	50 mL	0.500 g	
6	60 mL	0.500 g	

Post Lab Questions:

Q1. Describe in detail what occurred when the acetic acid was mixed with the sodium bicarbonate. Describe evidence of a chemical reaction in your response.

Q2. Create a graph that represents your data set. Describe the pattern of how much carbon dioxide, CO_2 was formed as you added more and more acetic acid.

Q3. For each trial explain which substance was the limiting and excess reagent. Explain how you were able to determine this.

Q4. You should have noticed that as you increased the amount of vinegar eventually you got the same amount of carbon dioxide, CO_2. Explain why that occurred. Write the balanced chemical reaction for this lab and refer to the equation in your answer.

Q5. In this lab we used dilute vinegar, which was only 2.5% by mass acetic acid. Assuming STP, use stoichiometry to determine the theoretical yield of carbon dioxide for both reactants using your experimental data from trial 1. Lastly, calculate the amount of excess reagent that remained after the reaction.