The Stoichiometry of Alka Seltzer

Alka Seltzer is one of the world's best-known antacids. Its main function is to absorb excess stomach acid (HCl). The two main ingredients that accomplish this are sodium bicarbonate ($NaHCO_3$) and citric acid ($C_6H_8O_7$). Aspirin is also present in Alka-Seltzer tablets to reduce fever and relieve headaches, but in this lab, we are going to study the reaction that takes place between the $NaHCO_3$ and $C_6H_8O_7$.

Equation: Sodium bicarbonate + citric acid → water + carbon dioxide + sodium citrate

$3\ NaHCO_3\ (aq) + C_6H_8O_{7\ (aq)} \rightarrow 3\ H_2O_{\ (l)} + 3\ CO_{2\ (g)} + Na_3C_6H_5O_{7\ (aq)}$

Objective: Determine what mass of carbon dioxide is produced from the reaction of one tablet of Alka Seltzer and water. Determine which reactant, $NaHCO_3$ or $C_6H_8O_7$ is the limiting reactant.

Data: Each tablet contains the following:

1.000 g of $C_6H_8O_7$

1.916 g of $NaHCO_3$

Procedures:

1) Fill a plastic cup about half full of distilled water (fill to the marked line) and find its mass.
2) Determine the mass of one Alka-Seltzer tablet. Record in data table.
3) Add the tablet to the water and observe/record the reaction.
4) After the tablet has completely dissolved, find the mass of the cup and its contents.
5) Tap the sides of the cup or stir with a stirring rod to dislodge any bubbles, wait about 10 minutes, and weigh again.

Data Table 1:

Mass of cup With water (g)	Mass of Alka Seltzer (g)	Mass of cup + water + Alka Seltzer (g)	Mass of cup With water after Reaction (g)

Data Table 2: Show work on the back of this page.

Calculated mass of CO_2 lost (g)	**Moles of CO_2 lost**	**Calculated mass of $C_6H_8O_7$ reacted (g)**	**Calculated mass of $NaHCO_3$ reacted (g)**	**Calculated % by mass of reacted $NaHCO_3$ in tablet**

Post – Lab Questions:

1) Calculate the mass and moles of CO_2 lost. Show work.

2) Calculate the mass of $\mathbf{C_6H_8O_7}$ reacted. Record in data table. Show work.

3) Calculate the mass of $NaHCO_3$ reacted.

4) Was the sodium bicarbonate or citric acid the limiting reactant?

5) How many grams of the excess reactant are there in an Alka-Seltzer tablet? Use the given mass on the front page and the mass you used. Show work.

6) How many grams of the limiting reactant would you have to add to your cup after the reaction is complete to completely use up the excess reactant? Use the answer from #5.

7) Calculate the theoretical yield using the given mass of the limiting reactant on the front of this page. What was the percent yield of CO_2 in this reaction?

8) Discuss reasons for why your percent yield of $NaHCO_3$ was not 100%. Discuss any potential errors that occurred.