

## Chemistry 121

### Lab 4: Determination of the mass percent of sodium bicarbonate in Alka Seltzer Tablets

#### Objective:

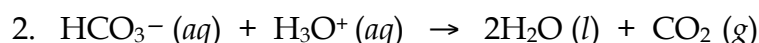
To determine the amount of  $\text{NaHCO}_3$  in Alka Seltzer tablets by observing the amount of  $\text{CO}_2$  produced from the acid-base reaction of  $\text{HCO}_3^-$  with acetic acid (in vinegar).

#### Background:

Alka Seltzer is an effervescent tablet that contains aspirin (acetylsalicylic acid), citric acid, and sodium bicarbonate ( $\text{NaHCO}_3$ ). As soon as the tablet dissolves in water, the  $\text{NaHCO}_3$  dissociates to form a bicarbonate ion ( $\text{HCO}_3^-$ ) and a sodium ion ( $\text{Na}^+$ )



Acetic acid, which will "donate"  $\text{H}^+$  to water to create  $\text{H}_3\text{O}^+(aq)$ , is added to the mixture. The following acid-base reaction then takes place:



(The sodium ion does not take part in this reaction, and so is not included in the equation.)

According to the above equation, one mole of  $\text{HCO}_3^-$  reacts with one mole of  $\text{H}_3\text{O}^+$ . If the number of moles of each reactant is not the same, then one reactant will be completely used up during the reaction, while some of the other reactant will remain at the end of the reaction. In this experiment you will dissolve Alka Seltzer in various concentrations of vinegar and measure the amount of  $\text{CO}_2$  produced. From this data you will calculate the amount of  $\text{NaHCO}_3$  in the Alka Seltzer by percent weight (mass).

#### Pre-lab Questions:

- What is the ratio of moles of  $\text{CO}_2$  produced to moles of  $\text{NaHCO}_3$  reacted?
- Mass can neither be created nor destroyed. If solution decreases in mass where did this "lost" mass go?

#### Procedure:

- Using a 50 mL graduated cylinder, add 35 mL of distilled water to a clean 250 mL beaker. Weigh and record the **total mass of the beaker plus water** (column 1, Run #1, in data table). Also **record the measured volume** of the water (**don't just write 35 mL – you should read this number to the tenths of mL**).
- Weigh and record the mass of an Alka Seltzer tablet (pay attention to sig figs)
- Drop the tablet into the beaker and swirl carefully. As soon as the bubbling ceases, weigh the beaker with the dissolved Alka Seltzer solution. Record this mass.
- Rinse the beaker with distilled water. Then, repeat steps 1-3 with 5 mL vinegar + 30 mL water, 10 mL vinegar + 25 mL water, and so on, increasing the volume of vinegar by 5 mL each time while keeping the total volume of the solution at 35 mL. Record your data in the table below (Run #2 – Run #8). Again, be sure to **record the actual measured volumes** and record them **with the correct number of significant figures** for the glassware that you use.



**Analysis and questions:**

1. Show, in detail, the calculations for run #4 in the data table, all the way to the % by mass of reacted sodium bicarbonate in the tablet.
2. Based on your data, what is the percent by mass of  $\text{NaHCO}_3$  in the average Alka Seltzer tablet? Be careful about sig figs. Show **how** you determined your answer from your data.
3. How might this product reduce indigestion or heartburn?