

Lab One

AP Chemistry

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Contents

1	Pre-Lab	3
2	Data	3
3	Question and Statement of Purpose	3
4	Calculations	4
5	Conclusion	4

1 Pre-Lab

- This Lab Requires:
 1. Question
 2. Data (including calculations)
 3. Conclusion
- $\text{NaHCO}_3 + \text{HCl} \longrightarrow \text{H}_2\text{O} + \text{NaCl} + \text{CO}_2$
 1. Calculate how much NaCl formed
 2. Calculate Limiting Factor
 3. Determine how much NaCl should form
 4. Calculate % yield

2 Data

1. Mass of dish: 36.72[g]
2. Mass of NaHCO_3 (Baking Soda): 2.00[g]
3. Molarity of HCl: 6[mol L⁻¹]
4. Moles of HCl: $3[\text{mL}] \cdot 6[\text{mol L}^{-1}] \cdot \frac{1[\text{L}]}{1000[\text{mL}]} = .018[\text{mol}_{\text{HCl}}]$
5. Mass Dish + NaCl after procedure: 38.00[g]

3 Question and Statement of Purpose

What is the theoretical mass of NaCl formed vs the experimental mass? What is the percent yield?

4 Calculations

The amount of NaCl formed may be easily determined by finding the change in the mass of the dish (Δm_{dish} (1)):

$$\begin{aligned}\Delta m_{dish} &= 38.00[\text{g}] - 36.72[\text{g}] \\ &= 1.28[\text{g}_{\text{NaCl}}]\end{aligned}\tag{1}$$

To find the limiting factor, one must first find the mass per mole (2). Then, it is necessary to find the moles of each molecule by dividing the experimental mass of the molecule by the mass per mole (3). Since, in this case, the amount of moles of each substance is one, the amount with the least moles is the limiting factor (4).

$$\begin{aligned}\frac{m_{\text{NaHCO}_3}}{\text{mol}_{\text{NaHCO}_3}} &= 23 + 1 + 12 + 3(16) \\ &= 84 \left[\frac{\text{g}}{\text{mol}} \right]\end{aligned}\tag{2}$$

$$\frac{2[\text{g}_{\text{NaHCO}_3}]}{84[\text{g}_{\text{NaHCO}_3}]} = .024[\text{mol}_{\text{NaHCO}_3}]\tag{3}$$

$$\begin{aligned}.018[\text{mol}_{\text{HCl}}] &< .024[\text{mol}_{\text{NaHCO}_3}] \\ \therefore \text{HCl is the limiting factor}\end{aligned}\tag{4}$$

Because the limiting factor is the $.018[\text{mol}_{\text{HCl}}]$, and the chemical equation involves only one mole of each molecule, then $.018[\text{mol}]$ of each molecule will be formed. To switch this value to grams, multiply the grams per mole by the amount of moles (5).

$$\begin{aligned}.018[\text{mol}_{\text{NaCl}}] \cdot 58 \left[\frac{\text{g}}{\text{mol}} \right] &= m_{\text{NaCl}} \\ &= 1.044[\text{g}_{\text{NaCl}}]\end{aligned}\tag{5}$$

Finally, to calculate the percent yield, one must divide the experimental mass by the theoretical mass, while multiplying by 100% (6).

$$\frac{1.28[\text{g}_{\text{NaCl}}]}{1.044[\text{g}_{\text{NaCl}}]} \cdot 100\% = 123\%\tag{6}$$

5 Conclusion

The results of this laboratory experiment demonstrate our percent yield as 123%. Therefore, it is evident that this experiment yielded a greater amount of Sodium Chloride (NaCl) than expected, given the limiting factor of Hydrochloric Acid (HCl).