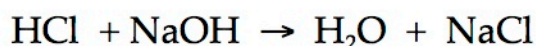


Acid-Base Titrations

A **titration** is a type of analysis where you carefully add just enough of a solution of known concentration to neutralize a sample with unknown concentration.

By measuring the amount of the known solution that was added, the concentration of the unknown can be calculated.

Example: 25.00 mL of a sample of HCl (aq) was titrated with 0.775 M NaOH (aq). If it took 37.46 mL of the base to just neutralize the acid, what was the concentration of the acid sample initially?

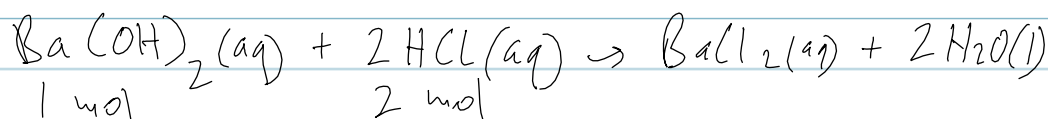
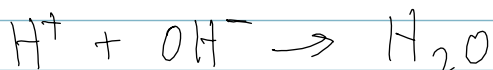


$$\text{moles HCl} = \text{moles NaOH}$$

$$0.775 \frac{\text{mol}}{\text{L}} \times 37.46 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.0290 \text{ mol}$$

$$\text{moles HCl} = 0.0290 \text{ mol}$$

$$\frac{0.0290 \text{ mol}}{\left(25.00 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}}\right)} = 1.16 \text{ M}$$



Gas-Evolving Reactions

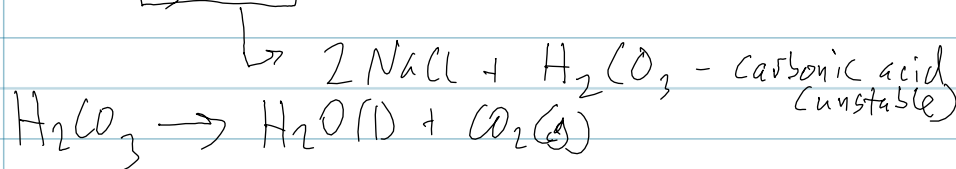
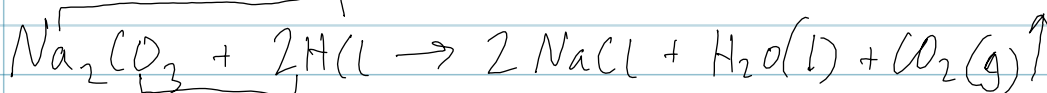


TABLE 4.3 Types of Compounds That Undergo Gas-Evolution Reactions

Reactant Type	Intermediate Product	Gas Evolved	Example
Sulfides	None	H ₂ S	2 HCl(aq) + K ₂ S(aq) → H ₂ S(g) + 2 KCl(aq)
Carbonates and bicarbonates	H ₂ CO ₃	CO ₂	2 HCl(aq) + K ₂ CO ₃ (aq) → H ₂ O(l) + CO ₂ (g) + 2 KCl(aq)
Sulfites and bisulfites	H ₂ SO ₃	SO ₂	2 HCl(aq) + K ₂ SO ₃ (aq) → H ₂ O(l) + SO ₂ (g) + 2 KCl(aq)
Ammonium	NH ₄ OH	NH ₃	NH ₄ Cl(aq) + KOH(aq) → H ₂ O(l) + NH ₃ (g) + KCl(aq)