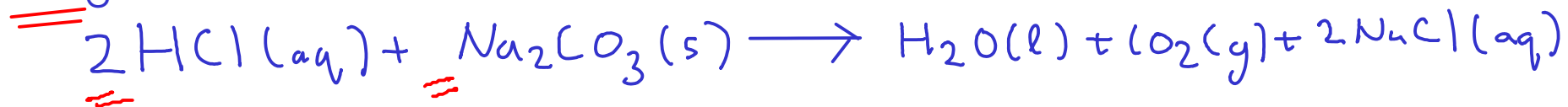


Example:

How many milliliters of 6.00M hydrochloric acid is needed to completely react with 25.0 g of sodium carbonate?



1 - Convert 25.0 g sodium carbonate to moles. Use FORMULA WEIGHT.

2 - Convert moles sodium carbonate to moles HCl. Use CHEMICAL EQUATION.

3 - Convert moles HCl to volume. Use MOLARITY.

$$\textcircled{1} \text{Na}_2\text{CO}_3: \begin{array}{l} \text{Na: } 2 \times 22.99 \\ \text{C: } 1 \times 12.01 \\ \text{O: } 3 \times 16.00 \\ \hline 105.99 \text{ g Na}_2\text{CO}_3 = \text{mol Na}_2\text{CO}_3 \end{array}$$

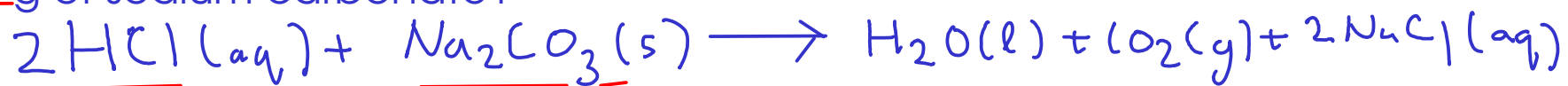
$$25.0 \text{ g Na}_2\text{CO}_3 \times \frac{\text{mol Na}_2\text{CO}_3}{105.99 \text{ g Na}_2\text{CO}_3} = 0.2358713086 \text{ mol Na}_2\text{CO}_3$$

$$\textcircled{2} 2 \text{ mol HCl} = \text{mol Na}_2\text{CO}_3$$

$$0.2358713086 \text{ mol Na}_2\text{CO}_3 \times \frac{2 \text{ mol HCl}}{\text{mol Na}_2\text{CO}_3} = 0.4717426172 \text{ mol HCl}$$

102 Example:

How many milliliters of 6.00M hydrochloric acid is needed to completely react with 25.0 g of sodium carbonate?



- 1 - Convert 25.0 g sodium carbonate to moles. Use FORMULA WEIGHT.
- 2 - Convert moles sodium carbonate to moles HCl. Use CHEMICAL EQUATION.
- 3 - Convert moles HCl to volume. Use MOLARITY.

$$\textcircled{3} \quad 6.00 \text{ mol HCl} = \text{L}$$

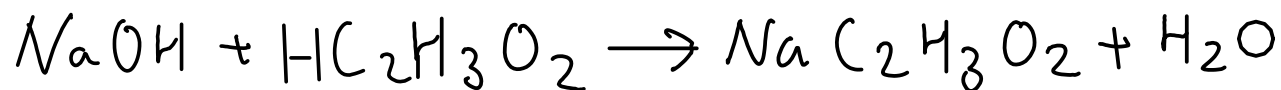
$$0.4717426172 \text{ mol HCl} \times \frac{\text{L}}{6.00 \text{ mol HCl}} = 0.0786 \text{ L}$$

We were asked to provide the volume in mL ... so we'll convert 0.0786 L to mL.

$$\text{mL} = 10^{-3} \text{ L}$$

$$0.0786 \text{ L} \times \frac{\text{mL}}{10^{-3} \text{ L}} = 78.6 \text{ mL of } 6.00 \text{ M HCl}$$

25.0 mL of acetic acid solution requires 37.3 mL of 0.150 M sodium hydroxide for complete reaction. The equation for this reaction is:



What is the molar concentration of the acetic acid?

$$\frac{\text{mol HC}_2\text{H}_3\text{O}_2}{\text{L solution}} \leftarrow = 25.0 \text{ mL or } 0.0250 \text{ L}$$

$$\text{L solution} \leftarrow = 25.0 \text{ mL or } 0.0250 \text{ L}$$

1 - Convert 37.3 mL of sodium hydroxide solution to moles. Use MOLARITY.

2 - Convert moles NaOH to moles acetic acid. Use CHEMICAL EQUATION

3 - Convert moles acetic acid to MOLARITY by dividing by the solution volume.

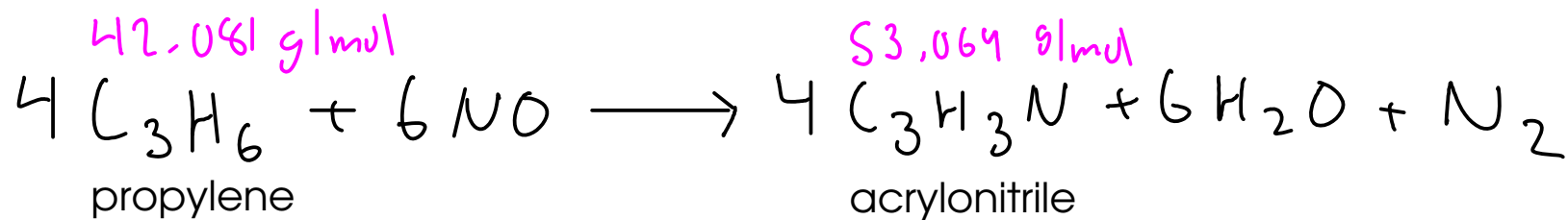
$$\textcircled{1} 0.150 \text{ mol NaOH} = \text{L}; \text{ mL} = 10^{-3} \text{ L} \quad \textcircled{2} \text{ mol NaOH} = \text{mol HC}_2\text{H}_3\text{O}_2$$

$$37.3 \text{ mL} \times \frac{10^{-3} \text{ L}}{\text{mL}} \times \frac{0.150 \text{ mol NaOH}}{\text{L}} \times \frac{\text{mol HC}_2\text{H}_3\text{O}_2}{\text{mol NaOH}} = 0.005595 \text{ mol HC}_2\text{H}_3\text{O}_2$$

①
②

$$M = \frac{\text{mol HC}_2\text{H}_3\text{O}_2}{\text{L solution}} = \frac{0.005595 \text{ mol HC}_2\text{H}_3\text{O}_2}{0.0250 \text{ L}} = \boxed{0.224 \text{ M HC}_2\text{H}_3\text{O}_2}$$

* Note for this week: This is the main calculation for Experiment 4C ...



Calculate how many grams of acrylonitrile could be obtained from 651 kg of propylene, assuming there is excess NO present.

- 1 - Convert mass propylene to moles propylene. Use FORMULA WEIGHT.
- 2 - Convert moles propylene to moles acrylonitrile. Use CHEMICAL EQUATION.
- 3 - Convert moles acrylonitrile to mass acrylonitrile. Use FORMULA WEIGHT.

$$\textcircled{1} \quad 42.081 \text{ g C}_3\text{H}_6 = \text{mol C}_3\text{H}_6 ; \text{ kg} = 10^3 \text{ g}$$

$$\textcircled{2} \quad 4 \text{ mol C}_3\text{H}_6 = 4 \text{ mol C}_3\text{H}_3\text{N}$$

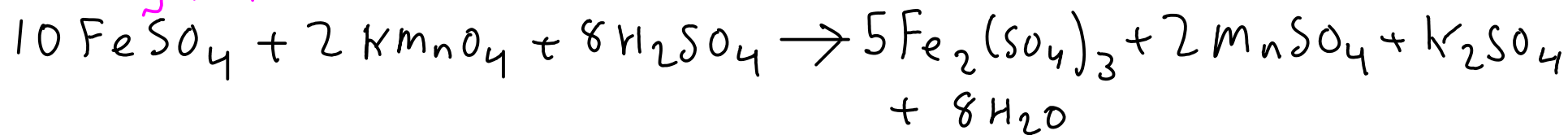
$$\textcircled{3} \quad 53.064 \text{ g C}_3\text{H}_3\text{N} = \text{mol C}_3\text{H}_3\text{N}$$

$$651 \text{ kg C}_3\text{H}_6 \times \frac{10^3 \text{ g}}{\text{kg}} \times \frac{\text{mol C}_3\text{H}_6}{42.081 \text{ g C}_3\text{H}_6} \times \frac{4 \text{ mol C}_3\text{H}_3\text{N}}{4 \text{ mol C}_3\text{H}_6} \times \frac{53.064 \text{ g C}_3\text{H}_3\text{N}}{\text{mol C}_3\text{H}_3\text{N}} =$$

①
②
③

$$= \boxed{821000 \text{ g C}_3\text{H}_3\text{N}} \quad (821 \text{ kg})$$

151.90 g/mol



How many mL of 0.250M potassium permanganate are needed to react with 3.36 g of iron(II) sulfate?

- 1 - Convert 3.36 grams iron(II) sulfate to moles. Use FORMULA WEIGHT.
- 2 - Convert moles iron(II) sulfate to moles potassium permanganate. Use CHEMICAL EQUATION.
- 3 - Convert moles potassium permanganate to volume. Use MOLARITY.

$$\textcircled{1} \quad 151.90 \text{ g FeSO}_4 = \text{mol FeSO}_4$$

$$\textcircled{2} \quad 10 \text{ mol FeSO}_4 = 2 \text{ mol KMnO}_4$$

$$\textcircled{3} \quad 0.250 \text{ mol KMnO}_4 = \text{L} ; \text{ mL} = 10^{-3} \text{ L}$$

$$3.36 \text{ g FeSO}_4 \times \frac{\text{mol FeSO}_4}{151.90 \text{ g FeSO}_4} \times \frac{2 \text{ mol KMnO}_4}{10 \text{ mol FeSO}_4} \times \frac{\text{L}}{0.250 \text{ mol KMnO}_4} \times \frac{\text{mL}}{10^{-3} \text{ L}} =$$

$$= \boxed{17.7 \text{ mL of } 0.250 \text{ M KMnO}_4}$$