

22.4 grams of benzene are reacted with excess nitric acid. If 31.6 grams of nitrobenzene are collected from the reaction, what is the percent yield?

To find the percent yield, we need to know both the THEORETICAL and ACTUAL yields of nitrobenzene. From the experiment, we already know the ACTUAL YIELD (31.6 g). We must CALCULATE the theoretical yield!

$$78.114 \text{ g C}_6\text{H}_6 = \text{mol C}_6\text{H}_6 \mid \text{mol C}_6\text{H}_6 = \text{mol C}_6\text{H}_5\text{NO}_2 \mid 123.11 \text{ g C}_6\text{H}_5\text{NO}_2 = \text{mol C}_6\text{H}_5\text{NO}_2$$

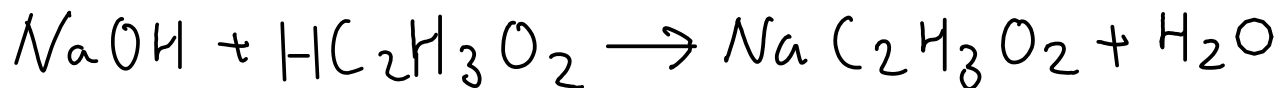
$$22.4 \text{ g C}_6\text{H}_6 \times \frac{\text{mol C}_6\text{H}_6}{78.114 \text{ g C}_6\text{H}_6} \times \frac{\text{mol C}_6\text{H}_5\text{NO}_2}{\text{mol C}_6\text{H}_6} \times \frac{123.11 \text{ g C}_6\text{H}_5\text{NO}_2}{\text{mol C}_6\text{H}_5\text{NO}_2} = 35.3 \text{ g C}_6\text{H}_5\text{NO}_2$$

$$\% \text{ YIELD} = \frac{\text{ACTUAL YIELD}}{\text{THEORETICAL YIELD}} \times 100\%$$

$$= \frac{31.6 \text{ g}}{35.3 \text{ g}} \times 100\% = \boxed{89.5\%}$$

THEORETICAL
YIELD

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?

$$\text{L mol HC}_2\text{H}_3\text{O}_2$$

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

Since we know the volume of solution, we just need to calculate MOLES of acid.

$$0.150 \text{ mol NaOH} = \text{L mol NaOH} = \text{mol HC}_2\text{H}_3\text{O}_2$$

$$\text{units: } 37.3 \text{ mL} \rightarrow 0.0373 \text{ L}$$

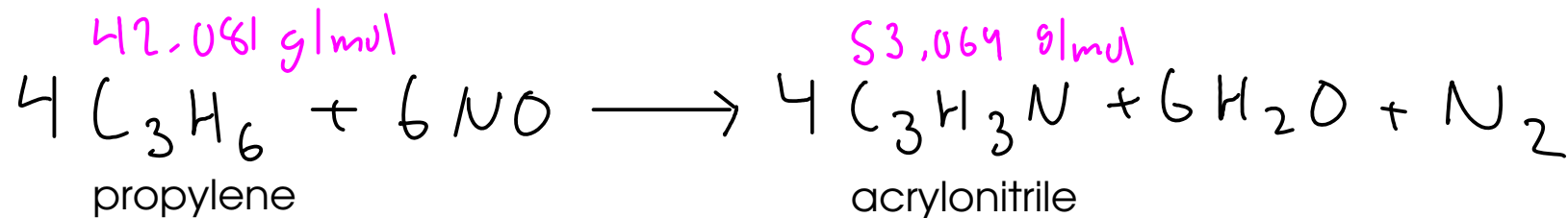
$$0.0373 \text{ L} \times \frac{0.150 \text{ mol NaOH}}{\text{L}} \times \frac{\text{mol HC}_2\text{H}_3\text{O}_2}{\text{mol NaOH}} = 0.005595 \text{ mol HC}_2\text{H}_3\text{O}_2$$

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

Shortcut: Use millimoles!

$$37.3 \text{ mL} \times \frac{0.150 \text{ mol NaOH}}{\text{L}} \times \frac{1 \text{ mol HC}_2\text{H}_3\text{O}_2}{1 \text{ mol NaOH}} = 5.595 \text{ mmol HC}_2\text{H}_3\text{O}_2$$

$$M = \frac{\text{mol}}{\text{L}} = \frac{\text{mmol}}{\text{mL}} = \frac{5.595 \text{ mmol HC}_2\text{H}_3\text{O}_2}{25.0 \text{ mL}} = 0.224 \text{ M HC}_2\text{H}_3\text{O}_2$$



Calculate how many grams of acrylonitrile could be obtained from 651 kg of propylene, assuming there is excess NO present. (651 000 g)

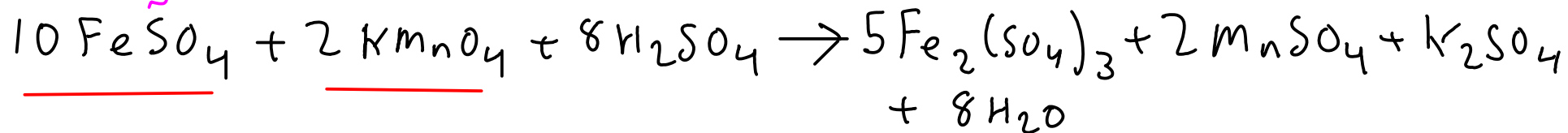
- 1 - Convert mass propylene to moles using formula weight of propylene.
- 2 - Convert moles propylene to moles acrylonitrile using chemical equation
- 3 - Convert moles acrylonitrile to mass using formula weight of acrylonitrile

$$42.061 \text{ g C}_3\text{H}_6 = \text{mol C}_3\text{H}_6 \quad | \quad 4 \text{ mol C}_3\text{H}_6 = 4 \text{ mol C}_3\text{H}_3\text{N} \quad | \quad 53.064 \text{ g C}_3\text{H}_3\text{N} = \text{mol C}_3\text{H}_3\text{N}$$

$$651000 \text{ g C}_3\text{H}_6 \times \frac{\text{mol C}_3\text{H}_6}{42.061 \text{ g C}_3\text{H}_6} \times \frac{4 \text{ mol C}_3\text{H}_3\text{N}}{4 \text{ mol C}_3\text{H}_6} \times \frac{53.064 \text{ g C}_3\text{H}_3\text{N}}{\text{mol C}_3\text{H}_3\text{N}} =$$

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

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 - Change the mass of iron(II) sulfate to moles using formula weight of iron(II) sulfate
- 2 - Change the moles of iron(II) sulfate to moles potassium permanganate using chemical equation
- 3 - Change moles of potassium permanganate to volume using concentration (0.250 mol/L)

$$151.90 \text{ g FeSO}_4 = \text{mol FeSO}_4 \quad | \quad 10 \text{ mol FeSO}_4 = 2 \text{ mol KMnO}_4 \quad | \quad 0.250 \text{ mol KMnO}_4 = \text{L}$$

$$3.36 \text{ g FeSO}_4 \times \frac{\text{mol FeSO}_4}{151.90 \text{ g FeSO}_4} \times \frac{2 \text{ mol KMnO}_4}{10 \text{ mol FeSO}_4} \times \frac{\text{L}}{0.250 \text{ mol KMnO}_4} = 0.0177 \text{ L}$$

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

$$0.0177 \text{ L} \times \frac{\text{mL}}{10^{-3} \text{ L}} = \boxed{17.7 \text{ mL of } 0.250 \text{ M KMnO}_4}$$