

YIELDS OF CHEMICAL REACTIONS

- Since reactions rarely go to completion, reactants often combine in more than one manner, reagents are not pure, and the entire product is not recovered, reactions rarely have 100% yield.
- The percent yield:

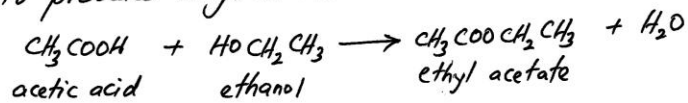
$$\% \text{ yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100\%$$

- * To prevent the ratios from being upside down, students must label numerator and denominator well.

$$\text{eg. } \% \text{ yield} = \frac{\text{g NO}_2 \text{ produced}}{\text{g NO}_2 \text{ calculated}} \times 100\%$$

Example 1.

In the presence of H_2SO_4 (concentrated), acetic acid react with ethanol to produce ethyl acetate ester.



What is mass of acetic acid is needed to prepare 52g ethyl acetate if the expected percent yield is 90.5%

Solution

Given: actual yield = 52g

$$\begin{array}{l} \text{Method 1.} \\ \therefore 90.5\% \equiv 52 \text{ g yield} \\ \therefore 100\% \equiv \left(\frac{100 \times 52}{90.5}\right) \text{g} = 57.5 \text{g} \end{array}$$

$$\therefore \text{theoretical yield} = 57.5 \text{g (Ans)}$$

$$\begin{array}{l} \text{Method 2} \\ \text{(using formula)} \end{array} \quad \text{theoretical yield} = \frac{\text{actual yield}}{\% \text{ yield}} \times 100\%$$

$$= \left(\frac{52}{90.5} \times 100\right)$$

$$= 57.5 \text{g (Ans)}$$