

STOICHIOMETRY

\* in a balanced equation, the coefficients can represent **MOLES**

get to moles  $\rightarrow$  Switch your moles  $\rightarrow$  get out B moles

Complete combustion of lysine



How many grams of  $\text{CO}_2$  can be produced from the complete combustion of  $1.00 \times 10^2 \text{g}$  of lysine?

$$\text{lysine} = 146.22 \text{g/mole} \quad \text{CO}_2 = 44.01 \text{g/mole}$$

$$1.00 \times 10^2 \text{g C}_6\text{H}_{14}\text{O}_2\text{N}_2 \times \frac{1 \text{ mole}}{146.22 \text{g}} \times \frac{12 \text{ mole CO}_2}{2 \text{ mole C}_6\text{H}_{14}\text{O}_2\text{N}_2} \times \frac{44.01 \text{g}}{1 \text{ mole}} = 181 \text{g CO}_2 \text{ theoretical yield}$$

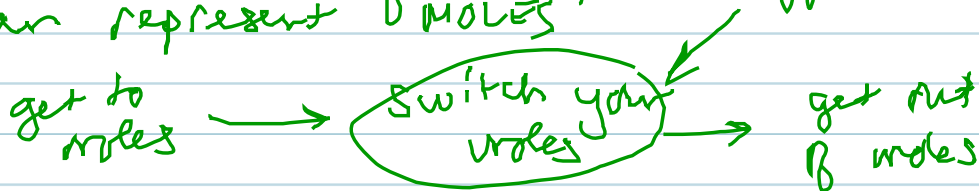
$$\% \text{ yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100\%$$

If the actual yield is  $123.4 \text{g CO}_2$ , what is the percent yield?

$$\frac{123.4 \text{g}}{181 \text{g}} \times 100\% = 68.2\% \text{ yield}$$

## STOICHIOMETRY

\* in a balanced equation, the coefficients can represent MOLES



complete combustion of lysine



How many grams of  $\text{CO}_2$  can be produced from the complete combustion of  $1.00 \times 10^2 \text{g}$  of lysine?

$$\text{lysine} = 146.22 \text{g/mol} \quad \text{CO}_2 = 44.01 \text{g/mol}$$

$$1.00 \times 10^2 \text{g C}_6\text{H}_{14}\text{O}_2\text{N}_2 \times \frac{1 \text{ mol}}{146.22 \text{g}} \times \frac{12 \text{ mol CO}_2}{2 \text{ mol C}_6\text{H}_{14}\text{O}_2\text{N}_2} \times \frac{44.01 \text{g}}{1 \text{ mol}}$$

$$= 181 \text{g CO}_2 \text{ theoretical yield}$$

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

If the actual yield is  $123.4 \text{g CO}_2$ , what is the percent yield?

$$\frac{123.4 \text{g}}{181 \text{g}} \times 100\% = 68.2\% \text{ yield}$$

## LIMITING REAGENT

- amount of a product made
- what is the limiting reagent (or excess reagent)
- amount of excess reagent remaining



1.00g  $\frac{500 \text{ mL of}}{0.400 \text{ M}}$

$P = 99 \text{ kPa}$

$T = 25^\circ \text{C}$

$V = ?$

assume constant  
volume for aqueous  
soln's

$$1.00 \text{ g Al} \times \frac{1 \text{ mol}}{26.98 \text{ g}} \times \frac{3 \text{ mol H}_2}{2 \text{ mol Al}} = 0.0556 \text{ mol H}_2$$

$$n = M \times L = \underbrace{(0.400 \text{ M})(0.500 \text{ L})}_{\text{HCl}} \times \frac{3 \text{ mol H}_2}{6 \text{ mol HCl}} = 0.100 \text{ mol H}_2$$

LR = Al  
XS = HCl

$$V_{\text{H}_2} = \frac{nRT}{P} = \frac{(0.0556 \text{ mol})(8.314 \frac{\text{kJ}}{\text{mol} \cdot \text{K}})(298 \text{ K})}{99 \text{ kPa}}$$

$$V_{\text{H}_2} = 1.4 \text{ L H}_2$$

$[\text{HCl}] = ?$  when reaction stops

$$\begin{array}{l} 0.100 \text{ mol H}_2 \text{ all acid reacts} \\ - 0.0556 \text{ mol H}_2 \text{ actually produced} \\ \hline 0.0444 \text{ mol H}_2 \text{ not produced} \end{array} \times \frac{6 \text{ mol HCl}}{3 \text{ mol H}_2} = \frac{0.0888 \text{ mol HCl}}{0.500 \text{ L}}$$

$$\downarrow$$
$$0.178 \text{ M HCl}$$
$$500 \text{ mL}$$