STOICHIOMETRY

* in a balanced equation, the coefficients can represent MOLES

get to moles → (switch your moles) → get out of moles

complete combustion of lysine

$$2\,C_6H_{14}O_2N_2 + 17O_2 \longrightarrow 12\,CO_2 + 14H_2O + 2N_2$$

How many grams of CO_2 can be produced from the complete combustion of 1.00×10^2 g of lysine?

lysine = 146.22 g/mole CO_2 = 44.01 g/mol

$$1.00\times10^2\,g\,C_6H_{14}O_2N_2 \times \frac{1\,mol}{146.22\,g} \times \frac{12\,mol\,CO_2}{2\,mol\,C_6H_{14}O_2N_2} \times \frac{1\,mol}{44.01\,g}$$

= 181 g CO_2 theoretical yield

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

If the actual yield is 123.4 g CO_2, what is the percent yield?

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

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LIMITING REAGENT

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

$$2Al_{(s)} + 6HCl_{(aq)} \longrightarrow 3H_{2(g)} + 2AlCl_{3(aq)}$$

1.00 g Al; 500 mL of 0.400 M HCl

P = 99 kPa
T = 25°C
V = ?

assume constant volume for aqueous soln's

$$1.00\,g\,Al \times \frac{1\,mol}{26.98\,g} \times \frac{3\,mol\,H_2}{2\,mol\,Al} = 0.0556\,mol\,H_2$$

$$n = M \times L = \underbrace{(0.400M)(0.500L)}_{HCl} \times \frac{3\,mol\,H_2}{6\,mol\,HCl} = 0.100\,mol\,H_2$$

LR = Al
XS = HCl

$$V_{H_2} = \frac{nRT}{P} = \frac{(0.0556\,mol)(8.314\,\frac{kPa\cdot L}{mol\cdot K})(298K)}{99\,kPa}$$

$V_{H_2} = 1.4\,L\,H_2$

[HCl] = ? when reaction stops

0.100 mol H_2 — all acid reacts
− 0.0556 mol H_2 — actually produced
0.0444 mol H_2 — not produced

$$0.0444\,mol\,H_2 \times \frac{6\,mol\,HCl}{3\,mol\,H_2} = \frac{0.0888\,mol\,HCl}{0.500\,L}$$

XS

↓

0.178 M HCl
500 mL