CHM2045-133

1-26-17

Reactions

Stoichiometry
- % yield
- L.R.

$CH_{4(g)} + 2O_{2(g)} \xrightarrow{\Delta} CO_{2(g)} + \underline{2}H_2O_{(l)}$

g - gas l - liquid s - solid aq - aqueous

$(NH_4)_2Cr_2O_7 \rightarrow Cr_2O_3 + N_2 + \underline{4}H_2O$

$2\left[2NH_3 + \frac{5}{\underline{2}}O_2 \rightarrow 2NO + 3H_2O\right]$

$4NH_3 + 5O_2 \xrightarrow[\Delta]{\text{yields}} 4NO + 6H_2O$

Reactants — Reaction Conditions — Products

Stoichiometry

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

100.0g g?

1. Balance

$$\frac{100.0\,\text{g}}{1} \left| \frac{1\,\text{mole}\,C_3H_8}{44.097\,\text{g}} \right| \frac{3\,\text{moles}\,CO_2}{1\,\text{mole}\,C_3H_8} \left| \frac{43.991\,\text{g}}{1\,\text{mole}\,CO_2} \right. = 299.3\,\text{g}$$

(12.011 + 2×15.99)

2. Convert to moles 3. Mole to mole ratio 4. Convert to mass

What mass of O_2 is needed to make 299.3g of CO_2?

$$\frac{299.3\text{g } CO_2}{} \left| \frac{1\text{ mole } CO_2}{43.99\text{g}} \right| \frac{5\text{ mole } O_2}{3\text{ mole } CO_2} \left| \frac{31.98\text{g}}{1\text{ mole } O_2} \right. = \boxed{362.6\text{g } O_2}$$

% Yield $10KClO_3 + 3P_4 \rightarrow 3P_4O_{10} + 10KCl$

A happy grad student made 32.5g of P_4O_{10} from 52.9g of $KClO_3$.
What is the actual & theoretical yield?

How much P_4O_{10} does 52.9g of $KClO_3$ make?

$$\frac{52.9\text{g } KClO_3}{} \left| \frac{1\text{ mole}}{122.52\text{g}} \right| \frac{3\text{ mole}}{10\text{ mole}} \left| \frac{283.795\text{g}}{1\text{ mole } P_4O_{10}} \right. = 36.8\text{g}$$

↑

Theoretical ~~Theoretical~~ yield.

★ $\% \text{ yield} = \frac{\text{actual}}{\text{theoretical}} = \frac{32.5\text{g}}{36.8\text{g}} \times 100 = 88.3\%$

Limiting Reagent - One substance runs out.

L.R.

$$2C_3H_6 + 2NH_3 + 3O_2 \rightarrow 2C_3H_3N + 6H_2O$$

15.0g ~~10.0g~~ 10.0g

What is the most C_3H_3N that can be made?

$$\frac{15.0\text{g } C_3H_6}{} \left| \frac{1\text{ mole } C_3H_6}{42.08\text{g}} \right| \frac{2\text{ mole}}{2\text{ mole}} \left| \frac{53.064\text{g}}{1\text{ mole}} \right. = 18.9\text{g}$$

$$\frac{10.0\text{g } O_2}{} \left| \frac{1\text{ mole } O_2}{31.98\text{g}} \right| \frac{2\text{ mole}}{3\text{ mole}} \left| \frac{53.064}{1\text{ mole } C_3H_3N} \right. = 11.1\text{g}$$

← most

$$2C_6H_5Cl + C_2HOCl_3 \rightarrow C_{14}H_9Cl_5 + H_2O$$

1142g 485g

% yield? When 200.0g of $C_{14}H_9Cl_5$ is made?

A: $\frac{1170\,g}{\cancel{1160\,g}}$ = Theoretical

17.2% = % yield.