IB Chemistry HL Notes

Stoichiometry

Isaac D. Lim

For any queries, please contact the author at isaaclimdc@gmail.com.

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GAS VOLUME CALCULATIONS

1/ $C_xH_y + \frac{x+y}{4}O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$

$20cm^3$ $60cm^3$ $40cm^3$

coeff of $O_2 = 2x + \frac{y}{2} = \frac{4x+y}{2} = x + \frac{y}{4}$

Because $20cm^3$ $C_xH_y \rightarrow 40cm^3$ CO_2
then coeff. $x = 2$

Because $20cm^3$ C_xH_y reacts with $60cm^3$ O_2
then $x + \frac{y}{4} = 3$

$2 + \frac{y}{4} = 3$

$\frac{y}{4} = 1$

$y = 4$

$\therefore$ hydrocarbon gas is C_2H_4 // (ethane).

2/ At s.t.p., 1 mole C_3H_8 - $22.4\ dm^3$ volume
so $\frac{1}{3}$ mole $C_3H_8 = \frac{22.4}{3} = 7.47\ dm^3 = L$.

3/ M_r of $C_2H_4 = 28\ gmol^{-1}$
so no. of moles $C_2H_4 = \frac{12}{28} = 0.43$ moles

By avogadro's law, no. of moles $C_3H_6 = C_2H_4 = 0.43$ moles

$\therefore$ mass of $C_3H_6 = (0.43)(42) = 18.06g$ //

4/ $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

$100\ cm^3$

volume of O_2 required $= \frac{100}{2} \times 13$

$= 650\ cm^3\ O_2$ //

5/ $N = 7g$ $\quad O = 20g$

$\%N = 25.9\%$ $\quad \%O = 74.1\%$

Mole fraction: $N = 1.85$ $\quad O = 4.63$

Mole ratio = $N = 1 : O = 2.5$

$= 2 : 5$

∴ empirical formula is N_2O_5 //

6/ $2M + 6HCl \rightarrow 2MCl_3 + 3H_2$

$0.9g$ $\quad 1.12\ dm^3$

ionic equation: $2M^{3+} + 6H^+ + 6Cl^- \rightarrow 2M^{3+} + 2Cl_3^- + 3H_2^+$

so $2M + 6H^+ \rightarrow 2M^{3+} + 3H_2^+$

no. of moles H_2 liberated $= \frac{1.12}{22.4} = 0.05$ moles

so no. of moles $M = \frac{2}{3} \times 0.05 = 0.033$ moles

∴ M_r of $M = \frac{0.9}{0.033} = 27.3\ gmol^{-1}$

∴ element M is Aluminium (Al) //