Q1 (a) $2VO + 3Fe_2O_3 \longrightarrow V_2O_5 + 6FeO$

2.50g 6.25g

[V = 50.9415; Fe = 55.84; O = 15.999]

First determine the limiting reactant

$r_{theoretical} = \frac{n_{VO}}{n_{Fe_2O_3}} = \frac{2}{3} = 0.67$

$r_{experimental} = \frac{n_{VO}}{n_{Fe_2O_3}} = \frac{(2.50/66.941)}{(6.25/159.691)}$

$= 0.95$ ← larger value than 0.67

$M_r(VO) = 66.941$

$M_r(Fe_2O_3) = 159.691$

$M_r(V_2O_5) = 181.878$

$\therefore r_{exp.} > r_{theoretical}$

So VO is in excess

Fe_2O_3 = Limiting Reactant

$\frac{n_{V_2O_5}}{n_{Fe_2O_3}} = \frac{1}{3} \Rightarrow n_{V_2O_5} = \frac{1}{3} \times n_{Fe_2O_3}$

Limiting Reactant

$\left(\frac{m}{181.878}\right) = \frac{1}{3} \times \frac{6.25}{159.691}$

$\therefore m_{V_2O_5} = \left(\frac{6.25 \times 181.878}{159.691 \times 3}\right) g$

$= 2.37g$ (Ans)//

Q1(b) Aniline $\xrightarrow[\text{combustion}]{+O_2}$ $CO_2(g)$ + $H_2O(\ell)$

1.00g (C, H, N) 2.84g 0.677g

$n_C = n_{CO_2} = \frac{2.84}{44} = 0.0645 mol$ $\therefore m_C = (0.0645 \times 12) g = 0.774g$

$n_H = 2 \times n_{H_2O} = \left(2 \times \frac{0.677}{18}\right) = 0.0752 mol$ $\therefore m_H = 0.0752g$

$\therefore m_N = 1.00 - (0.774 + 0.0752) g = 0.1508g$ $n_N = \frac{0.1508}{14} = 0.011 mol$

(1/2)

Sem 1 (1999/2000) : Stoichiometry

Q1(6) cont. $n_C : n_H : n_N$

$0.0645\ mol : 0.0752\ mol : 0.0110\ mol$

$\left(\frac{0.0645}{0.0110}\right) : \left(\frac{0.0752}{0.0110}\right) : 1$

$5.9 : 6.8 : 1$

$6 : 7 : 1$

Empirical formula (aniline) = C_6H_7N

$(C_6H_7N)n = 93$

$93n = 93$

$n = 1$

Molecular formula (aniline) = C_6H_7N

2/2

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