

$$Q_1(a) \quad 1u = \frac{\text{mass of 1 atom C-12 (in grams)}}{12}$$

$$\text{mass 1 atom C-12} = \left(\frac{12.00}{N_A}\right)g \quad \left(\because N_A = \text{Avogadro no} = 6.022 \times 10^{23} \text{ mol}^{-1}\right)$$

$$\therefore 1u = \frac{\left(\frac{12.00}{N_A}\right)}{12}g$$

$$= \left(\frac{12.00}{N_A} \times \frac{1}{12}\right)g$$

$$\therefore 1u = \left(\frac{1}{N_A}\right)g$$

$$1u = 1.66 \times 10^{-24}g \text{ (Ans)}$$

$$\text{Mass of 1 atom Li-7} = \left(7.01600 \times \frac{1}{N_A}\right)g$$

$$\therefore \text{Mass of 1 mol Li-7} = \left(7.01600 \times \frac{1}{N_A} \times N_A\right)g = 7.01600g$$

$$Q_1(b) \text{ Using } PV = nRT @ \quad PV = \frac{m}{M_r} \cdot RT$$

$$\therefore M_r = \frac{mRT}{PV} = \frac{(2.96g)(0.082 \text{ Latm K}^{-1} \text{ mol}^{-1})(680K)}{(1.0L) \left(\frac{462}{760} \text{ atm}\right)} = 271.51 \text{ g mol}^{-1}$$

If the formula of the compound is MCl_x

$$200.6 + x(35.453) = 271.51$$

$$x = 2.0$$

$$\therefore \text{Molecular formula} = MCl_2 \text{ (Ans)}$$

$\frac{1}{2}$

Q₁(b) - continued

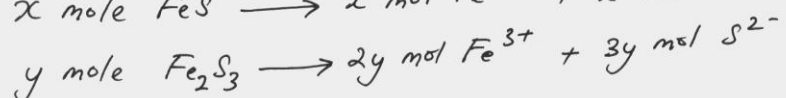
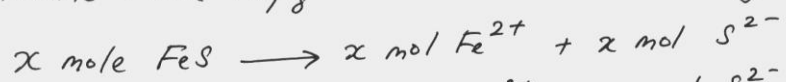
$$n_M : n_{Cl}$$

$$\left(\frac{0.1892}{200.6}\right) : \left(\frac{0.0668}{35.453}\right)$$

$$9.43 \times 10^{-4} : 1.884 \times 10^{-3}$$

$$1 : \frac{1.884 \times 10^{-3}}{9.43 \times 10^{-4}}$$

$$1 : 2$$

Empirical formula : MCl_2 (Ans)Q₁(c) Assume 1 mole Fe_7S_8 contains x mole FeS and y mole Fe_2S_3 

Comparing : $x + 2y = 7$ -----(i)

$x + 3y = 8$ -----(ii)

Solving for x & y : $y = 1$; $x = 5$

\therefore 5 mole of FeS and 1 mole of Fe_2S_3
 which contains 5 mols of Fe^{2+} and 2 mols of Fe^{3+}

$$n_{Fe^{2+}} : n_{Fe^{3+}} = 5 : 2 \text{ (Ans)}$$

2/2

Sem 1: 2003/2004 : Q1c

Alternative method:

Sem 1 (2003/2004): stoichiometry

Q₁ (c) Assume x atom of Fe^{2+}
 \therefore No. of Fe^{3+} atom in $\text{Fe}_7\text{S}_8 = (7-x)$ } $(\text{Fe}^{2+})_x (\text{Fe}^{3+})_{7-x} \text{S}_8$

$$\therefore x(+2) + (7-x)(+3) + 8(-2) = 0$$

$$x = 5$$

$$\text{no. of } \text{Fe}^{3+} \text{ ions} = 7 - 5 = 2$$

$$\text{no. of } \text{Fe}^{2+} \text{ ions} = 5$$

$$\therefore \frac{n_{\text{Fe}^{2+}}}{n_{\text{Fe}^{3+}}} = \frac{5}{2}$$



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