1) Calculate the mass percentage of benzene (C_6H_6) and Carbon tetrachloride (CCl_4) if 22 g of benzene is dissolved in 122 g of CCl_4.

Sol: ~~Mass % of component = Mass of the component of sol.~~ benzene

Sol: Mass % of component (Benzene) = $\frac{\text{Mass of the Benzene}}{\text{Total mass of solution}} \times 100$

$= \frac{22}{122+22} \times 100 = \frac{11}{144} \times 100$

$= \frac{1100}{72} = 15.2\%$

Mass % of $C_6H_6 = 15.2\%$

Mass % of $CCl_4 = 100 - 15.2\% = 84.8\%$

2.2 Calculate the mole fraction of benzene in solution containing 30% by mass in CCl_4.

Sol: Let the mass of solution be 100 g.

Mass of benzene = 30 g.

Mass of $CCl_4 = 100 - 30 = 70$ g

Molar Mass of benzene (C_6H_6) = $6 \times 12 + 6 \times 1$

$= 78$ g mol^{-1}

Molar Mass of $CCl_4 = 1 \times 12 + 4 \times 35.5 = 154$ g mol^{-1}.

Moles of C_6H_6 = $\frac{\text{Given Mass}}{\text{Molecular mass}} = \frac{30}{78}$ mol

Moles of $CCl_4 = \frac{70}{154}$ mol.

Mole fraction of C_6H_6 = $\frac{\text{No. of moles of } C_6H_6}{\text{No. of moles of } C_6H_6 + \text{No of moles of } CCl_4}$

$$= \frac{\frac{30}{78}}{\frac{30}{78} + \frac{70}{154}} = \frac{0.385}{0.385 + 0.455} \text{ mol.}$$

$$= \frac{0.385}{0.840}$$

Mole fraction of C_6H_6 = 0.458

(23)

2.3. Calculate the molarity of each of the following solutions

a) 30 g of $Co(NO_3)_2 \cdot 6H_2O$ in 4.3 L.

Molecular mass = $Co(NO_3)_2 \cdot 6H_2O$

$= 59 + 2 \times 14 + 6 \times 16 + 6 \times 18 = 291.$

Vol. of sol. = 4.3 L.

Given mass = 30 g.

~~Molarity~~ = No of Moles of solute = $\frac{\text{Given mass}}{\text{Molecular mass}}$

$= \frac{30}{291}$

Molarity = $\frac{\text{Moles of solute}}{\text{Vol. of solution}} = \frac{\frac{30}{291}}{4.3} = 0.024$ mol/L

$= 0.024$ M.

Molarity = 0.024 M

b) 30 ml of 0.5 M H_2SO_4 diluted to 500 ml

Volume of undiluted H_2SO_4 solution (V_1) = 30 ml.

Molarity of undiluted H_2SO_4 sol. (M_1) = 0.5 M.

Volume of diluted H_2SO_4 (V_2) = 500 ml.

Molarity of diluted H_2SO_4 (M_2),

$$M_1V_1 = M_2V_2$$

$$M_2 = \frac{M_1V_1}{V_2} \rightarrow \frac{30 \times 0.5M}{30} = 0.03\ M.$$

Molarity = 0.03 M.