

2. SOLUTION

2.26 If the density of some lake water is 1.25 g mL^{-1} and contains 92g of Na^+ ions per kg of water, calculate the molality of Na^+ ions in the lake.

Sol.

Molar mass of $\text{Na} = 23 \text{ g mol}^{-1}$

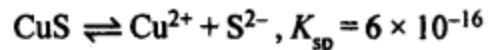
\therefore No. of moles of Na^+ ions present

$$= \frac{92}{23} = 4 \text{ moles}$$

$$\therefore \text{Molality} = \frac{4 \times 1000}{1000} = 4 \text{ m.}$$

2.27 If the solubility product of CuS is 6×10^{-16} , calculate the maximum molarity of CuS in aqueous solution.

Sol.



Maximum molarity of CuS in aqueous solution

means solubility of CuS .

Let the solubility of CuS be $S \text{ mol L}^{-1}$

$$\therefore K_{sp} = [\text{Cu}^{2+}][\text{S}^{2-}]$$
$$6 \times 10^{-16} = S \times S = S^2$$

$$\therefore S = \sqrt{6 \times 10^{-16}} = 2.45 \times 10^{-8} \text{ mol L}^{-1}.$$

2.28 Calculate the mass percentage of aspirin ($\text{C}_9\text{H}_8\text{O}_4$) in acetonitrile (CH_3CN) when 6.5g of CHO is dissolved in 450 g of CH_3CN .

Solution:

Mass percentage of aspirin

$$= \frac{\text{Mass of aspirin}}{\text{Mass of aspirin} + \text{Mass of acetonitrile}} \times 100$$

$$= \frac{6.5}{6.5 + 450} \times 100 = 1.424\%$$

2.29 Nalorphene ($C_{19}H_{21}NO_3$), similar to morphine, is used to combat withdrawal symptoms in narcotic users. Dose of nalorphene generally given is 1.5 mg. Calculate the mass of 1.5×10^{-3} m aqueous solution required for the above dose.

Solution:

1.5×10^{-3} m aqueous solution of nalorphene means that 1.5×10^{-3} mole of nalorphene is dissolved in 1 kg of water.

Molar mass of nalorphene, $C_{19}H_{21}NO_3$
 $= 19 \times 12 + 21 + 14 + 3 \times 16 = 311 \text{ g mol}^{-1}$

$\therefore 1.5 \times 10^{-3}$ mole of nalorphene

$= 1.5 \times 10^{-3} \times 311 \text{ g} = 0.467 \text{ g}$

\therefore Mass of solution $= 0.467 + 1000 = 1000.467 \text{ g}$.

For 0.467g of nalorphene, mass of solution required $= 1000.467 \text{ g}$

For 1.5 mg ($1.5 \times 10^{-3} \text{ g}$) of nalorphene, mass of solution required

$$= \frac{1000.467}{0.467} \times 1.5 \times 10^{-3} = 3.21 \text{ g.}$$

2.30 Calculate the amount of benzoic acid (C_6H_5COOH) required for preparing 250 mL of 0.15 M solution in methanol 0.15 M solution means that 0.15 mole of benzoic acid is dissolved in 1L of solution.

Solution:

0.15 M solution means that 0.15 mole of benzoic acid is dissolved in 1L of solution.

Molar mass of C_6H_5COOH

$= 12 \times 6 + 5 + 12 + 2 \times 16 + 1 = 122 \text{ g mol}^{-1}$

$\therefore 0.15 \text{ mol of } C_6H_5COOH = 0.15 \times 122 = 18.3 \text{ g}$

Thus, 1 L or 1000 mL of solution contain

$= 18.3 \text{ g of } C_6H_5COOH$

$\therefore 250 \text{ mL of the solution will contain}$

$$= \frac{18.3}{1000} \times 250 = 4.575 \text{ g of } C_6H_5COOH.$$