Nishant Jindal

Concentration terms

1M Molar

1m molal

(4) $MV = \text{moles}$

NaCl KCl

100 gm 100 gm

(8) (i) 40% w/w 100 gm → 40 gm

50 gm → 20 gm

(ii) 40% w/v 100 ml → 40 gm

50 ml → 20 gm

(iii) moles of NaOH $= M \times V$

$= 12 \times \frac{50}{1000} = 0.6$ mol

24 gm

Nishant Jindal

Concentration terms

(5)

$$[HCl] = \frac{1.825/36.5}{100} \times 10 \times 1000 = 0.5$$

$[HCl] = 0.5$

$[H^+] = 0.5$ $\quad [Cl^-] = 0.5$

x gm $BaCl_2$

$$[BaCl_2] = \frac{x/208}{250} \times 4 \times 1000 = \frac{x}{52}$$

$$[Cl^-] = \frac{x}{52} \times 2 = \frac{x}{26}$$

$$\frac{x}{26} = 0.5$$

$$x = 13 \text{ gm}$$

(8) $CH_3OH \longrightarrow CH_3O^- + H^+$

no. of moles → $a(1-\alpha)$ $a\alpha$ $a\alpha$

$C(1-\alpha)$ $C\alpha$ $C\alpha = [H^+]$

molarity

$c = 0.5$

$0.5 \times \alpha = 2.5 \times 10^{-4}$

$\alpha = 5 \times 10^{-4}$

Q.6 find molality of NaCl

H_2O = 1 mol

NaCl = 1 mol

$$m \text{ of NaCl} = \frac{1}{1 \times 18} \times 1000$$

Nishant Jindal

13% w/w H_2SO_4 $d = 0.98$ gm/ml

100 gm solution contains 13 gm H_2SO_4

$\frac{100}{0.98}$ ml " " $13/98$ mol H_2SO_4

$$M = \frac{13/98}{100/0.98} \times 1000$$

Nishant Jindal

Concentration terms

Molarity & molality of pure Substance

e.g $H_2O(\ell)$ let we have 1000 ml $H_2O(\ell)$

" 1000 gm $H_2O(\ell)$

$M = m$

moles of $H_2O(\ell) = \frac{1000}{18}$ mol

$$\text{Molarity} = \frac{1000/18}{1000} \times 1000 = \frac{1000}{18} = 55.55$$

$$\text{molality} = \frac{1000/18}{1000} \times 1000 = \frac{1000}{18}$$

Q. find M & m of pure $CH_3COOH(\ell)$ $d = 0.8$ gm/ml

Let the volume of CH_3COOH = 1000 ml

mass " = 800 gm

moles " $800/60 = 40/3$

$$M = \frac{40/3}{1000} \times 1000 = 40/3$$

$$m = \frac{40/3}{800} \times 1000 = 50/3$$

Nishant Jindal

Concentration terms

$[H_2O] = \frac{1000}{18} = C$

$$H_2O \longrightarrow H^+ + OH^-$$
$$C(1-\alpha) \quad C\alpha \quad C\alpha$$

Q. find 'α' of pure $H_2O(\ell)$ if its pH is 7.

$$H_2O \longrightarrow H^+ + OH^-$$
$$C(1-\alpha) \quad C\alpha \quad C\alpha$$

$$C\alpha = \frac{1000}{18}\alpha = 10^{-7}$$

$$\alpha = 18 \times 10^{-10}$$

$$pH = -\log[H^+]$$

pH = 2

$\log[H^+] = -2$

$[H^+] = 10^{-2}$

pH = 7

$[H^+] = 10^{-7}$ mol/lit

Nishant Jindal

Concentration terms

$[CH_3COOH] = M = 40/3$

Q. find 'α' of $CH_3COOH(\ell)$ if its pH is 5.

density = 0.8 gm/ml

$$CH_3COOH \longrightarrow CH_3COO^- + H^+$$
$$C(1-\alpha) \qquad C\alpha \qquad C\alpha$$

$[H^+] = C\alpha = 10^{-5}$

$\frac{40}{3}\alpha = 10^{-5}$

$\alpha = \frac{3}{4} \times 10^{-6}$

Nishant Jindal

Concentration terms

Problems related with mixing of solution.

Case-I When there is no chemical Rxn on mixing

5 lit 2 M NaOH (aq)	+	15 lit 1 M NaOH(aq)	=	20 lit [NaOH] = M $V_1 + V_2$

$n_1 + n_2 = n_t$

$M_1V_1 + M_2V_2 = M \times (V_1 + V_2)$

$$\frac{2 \times 5 + 1 \times 15}{20} = M = 1.25\,M$$

Nishant Jindal

Concentration terms

Q. | 5 lit, 2M NaOH | + | 15 lit, 100 gm/lit NaOH | = | 20 lit, gm/lit = x |

$W_1 + W_2 = W_f$

$5 \times 2 \times 40 + 100 \times 15 = x \times 20$

$\frac{400 + 1500}{20} = x = \frac{1900}{20} = 95$

Nishant Jindal

Concentration terms

Q. find volume of $H_2O(\ell)$ required to produce 1M $H_2SO_4(aq)$ from 4 lit 5M $H_2SO_4(aq)$ soln

4 lit 5M H_2SO_4	+	V lit $H_2O(\ell)$	=	(4+V) lit 1M H_2SO_4

$$5 \times 4 + 0 = 1 \times (4+V)$$

$$20 = 4 + V$$

$$V = 16 \text{ lit}$$

Nishant Jindal

③ 500 gm soln, 20% w/w NaOH + 1000 gm soln, 15% w/w NaOH = 1500 gm, %w/w = ? = 50/3

100 gm NaOH + 150 gm = x × 1500/100 , x = 250/15

10^6 gm — 400 g

10^5 gm — $\frac{400}{10^6} \times 10^5$

100 kg soln, 400 ppm KOH (40 gm) + 200 kg soln, 200 ppm KOH = 400 kg, ppm = ? = 250 ppm

$10^6 \rightarrow 200$

$3 \times 10^5 \rightarrow \frac{200}{10^6} \times 3 \times 10^5 = 60$

$ppm = \frac{100}{4 \times 10^5} \times 10^6 = 250$ ppm

⑤ 35% 55% 47.5

500 gm soln, 40% w/w HF + 200 ml soln, 60% w/w HF, d = 1.5 gm/ml = %w/w = ? = x

500 + 300 = 800

$100 \rightarrow 40$

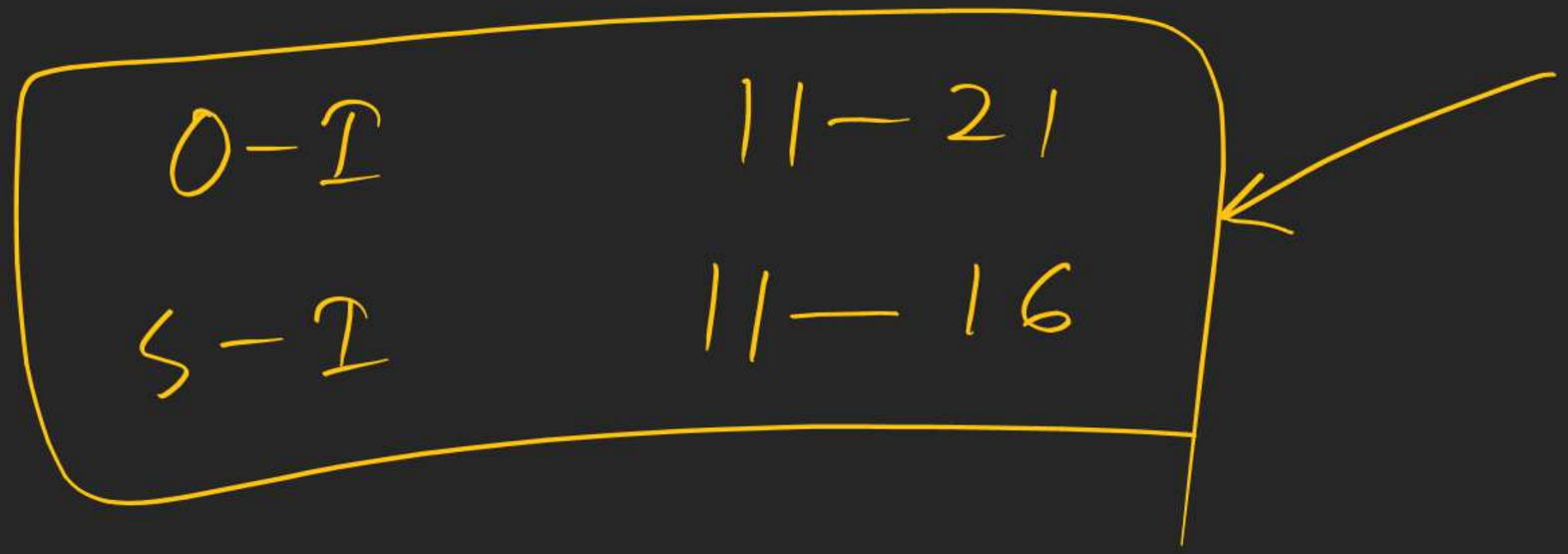
$500 \rightarrow \frac{40}{100} \times 500$

$\frac{40}{100} \times 500 + \frac{60}{100} \times 200 = \frac{x}{100} \times 800$

$200 + 120 = 8x$

$x = \frac{320}{8} = 40$

Nishant Jindal



Nishant Jindal

$$\frac{400}{10^6} \times 10^5 + (60) = \left(\frac{x}{10^6} \times 4 \times 10^5\right)$$

$$100 = \frac{x}{10} \times 4$$

$$250 = x$$