Normality of mixture :-

(1) Mixture of Acid - Acid or Base - Base.

$(Acid)_1 = (Base)_1 = N_1, V_1$

$(Acid)_2 = (Base)_2 = N_2, V_2$

$(A/B)_1 + (A/B)_2 \Rightarrow (A/B)_{Resultant}$

$$N_1V_1 + N_2V_2 = N_R \cdot V_R$$

$V_R = V_1 + V_2 + V_3 + \cdots$

If Sol^n is Acidic $N_R = [H^+]$

or

If Sol^n is Basic $N_R = [OH^-]$

(2) Mixture of Acid - Base :-

$(N_1V_1)_{Acid} \sim (N_2V_2)_{Base} = N_R \cdot V_R$; $\{ V_R = V_1 + V_2 + V_3 + \cdots \}$

Case I If $(N_1V_1)_{Acid} > (N_2V_2)_{Base} \Rightarrow$ Sol^n is Acidic

$\Rightarrow N_R = [H^+]$

$$(N_1V_1)_{Acid} - (N_2V_2)_{Base} = N_R V_R$$

Case II If $(N_1V_1)_{Acid} < (N_2V_2)_{Base} \Rightarrow$ Sol^n is Basic

$\Rightarrow N_R = [OH^-]$

$$(N_2V_2)_{Base} - (N_1V_1)_{Acid} = N_R V_R$$

Case III If $(N_1V_1)_{Acid} = (N_2V_2)_{Base} \Rightarrow$ Sol^n is Neutral.

$$N_R = 0$$

Q.1. Cal. Normality of mixture –

(a) 300ml of 0.2M H_2SO_4 (v.f. = 2) + 200ml of 0.5M HNO_3 (v.f. = 1) + 100ml of 0.6 M HCl (v.f. = 1) are mixed together & final Volume made 1 ltr by adding water then cal. Normality of mixture also cal. Normality of H_2SO_4

(b) 500ml of 0.5M H_2SO_4 + 100ml of 0.2 M KOH + 50ml of 0.2 M HCl

(c) 100ml of 0.1m HCl + 50ml of 0.2M NaOH.

Sol. (a) $N_1V_1 + N_2V_2 + N_3V_3 = N_R.V_R$

$0.2 \times 2 \times 300 + 0.5 \times 1 \times 200 + 0.6 \times 1 \times 100 = N_R \cdot 1000$

$$1\cancel{00}(1.2 + 1 + 0.6) = N_R \cdot 10\cancel{00}$$

$$N_R = \frac{2.8}{10} \Rightarrow \boxed{N_R = 0.28}$$

Sub Part Normality of H_2SO_4 = $\frac{\text{gm-eq. of } H_2SO_4}{\text{Total Volume}} = \frac{0.2 \times 2 \times 3\cancel{00}}{10\cancel{00}}$

$= 0.12$ Ans//

(b) gm eq. of Acid = $N_1V_1 + N_2V_2$

$= 0.5 \times 2 \times 500 + 0.2 \times 50$

$= \frac{1}{\cancel{2}} \times \cancel{2} \times 500 + \frac{2}{1\cancel{0}} \times 5\cancel{0} \Rightarrow$ gm-eq. Acid $= 510$

gm-eq. of Base $= 0.2 \times 1 \times 100 = 20$

(gm-eq. of Acid) − (gm-eq.)Base $= N_R \cdot (500 + 50 + 100)$

$510 - 20 = N_R \cdot 650$

$N_R = \frac{490}{650} \Rightarrow N_R = [H^+] = \frac{49}{65} = 0.75$

Q.2. How many ml of water must be added to 200ml of 0.65M HCl to dilute free Soln of 0.2 M.

Sol. gm-eq. Before dilution = gm-eq. After Dilution

$$m_1V_1 = m_2V_2$$

$$\Rightarrow 0.65 \times 200 = 0.2 \cdot V_2$$

$$\frac{130\cancel{0}}{0.\cancel{2}} = V_2 \Rightarrow \boxed{V_2 = 650\,ml}$$

Total Volume = 650

Volume of water = 650 − 200 = 450ml.

Q.3. How many ml of 0.1 M H_2SO_4 must be added to 50ml of 0.1M NaOH to give a Soln that has Concentration of 0.05M H_2SO_4 (v.f = 2)

Sol. (gm-eq. of Acid) − (gm-eq.) Base = $N_R V_R$

$$0.1 \times 2 \cdot V - 0.1 \times 1 \times 50 = 0.05 \times 2 \times (V + 50)$$

$$0.2V - 5 = 0.1(V+50) \Rightarrow 0.2V - 5 = 0.1V + 5$$

$$0.2V - 0.1V = 5 + 5$$

$$0.1V = 10 \Rightarrow \boxed{V = 100\,ml}$$

** Strength of H_2O_2 Solution :-

$$2H_2O_{2(l)} \longrightarrow 2H_2O_{(l)} + O_{2(g)}$$

ex:- (i) '2 Vol^m' H_2O_2

2ml or 2ltr of $O_{2(g)}$ at STP is produced by decomposition 1ml or 1ltr of H_2O_2 Sol^n.

ex(ii):- '3 Vol^m' H_2O_2

3ml of $O_{2(g)}$ at S.T.P. is produced by decomposition of 1ml of H_2O_2 Sol^n.

Volume of $O_{2(g)}$ at S.T.P. is produced by Decomposition of 1ml of H_2O_2 Sol^n is k/a Volume Strength.

** Strength of H_2O_2 Solution :-

$$2H_2O_{2(l)} \longrightarrow 2H_2O_{(l)} + O_{2(g)}$$

2 mole H_2O_2 — 1 mole $O_{2(g)}$

OR — OR

68 gm H_2O_2 — 22400 ml $O_{2(g)}$

$n = \frac{w}{m.w.}$

$w = n.m.w$

$= 2 \times 34$

$= 68\,gm$

$\Rightarrow$ 22400 ml of $O_{2(g)}$ at STP. is produced by 68 gm decomp. of H_2O_2

$\Rightarrow$ 1 ml " $O_{2(g)}$ — " — " — $\frac{68}{22400}$ gm. H_2O_2

$\therefore$ x ml $O_{2(g)}$ — " — $\frac{68}{22400} \cdot x$ gm H_2O_2 decom.

(i) Normality :-

$$N = \frac{W}{E} \times \frac{1000}{V(ml)}$$

$$N = \frac{\cancel{68}^{4} \cdot x}{\cancel{22400}_{56} \cancel{17}} \times \frac{10\cancel{00}}{1}$$

$$N = \frac{x}{56} \times 10 \Rightarrow N = \frac{x}{\left(\frac{56}{10}\right)} \Rightarrow \boxed{N = \frac{x}{5.6}}$$

{ $V = 1\,ml$ }

{ $E = \frac{m.w.}{V.f} = \frac{34}{2}$; $E = 17$ }

{ 'x ml' H_2O_2 ; "10V" H_2O ; $\boxed{x = 10}$; $x \rightarrow$ Volume. }

(ii) molarity :- $N = M \cdot V \cdot f.$

$$\frac{x}{5.6} = M \cdot 2 \Rightarrow \boxed{M = \frac{x}{11.2}}$$

(iii) Strength :- $S = N \cdot E. \Rightarrow S = \frac{x}{5.6} \times 17 \Rightarrow \boxed{S = \frac{17 \cdot x}{5.6}}$

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(iv) % Strength :-

1000 ml Sol^n $\longrightarrow$ $\frac{17x}{5.6}$

1 ml -" $\longrightarrow$ $\frac{17x}{5.6} \times \frac{1}{1000}$

100 ml -" -" $\longrightarrow$ $\frac{17x}{5.6} \times \frac{100}{1000}$

$\% S = \frac{17x}{5.6} \times \frac{1}{10} \Rightarrow \boxed{\% S = \frac{x}{5.6} \times \frac{17}{10}}$

Q.1. In '20V' H_2O_2 Sol^n Cal.
(i) N (ii) m (iii) S (iv) % S.