S-I 8 – 14

O-I 9 – 13

S-II Chem eqlbm

$[H^+] = [H_3O^+]$

(10) $K_a = \frac{c\alpha^2}{1-\alpha}$

$K_a = c_1\alpha_1^2 = c_2\alpha_2^2$

(12) $pH = 10 \quad pOH = 4$

$x = [OH^-] = 10^{-4}$

$10^{-5} = K_b = \frac{x^2}{c-x}$

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(4)

$$X(s) \longrightarrow A + C \qquad K = 400$$
$$\quad x \qquad x+y$$

$$Y(s) \longrightarrow B + C \qquad K = 900$$
$$\quad y \qquad y+x$$

$$K_p = 225 \times 10^{-4} = P_{H_2O}^2$$

$$15 \times 10^{-2} = P_{H_2O}$$

(5)

$$R.H. = \frac{P_{H_2O}}{\text{aq. tension}} \times 100 = \frac{P_{H_2O}}{22.8 \text{ torr}} \times 100$$

25°C $\quad H_2O(l)$

vap pr = 50 torr

(9) $H_2O(\ell) \longrightarrow H_2O(g)$

0.5 atm

$2H_2O(g) + 2Cl_2(g) \rightarrow 4HCl + O_2$ $\quad K_p = 12 \times 10^8$

0.5 atm	2	2	2
	0	2+4	2+1
		=6	=3
0.5	2x	6-4x	3-x

$$\frac{(6)^4 \times 3}{0.5 \times (2x)^2} = 12 \times 10^8$$

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(10) $Br_2(\ell) \longrightarrow Br_2(g)$

$5/3$ $\quad$ $0.1 = 5/3$

$Br_2(\ell) + Cl_2(g) \longrightarrow 2BrCl(g)$

$5/6$ $\quad$ 0.01 $\quad$ $0.1 = 5/3$

$K_p = 1 = \dfrac{(0.1)^2}{P_{Cl_2}}$

$P_{Cl_2} = 10^{-2}$

$5/3 + 5/6$

$\dfrac{10+5}{6} = 15/6$

$0.01 + 0.05$

$= 0.06$

$n_{Cl_2} = 1\ mol$

$K_p = 1\ atm$

$PV = nRT$

$0.06\ V = 1 \times RT$

$0.1\ V = n_{BrCl} \times RT$

$\dfrac{6}{10} = \dfrac{1}{n_{BrCl}}$

$n_{BrCl} = 5/3$

$$\longrightarrow \underline{B(OH)_4^-} + H^+$$

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Case-I if $C \geq 10^{-6}$ & $K_a C \geq 10^{-12}$

$$K_a = \frac{x^2}{C - x}$$

$K_a/C \leq 10^{-3}$

~~H_2O~~

Case-II $H_2O \rightarrow H^+ + OH^-$

Case-III if $K_a/C \geq 100$ WA → SA

Q. find pH of

① 10^{-4} M HCN ($K_a = 10^{-10}$ M) Case-II

② 10^{-2} M HA ($K_a = 10^{-6}$ M) Case-I

③ 10^{-7} M HA ($K_a = 10^{-3}$ M) Case-III

$$K_a = 10^{-6} = \frac{x^2}{10^{-2} - x}$$

$x = 10^{-4} = [H^+]$

$pH = 4$

③ 10^{-7} M HCl

$pH = 6.78$

① $K_a C = 10^{-14}$

$[H^+] = \sqrt{K_a C + K_w}$

$= \sqrt{10^{-14} + 10^{-14}}$

$[H^+] = \sqrt{2} \times 10^{-7}$

$pH = 7 - \log \sqrt{2}$

$= 7 - 0.15 = 6.85$

$pH = 6.85$

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(3) pH of solution containing more than one acid or base

(1) SA + SA

HCl	KOH
HNO_3	$NaOH$
HBr	$CsOH$
HI	
$HClO_4$	

$[HCl] = C_1$

$[HNO_3] = C_2$

$[H^+] = C_1 + C_2$

$\Rightarrow$ (V_1 ml C_1 M HCl) + (V_2 ml C_2 M HNO_3)

$[HCl] = \frac{V_1 C_1}{V_1 + V_2}$

$[HNO_3] = \frac{V_2 C_2}{V_1 + V_2}$

$$[H^+] = \frac{V_1 C_1 + V_2 C_2}{V_1 + V_2}$$

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(ii) SA + WA

$[HCl] = C_1$

$[CH_3COOH] = C_2$

$CH_3COOH \longrightarrow CH_3COO^- + H^+$

$C_2 - x$	x	$C_1 + x$

$$K_a = \frac{x(C_1+x)}{C_2-x}$$

(iii) WA + WA

$HA \longrightarrow H^+ + A^-$

$C_1 - x$	$(x+y)$	x

$HB \longrightarrow H^+ + B^-$

$C_2 - y$	$(y+x)$	y

$$K_{a_1} = \frac{x(x+y)}{C_1-x}$$

$$K_{a_2} = \frac{y(x+y)}{C_2-y}$$

$$\sqrt{K_{a_1}C_1 + K_{a_2}C_2} = (x+y)^2 = [H^+]$$

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Q. find pH of soln containing

(i) 10^{-3} M HCl & 0.1M CH_3COOH ($K_a = 10^{-5}$)

(ii) 0.1 M HA ($K_a = 10^{-5}$) & 0.1 M HB ($K_a = 3 \times 10^{-5}$ M)

(iii) 2 lit 0.02 M HCl + 8 lit 0.045 M HNO_3

(1) $10^{-5} = \dfrac{(10^{-3}+x)(x)}{0.1-x}$

$x^2 + 10^{-3}x - 10^{-6} = 0$

$x = \dfrac{-10^{-3} + \sqrt{10^{-6} + 4\times10^{-6}}}{2}$

$= \dfrac{(\sqrt{5}-1)\times10^{-3}}{2} = 0.62\times10^{-3}$

$[H^+] = C_1 + x$

$= 1.62\times10^{-3}$

$pH = 2.78$

(2) $[H^+] = \sqrt{10^{-6} + 3\times10^{-6}}$

$= 2\times10^{-3}$

$pH = 2.7$

$\dfrac{2\times0.02 + 8\times0.045}{10}$

$\dfrac{(4+36)\times10^{-2}}{10}$

$4\times10^{-2} = [H^+]$

Q. 1 mol of HA is added to 1 lit $H_2O(\ell)$. [$K_a = 10^{-4}$ M] find

(1) pH of soln

(2) pH of soln if it is diluted 10000 times

(3) " " " " 10^7 times

(4) Volume of $H_2O(\ell)$ required to double the pH.

(5) " " " " the $[OH^-]$

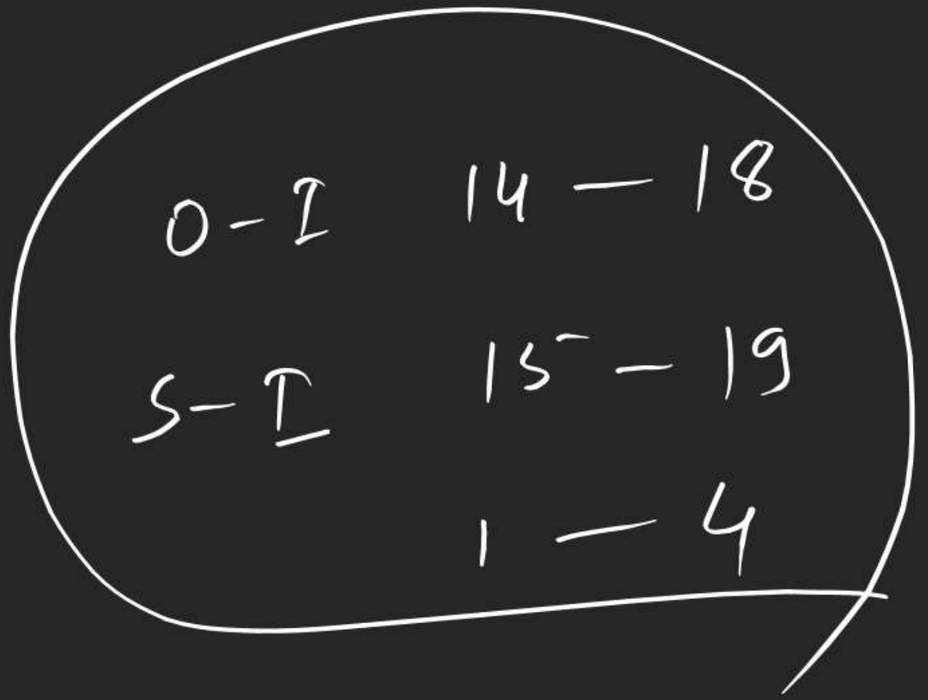
(6) " " removed to double the $[H^+]$.

(7) pH of soln at 80°C if at 80°C $K_w = 10^{-4}$ M^2

(8) pH of soln if 3 lit of 10^{-2} M HCl is added.

(9) " " " if 3 lit of $\frac{5}{4}$ M HB ($K_a = 4 \times 10^{-4}$ M) is added

(10) Calculate α of HA in all the above parts. ✗


0-I 14 — 18
5-I 15 — 19
1 — 4