Ⓐ Ⓒ $[Ba(OH)_2] = 0.1 M$

$\underline{100 \text{ times}}$

$[Ba(OH)_2] = \dfrac{0.1}{100} = 10^{-3}$

$\dfrac{10^{-7}}{}$

$\boxed{10^{-9} M}$

$[OH^-] = 2 \times 10^{-3}$

Ⓔ
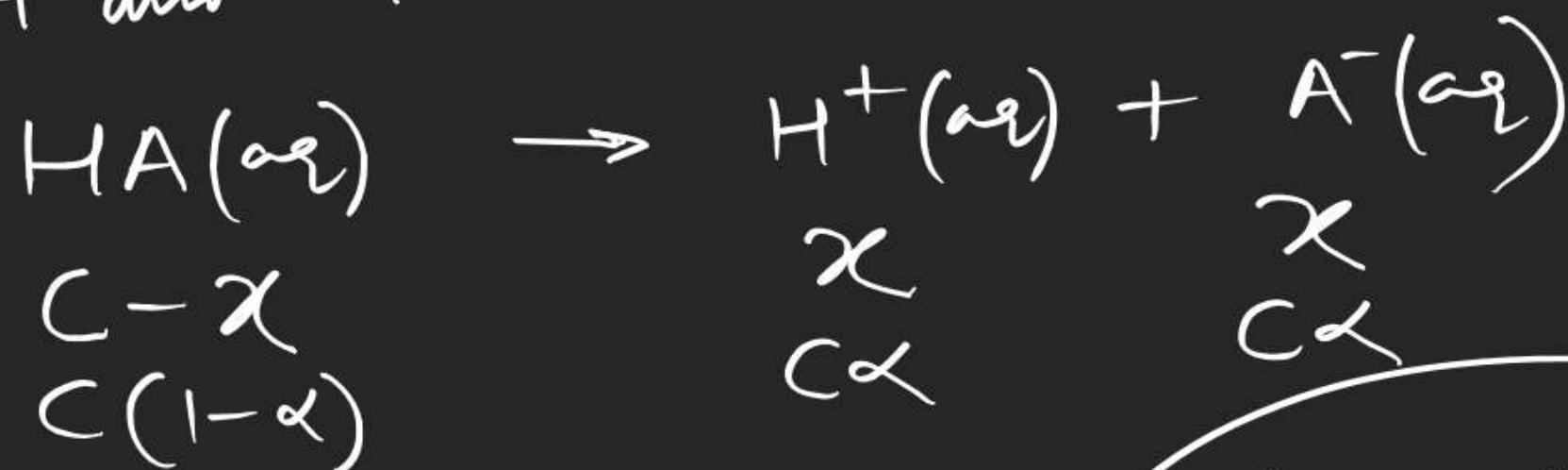
$\boxed{10^{-10} M \quad NaOH}$

$\boxed{pH = 7}$

$pH = 7$

pH of a solution containing weak acid or base :→

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

H^+ and OH^- due to water can be neglected.

$$HA(aq) \longrightarrow H^+(aq) + A^-(aq)$$

$$
\begin{array}{ccc}
C-x & x & x \\
C(1-\alpha) & C\alpha & C\alpha
\end{array}
$$
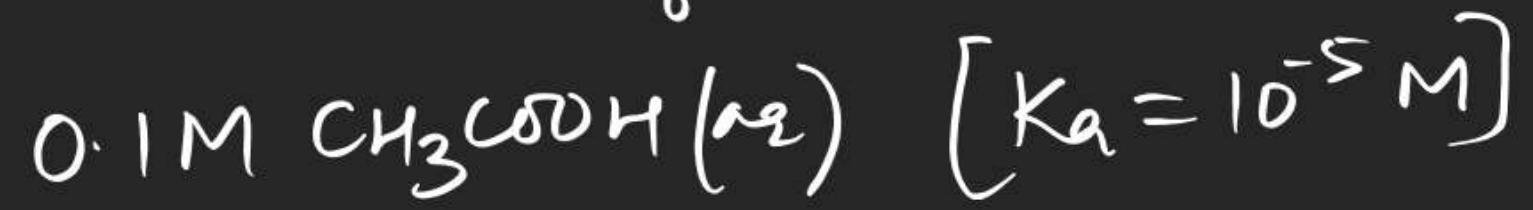
$$K_a = \frac{x^2}{C-x} = \frac{C\alpha^2}{1-\alpha}$$

if $\dfrac{K_a}{C} \leq 10^{-3}$

x can be neglected wrt C

find $[H^+]$ & pH of

① 0.1M CH_3COOH (aq) $[K_a = 10^{-5} M]$

② $10^{-3}M$ HA (aq) $[K_a = 10^{-3} M]$

$C > 10^{-6}$ $K_a C = 10^{-6}$

$C > 10^{-6}$ $K_a C = 10^{-6}$

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

$0.1-x$ x x
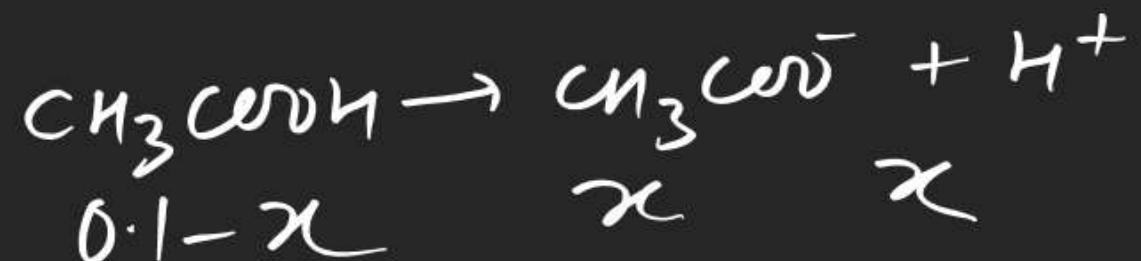
$10^{-5} = \dfrac{x^2}{0.1-x} \Rightarrow x = 10^{-3} = [H^+]$ pH = 3

Ⅱ. $10^{-3} = \dfrac{x^2}{10^{-3}-x}$

$x = 0.62 \times 10^{-3}$
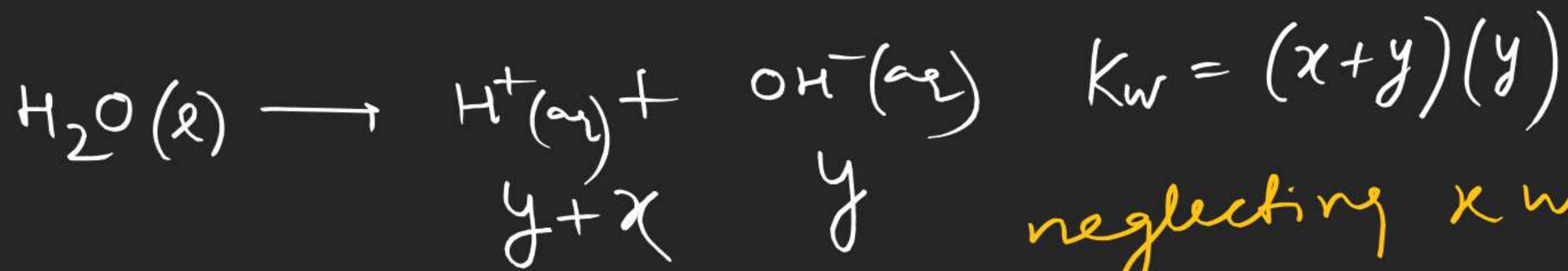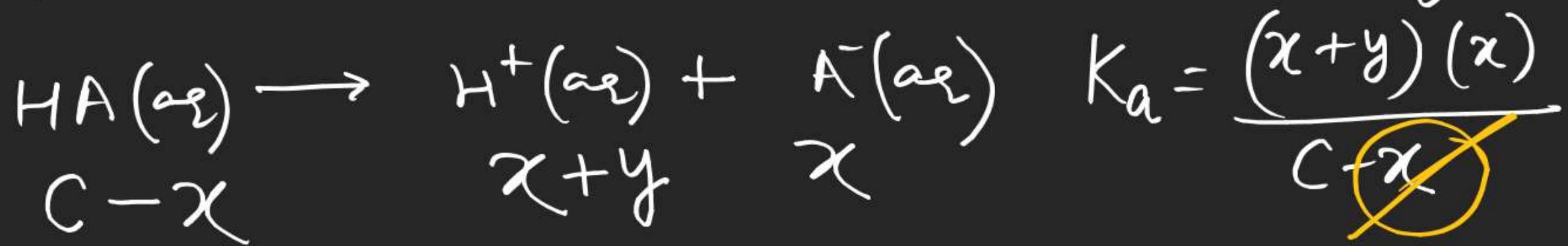
$[H^+] = 6.2 \times 10^{-4}$

pH = 4 - log 6.2

pH = 3.21

Case-II   In rest all cond^n

$[H^+]$ & $[OH^-]$ due to H_2O can not be neglected.

$$HA_{(aq)} \longrightarrow H^+_{(aq)} + A^-_{(aq)} \qquad K_a = \frac{(x+y)(x)}{C\cancel{-x}}$$

$$\phantom{HA_{(aq)}} C-x \qquad\qquad x+y \qquad x$$

$$H_2O_{(l)} \longrightarrow H^+_{(aq)} + OH^-_{(aq)} \qquad K_w = (x+y)(y)$$

$$\phantom{H_2O_{(l)}} y+x \qquad\qquad y$$

neglecting x wrt C

$$K_a C + K_w = (x+y)^2 = [H^+]^2$$

$$[H^+] = \sqrt{K_a C + K_w}$$
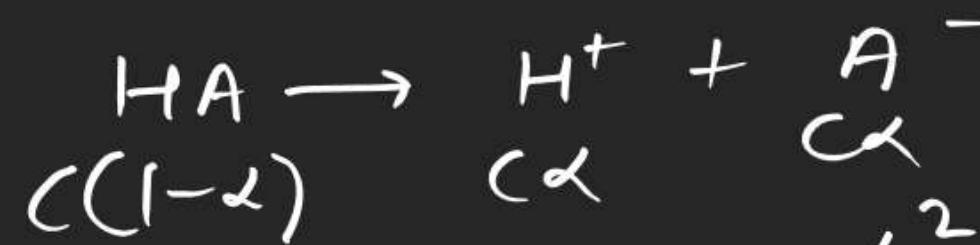
S-I
8 - 14

O - I
g - 13

S - II   Chem eqlbm

Case-III

Q. find α' of $\boxed{10^{-5}M\,HA}$ having $\underline{K_a = 10^{-2}\,M}$

$$HA \longrightarrow H^+ + A^-$$
$$C(1-\alpha) \qquad C\alpha \qquad C\alpha$$

$$K_a = \frac{C\alpha^2}{1-\alpha}$$

$$10^3 \cdot 10^{-2} = \frac{10^{-5}\alpha^2}{1-\alpha}$$

$$\alpha^2 + 10^3\alpha - 10^3 = 0$$

$$\alpha = \frac{-10^3 + \sqrt{10^6 + 4\times10^3}}{2}$$

$$\alpha = \frac{-10^3 + 10^3\left(1 + 4\times10^{-3}\right)^{1/2}}{2}$$

$$= \frac{-10^3 + 10^3\left(1 + 2\times10^{-3}\right)}{2}$$

$$= 1$$

Case-III   if $K_a/C \geq 100$

weak acid can be treated as strong acid.

Q. find pH of $10^{-7}M\,HA$ $(K_a = 10^{-4})$

$$WA \longrightarrow SA \quad \text{Case-2}$$

$$\boxed{pH = 6.78}$$

Ionic

(2) $[H^+] = 10^{-6.7} = [OH^-]$

$K_w = 10^{-6.7} \times 10^{-6.7}$

(1) $\underline{K_w = [H^+][OH^-]}$

(6) $[HCl] = 10^{-9}$

$10^{-14} = (10^{-9} + x)(x)$

(8) $[H_2SO_4] = \left(\dfrac{1}{200} M\right)$

$= \dfrac{M_1 V_1 + M_2 V_2}{V_1 + V_2}$

$\boxed{[H^+] = 2 \times \dfrac{1}{200} = \dfrac{1}{100}}$

$x = 10^{-7}$

$[H^+] = 10^{-9} + 10^{-7}$

$= 1.01 \times 10^{-7}$

$$X \longrightarrow 2Y$$

$$1-\alpha \qquad 2\alpha$$

$$K_{P_1} = \frac{4\alpha^2}{1-\alpha} \times \frac{P_1}{1+\alpha}$$

$$Z \longrightarrow P + Q$$

$$1-\alpha \qquad \alpha \qquad \alpha$$

$$K_{P_2} = \frac{\alpha^2}{1-\alpha} \times \frac{P_2}{1+\alpha}$$

(13)

$$A \longrightarrow B$$

$$a \qquad\qquad b \qquad\qquad \text{Total moles} = a + b$$

$$a \qquad\qquad b - x$$

$$a - y \qquad\qquad b - x + y \qquad\qquad \text{Total moles} = a + b - x$$

$$A(s) \longrightarrow A(g)$$

a	b

$$a \qquad\qquad b - x$$

a - x	b