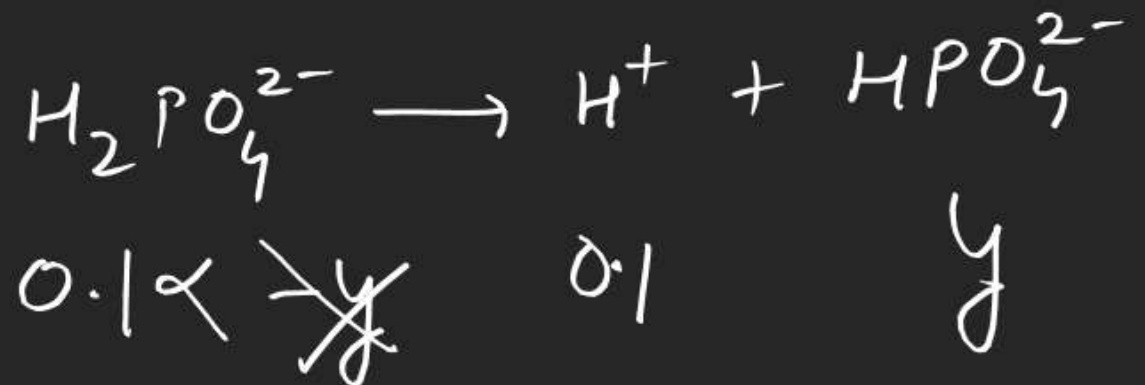
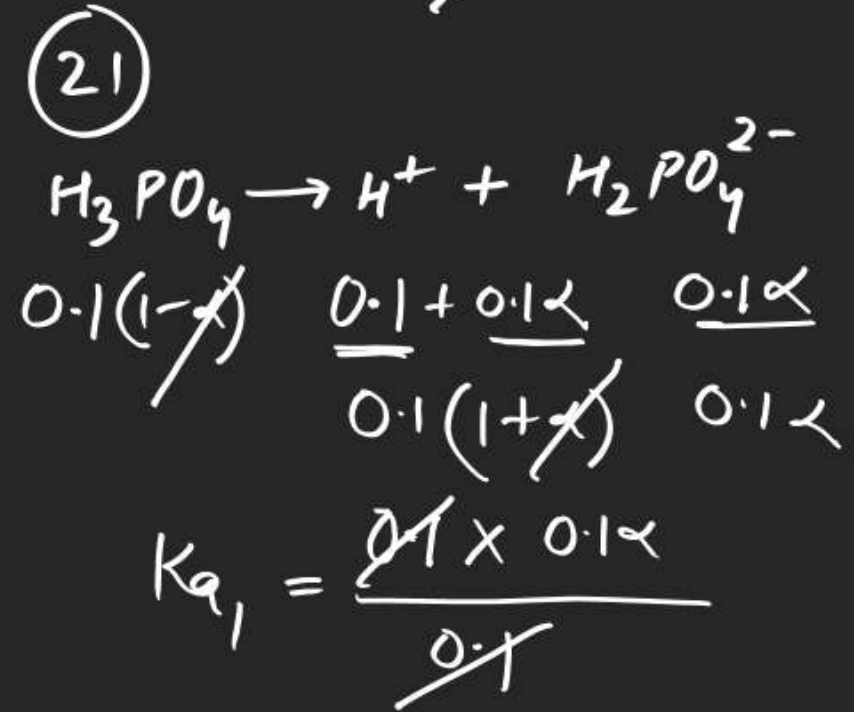




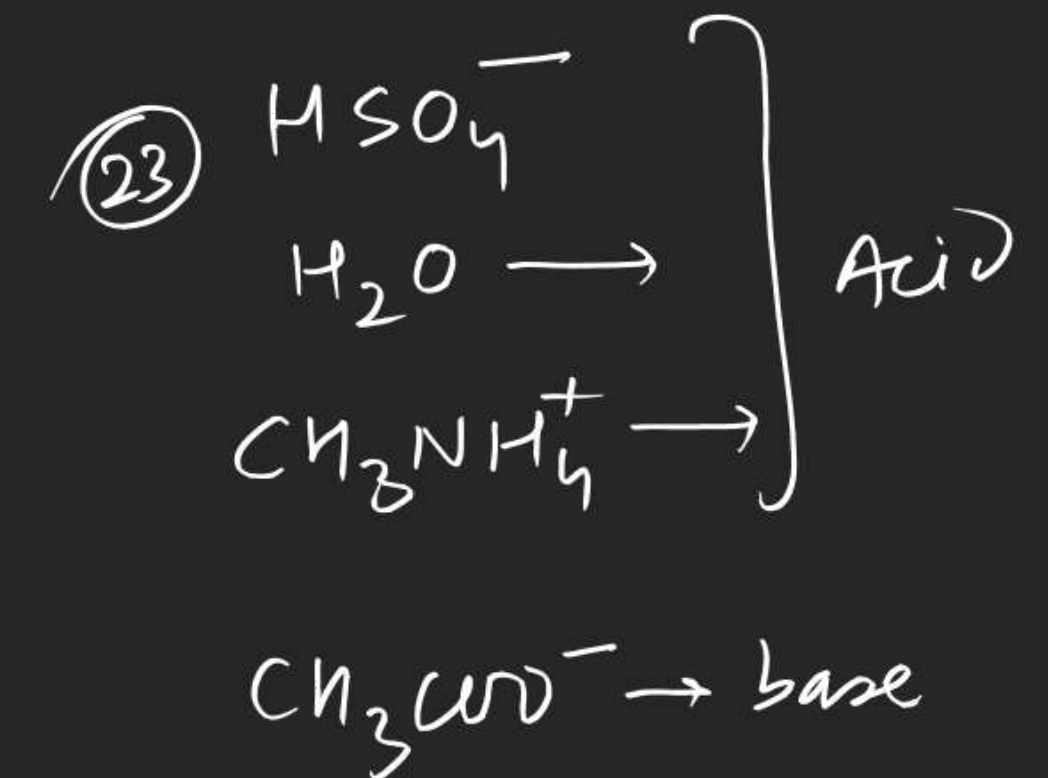
$$\begin{aligned}
 [\text{OH}] &= \sqrt{\frac{0.1}{2} \times 6.4 \times 10^{-5} + \frac{2}{45} \times 1.8 \times 10^{-5}} \\
 &= \sqrt{\frac{6.4}{2} + \frac{36}{45}} \times 10^{-3} \\
 &= \sqrt{3.2 + 0.8} \times 10^{-3} \\
 &= 2 \times 10^{-3}
 \end{aligned}$$

(20) $\alpha \ll 1$
 ~~$K_a = \frac{c\alpha^2}{1-\alpha} = \frac{x^2}{c-x}$~~

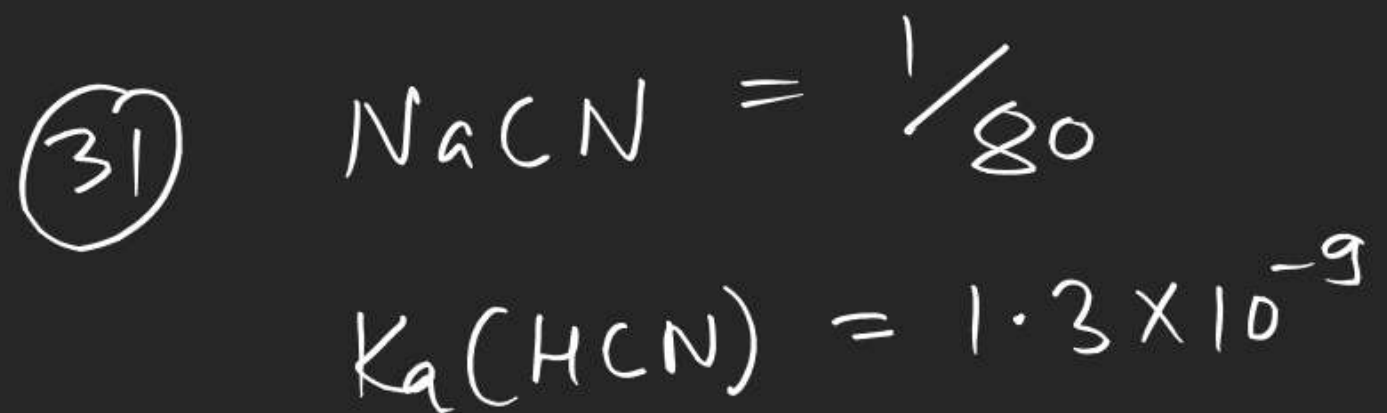


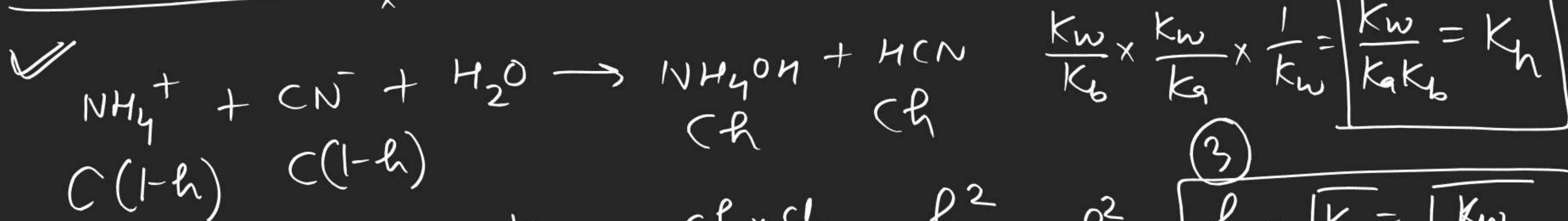
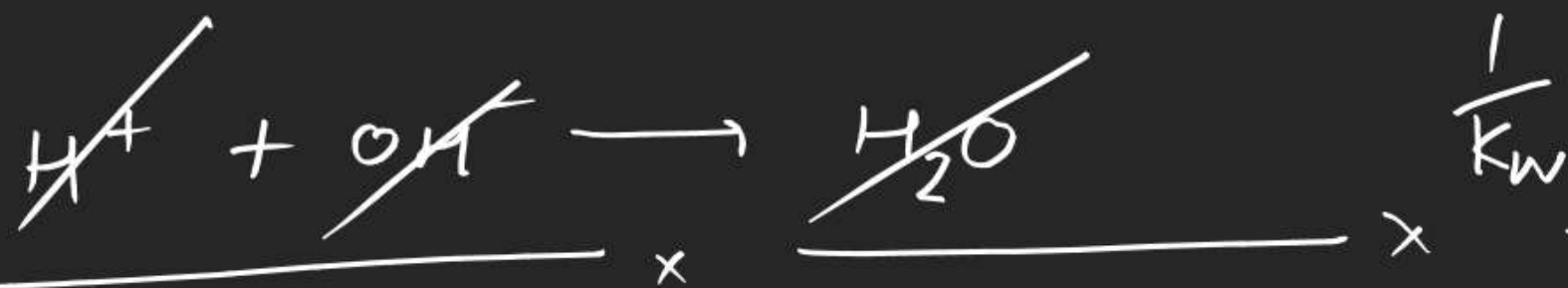
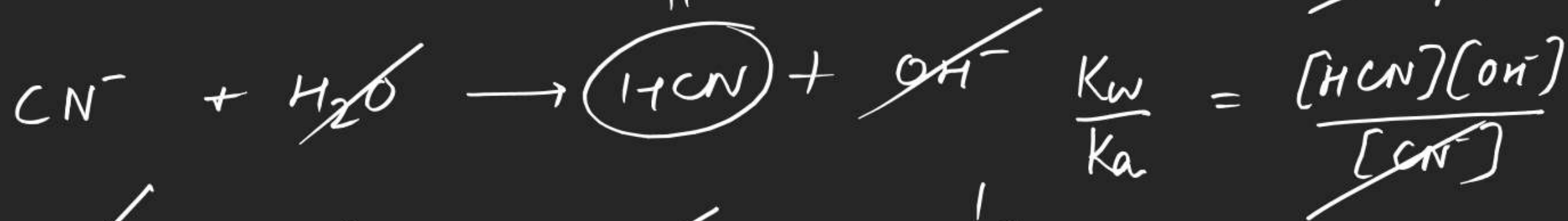
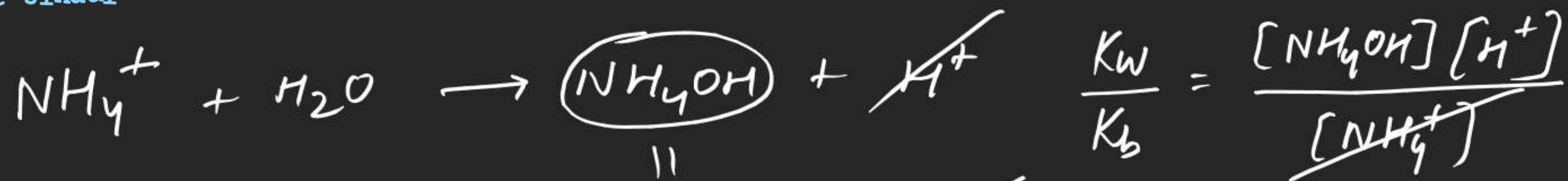
$K_{a2} = \frac{0.1 \times y}{0.1 \times \alpha}$

$y = \alpha K_{a2} = \underline{\underline{10K_{a1}K_{a2}}}$



(25) 2 (27)





$$K_h = \frac{K_w}{K_a K_b} = \frac{Ch \times Ch}{C^2(1-h)^2} = \frac{h^2}{(1-h)^2} = h^2$$

①

$$[\text{H}^+] = \sqrt{\frac{K_w K_a}{K_b}}$$

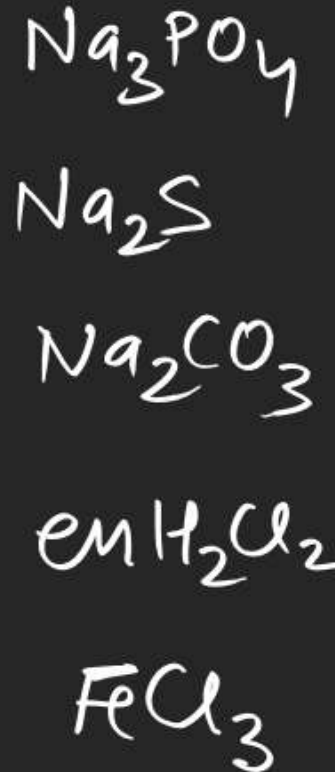
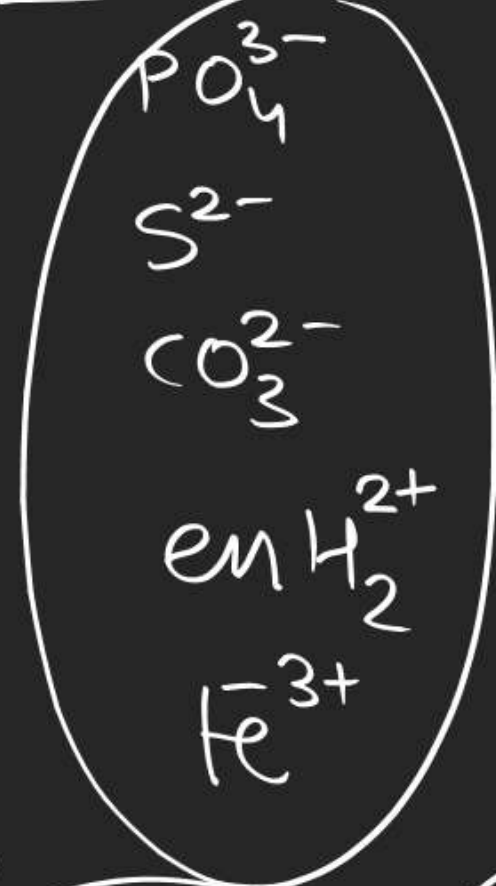
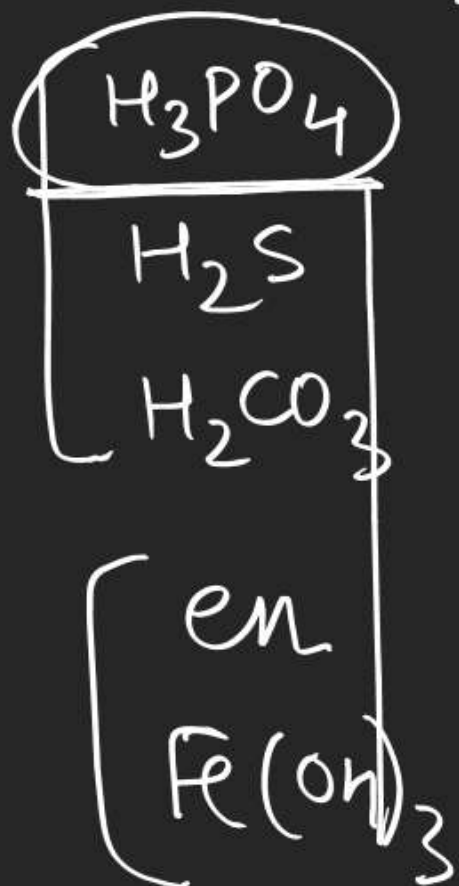
②

$$\frac{K_w}{K_b} \times \frac{K_w}{K_a} \times \frac{1}{K_w} = \frac{K_w}{K_a K_b} = K_h$$

③

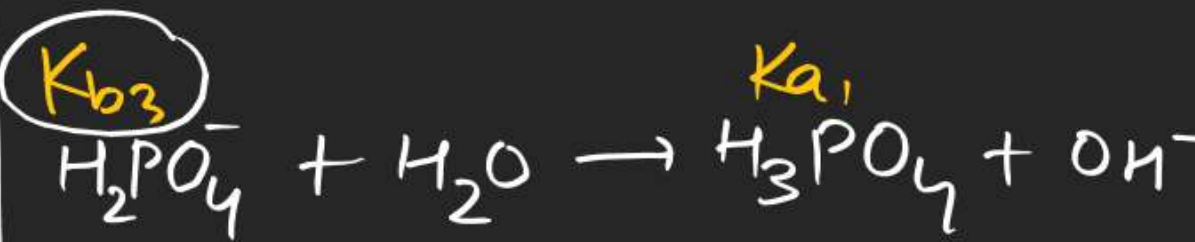
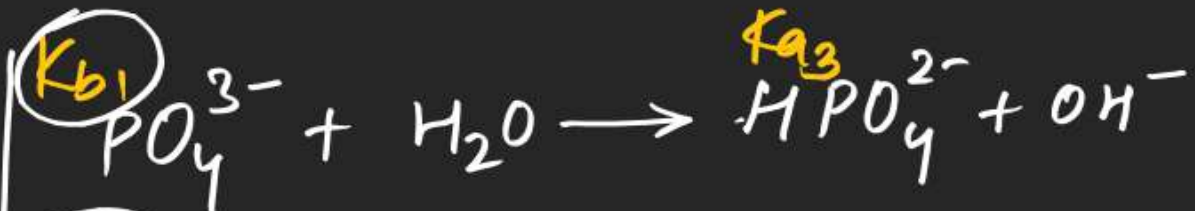
$$h = \sqrt{K_h} = \sqrt{\frac{K_w}{K_a K_b}}$$

Case-5: Solution containing multivalent cation or anion.



K_{a1}
 K_{a2}
 K_{a3}

K_{b1}
 K_{b2}
 K_{b3}



Since $K_{a1} \gg K_{a2} \gg K_{a3}$

$K_{b1} \gg K_{b2} \gg K_{b3}$
 $x \gg y \gg z$

$K_{b1} = \frac{K_w}{K_{a3}} = \frac{x^2}{c-x}$

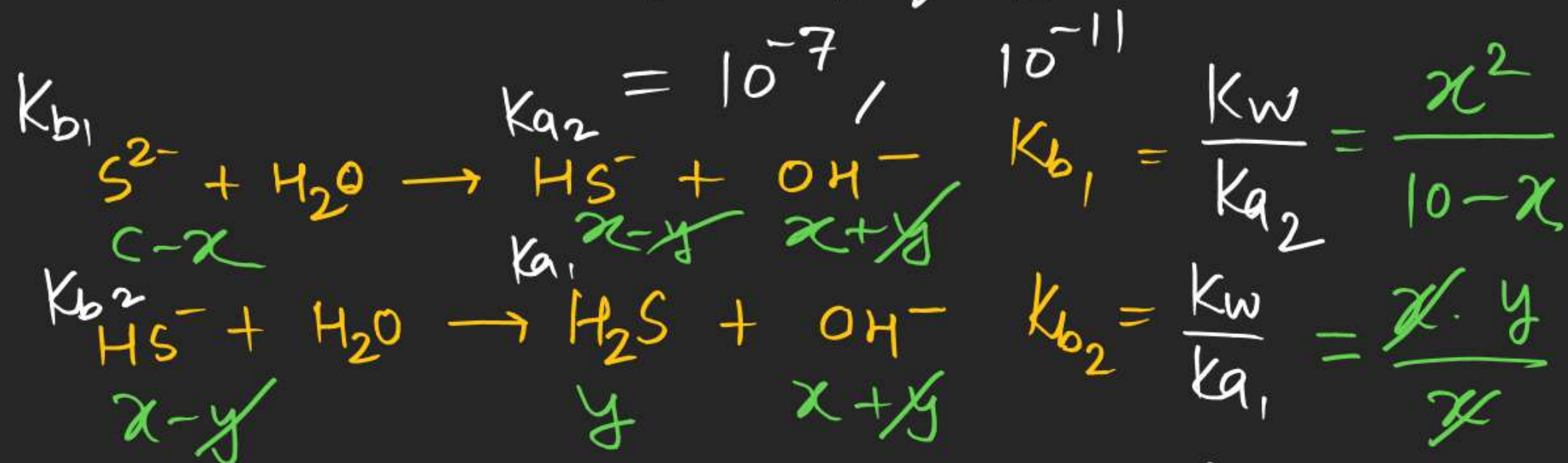
$K_{b2} = \frac{K_w}{K_{a2}} = y$

$K_{b3} = \frac{K_w}{K_{a1}} = \frac{xz}{y}$

find K_{b1} & K_{b2} of S^{2-} . Given K_{a1} & K_{a2} of H_2S

$$K_{b1} = \frac{K_w}{K_{a2}} = 10^{-3}$$

$$K_{b2} = \frac{K_w}{K_{a1}} = 10^{-7}$$

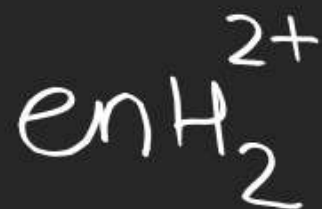
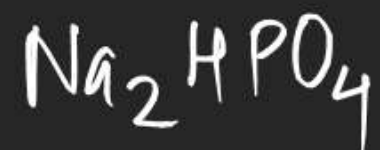
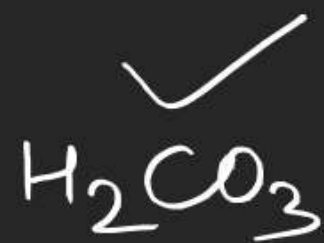


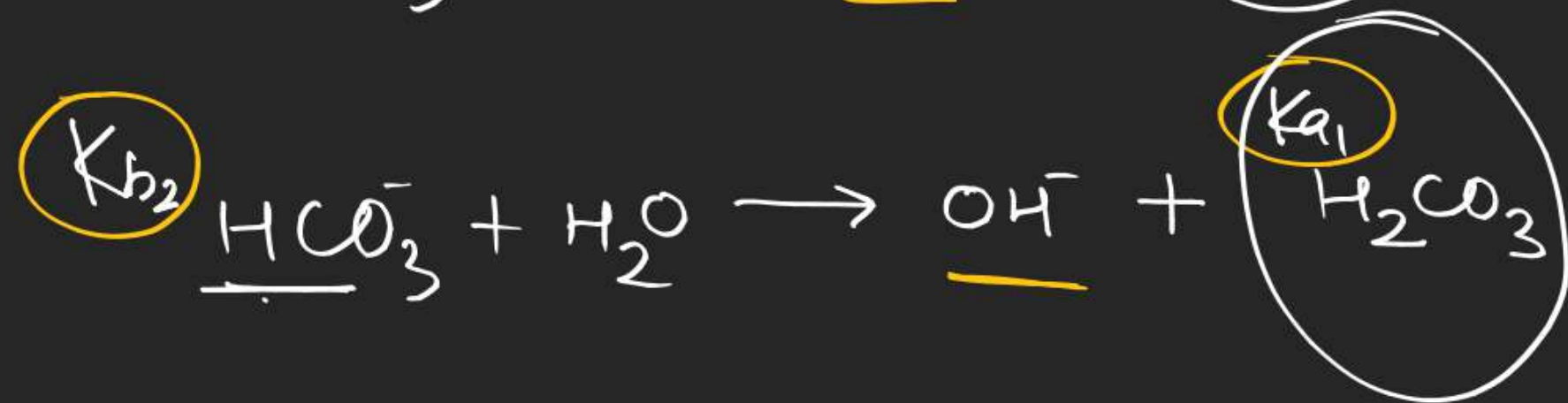
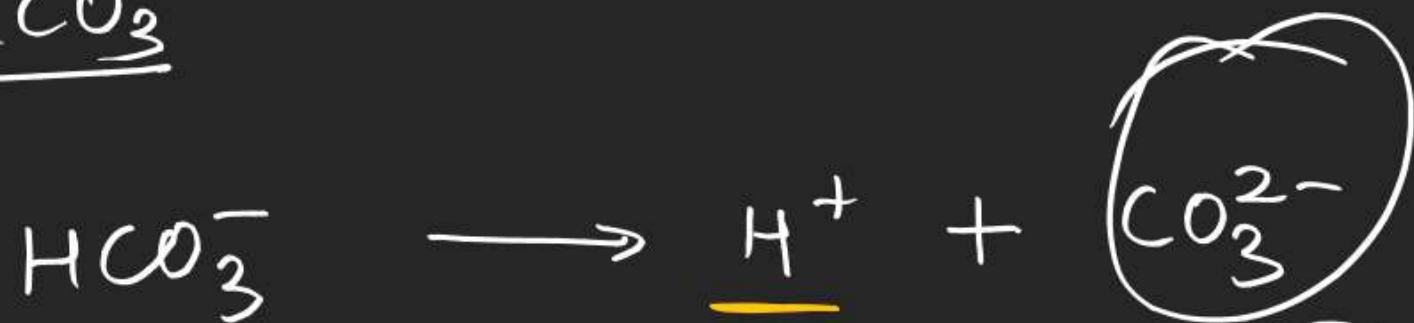
find $[OH^-]$, $[HS^-]$ & $[S^{2-}]$ in 10 M $Na_2S(aq)$ soln

$$K_{b2} = y = 10^{-7}$$

$$\frac{x_w}{10^{-11}} = 10^{-3} = \frac{x^2}{10 - x}$$

$$x^2 = 10^{-2}$$
$$x = 0.1$$

Case-VIpH of a solution containing amphiprotic salt

① NaHCO₃

$$K_{a2} = \frac{[\text{H}^+][\text{CO}_3^{2-}]}{[\text{HCO}_3^-]}$$

$$\frac{K_w}{K_{a1}} = \frac{[\text{OH}^-][\text{H}_2\text{CO}_3]}{[\text{HCO}_3^-]}$$

$$\frac{K_{a2} K_{a1}}{K_w} = \frac{[\text{H}^+]}{[\text{OH}^-]} = \frac{[\text{H}^+]^2}{K_w}$$

$$[\text{H}^+] = \sqrt{K_{a2} K_{a1}}$$

$$\text{pH} = \frac{1}{2}(\text{p}K_{a2} + \text{p}K_{a1})$$

S-I 24 - 38

