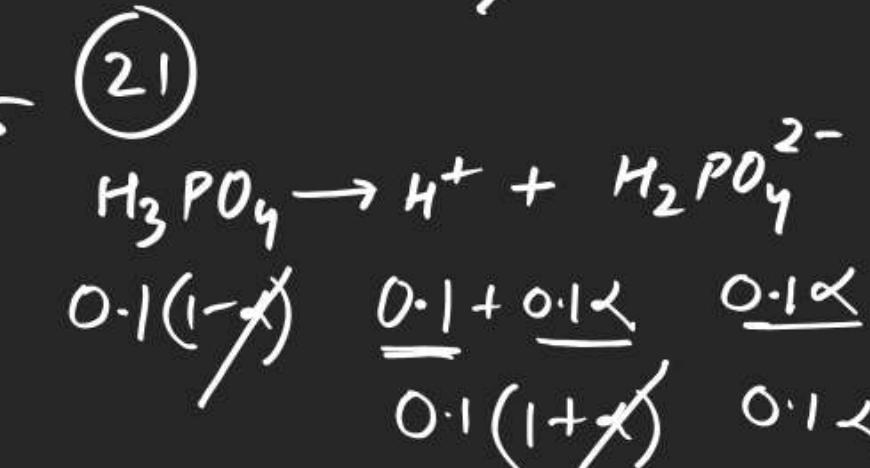
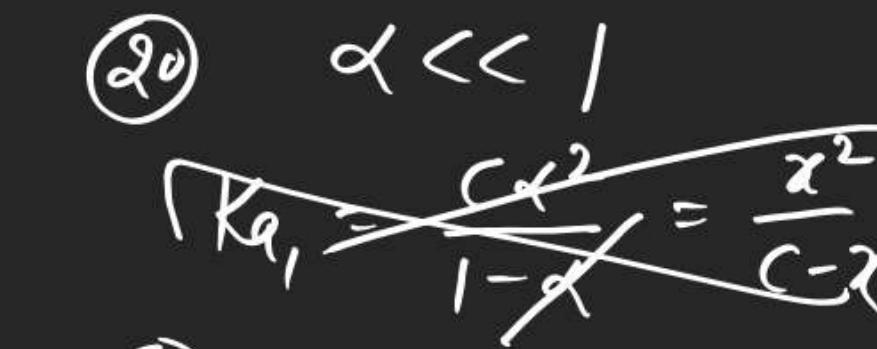


$$[OH] = \sqrt{\frac{0.1}{2} \times 6.4 \times 10^{-5} + \frac{2}{45} \times 1.8 \times 10^{-5}}$$

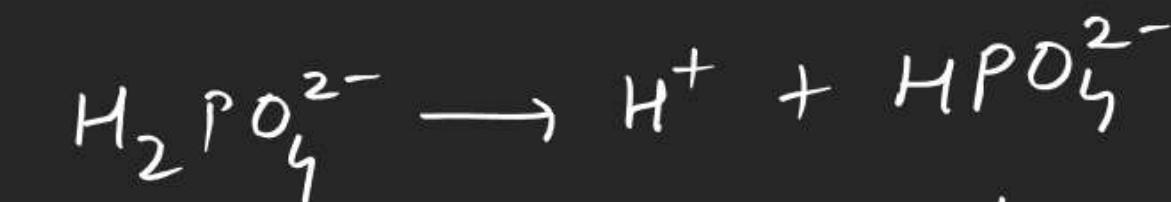
$$= \sqrt{\frac{6.4}{2} + \frac{3.2}{45}} \times 10^{-3}$$

$$= \sqrt{3.2 + 0.8} \times 10^{-3}$$

$$\approx 2 \times 10^{-3}$$



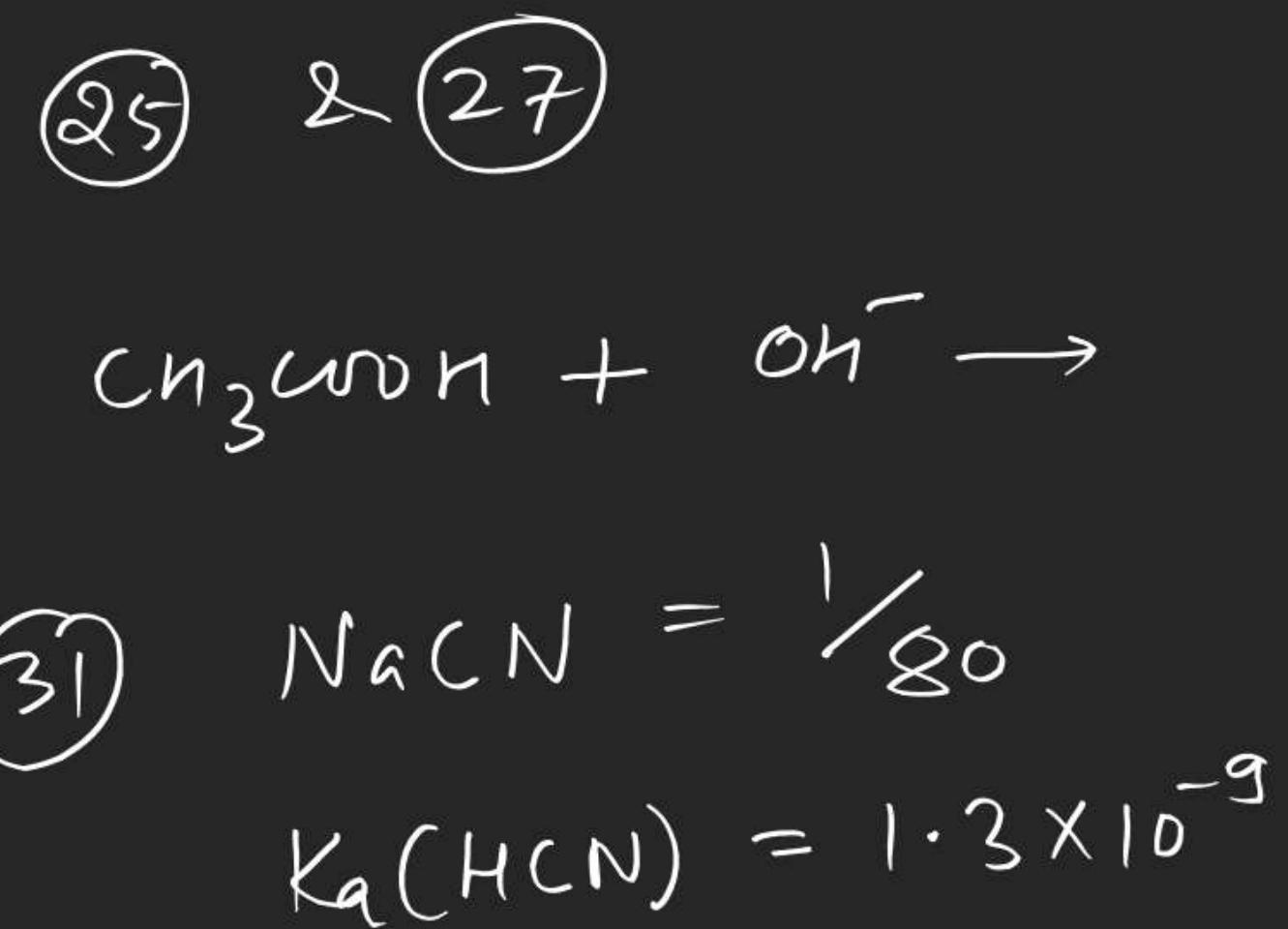
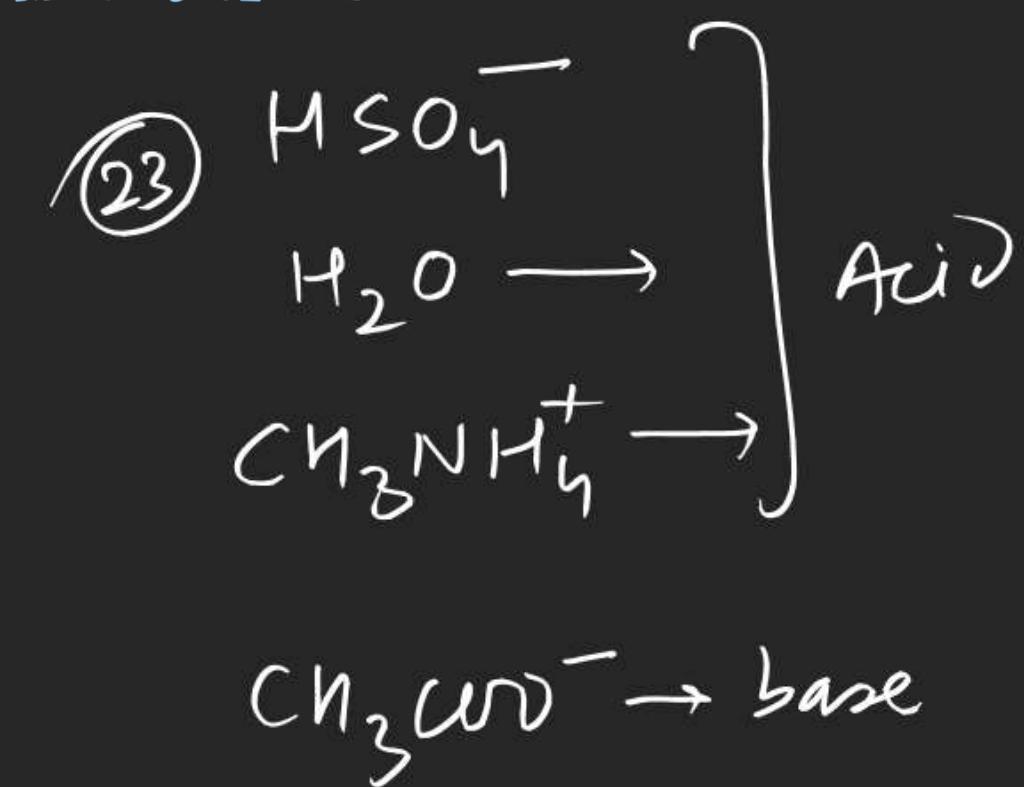
$$K_{a_1} = \frac{0.1 \times 0.1\cancel{x}}{0.1}$$

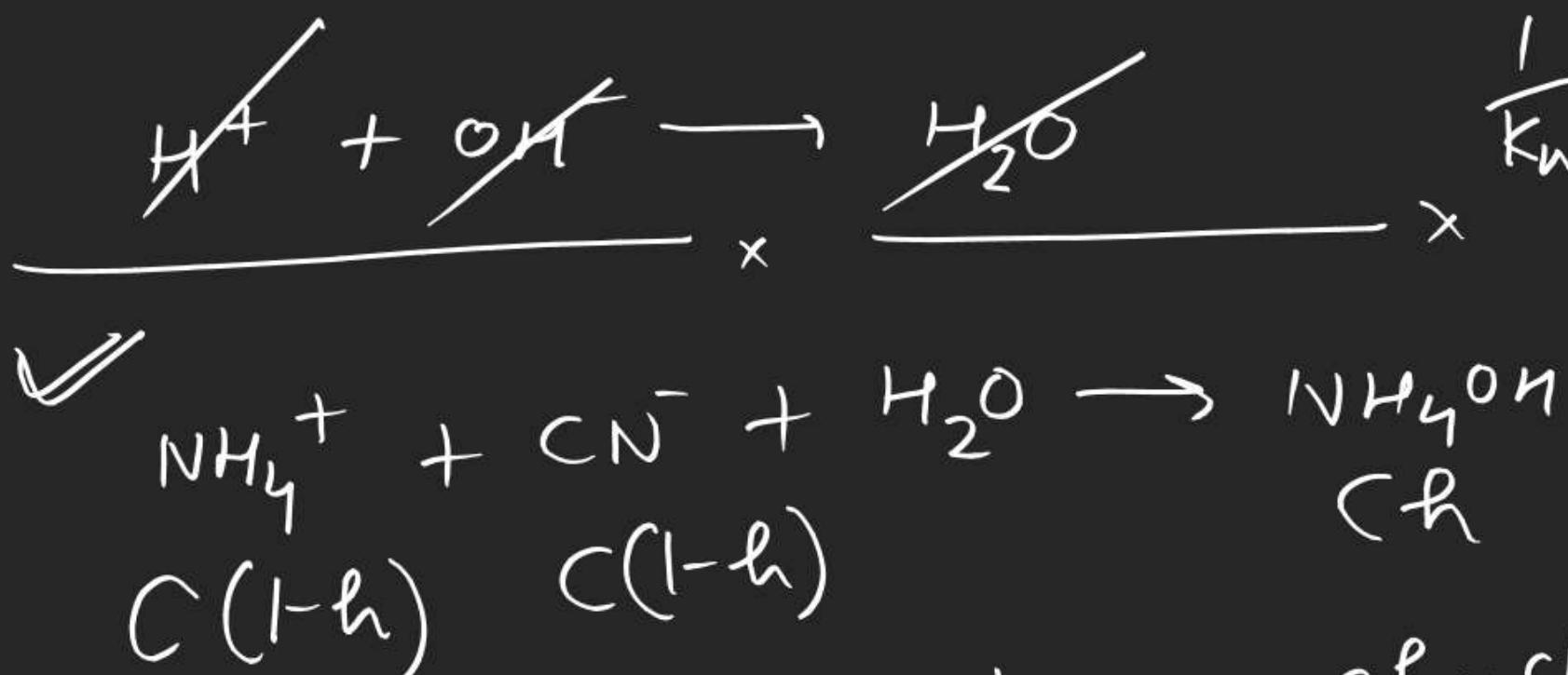
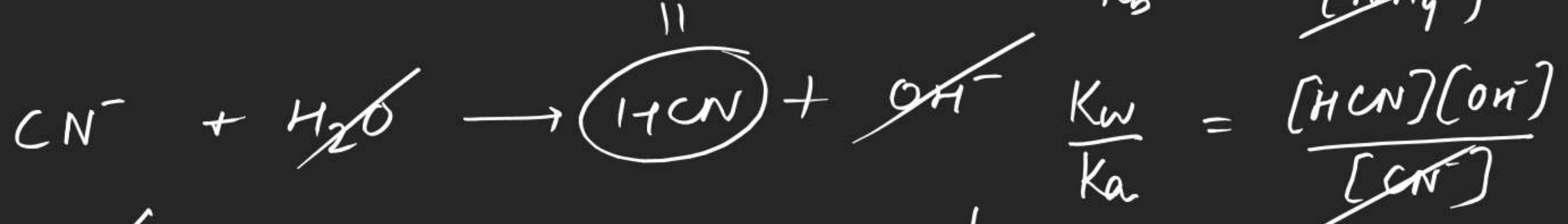
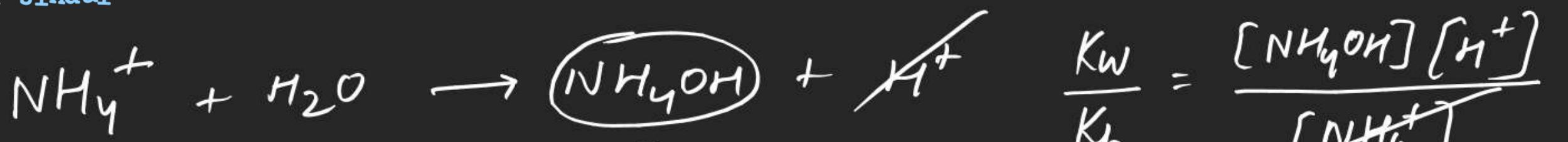


$$0.1\cancel{x} > y \quad 0.1 \quad y$$

$$K_{a_2} = \frac{0.1 \times y}{0.1 \times \cancel{x}}$$

$$y = \alpha K_{a_2} = \underline{\underline{10 K_{a_1} K_{a_2}}}$$





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

①

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

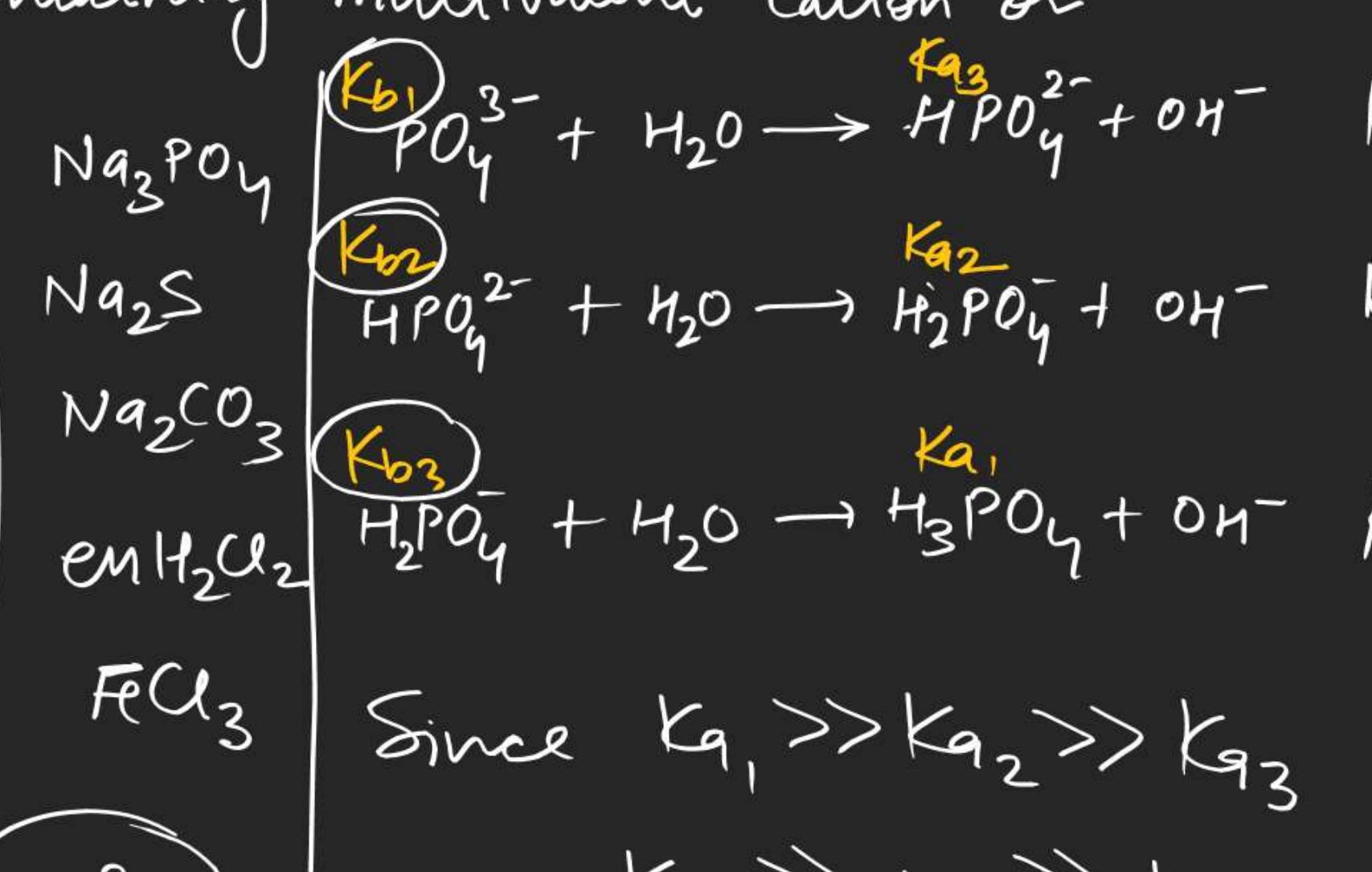
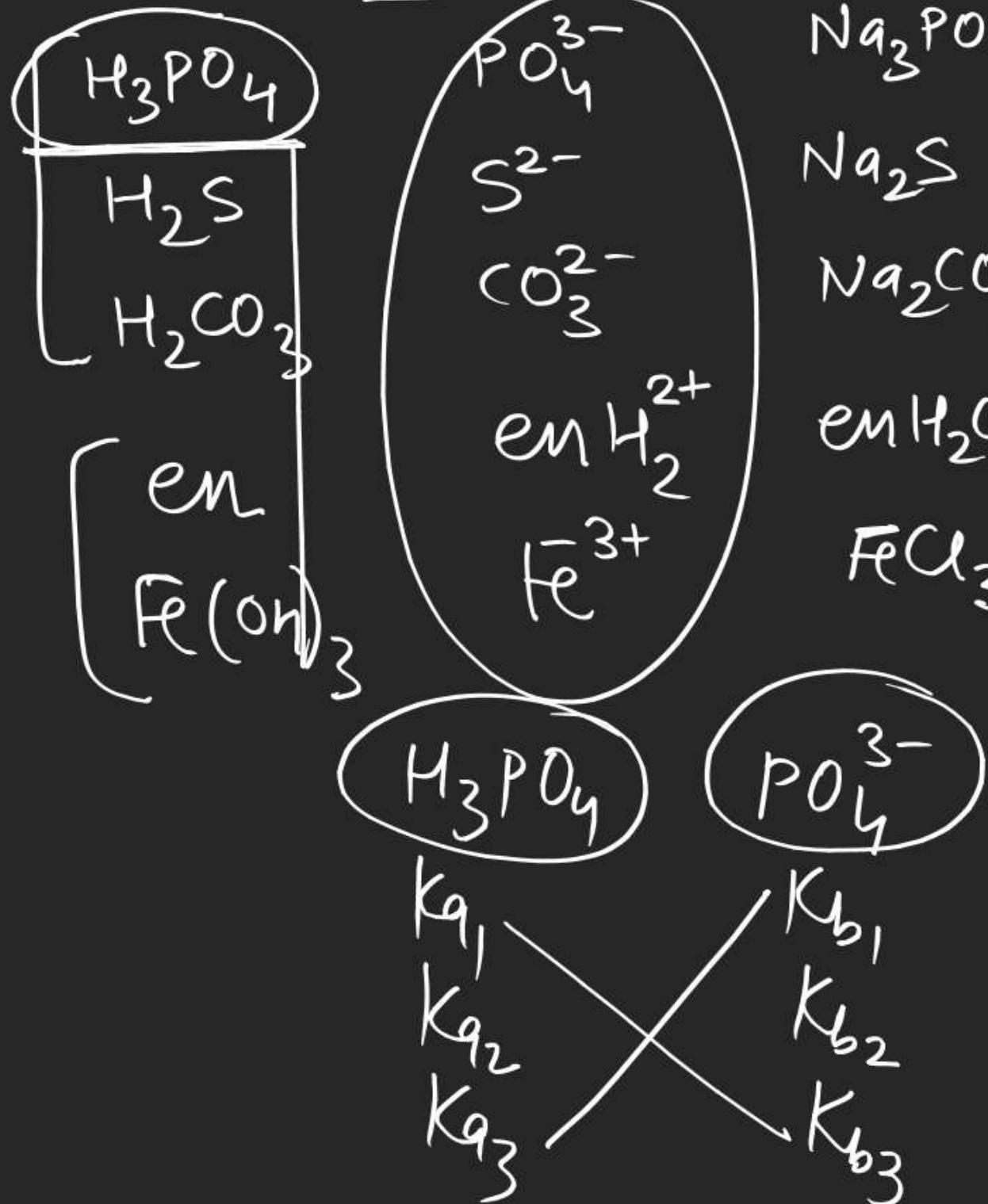
②

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

③

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

Case-5 : solution containing multivalent cation or anion.



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

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

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

$$x \gg y \gg z$$

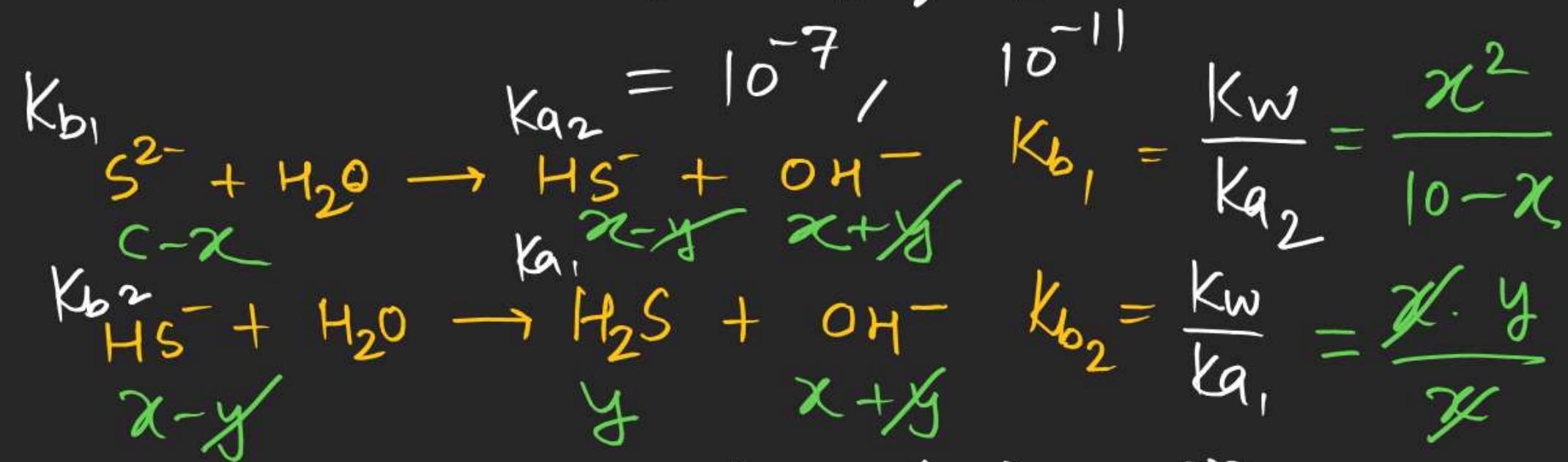
find  $K_{b_1}$  &  $K_{b_2}$  of  $S^{2-}$ . Given  $K_{a_1}$  &  $K_{a_2}$  of  $H_2S$

$$K_{b_1} = \frac{K_w}{K_{a_2}} = 10^{-3}$$

$$K_{b_2} = \frac{K_w}{K_{a_1}} = 10^{-7}$$

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

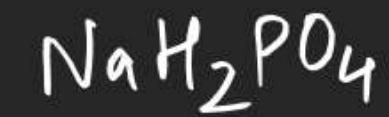
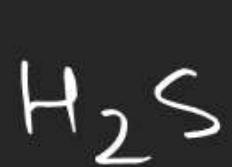
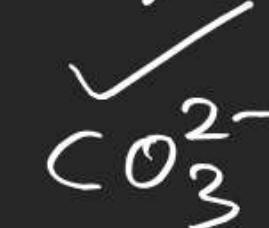
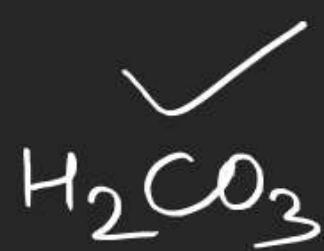
$$K_{b_2} = y = 10^{-7}$$

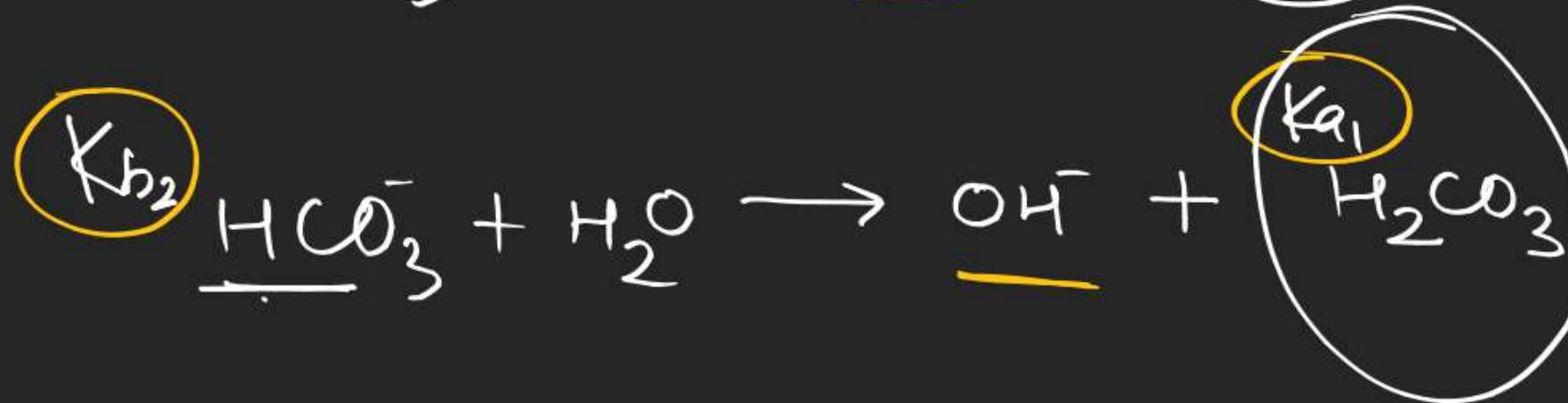


$$\frac{K_w}{10^{-11}} = 10^{-3} = \frac{x^2}{10-x}$$

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

$$x = 0.1$$

Case-VIpH of a solution containing amphiprotic salt

①  $\text{NaHCO}_3$ 

$$K_{a_2} = \frac{[\text{H}^+] [\text{CO}_3^{2-}]}{[\text{HCO}_3^-]}$$

$$\frac{K_w}{K_{a_1}} = \frac{[\text{OH}^-] [\text{H}_2\text{CO}_3]}{[\text{HCO}_3^-]}$$

$$\frac{K_{a_2} K_{a_1}}{K_w} = \frac{[\text{H}^+]}{[\text{OH}^-]} = \frac{[\text{H}^+]^2}{K_w}$$

$$[\text{H}^+] = \sqrt{K_{a_2} K_{a_1}}$$

$$\text{pH} = \frac{1}{2} (\text{p}K_{a_2} + \text{p}K_{a_1})$$

S-I      24 - 38

NaH<sub>2</sub>PO<sub>4</sub>

Na<sub>2</sub>HPO<sub>4</sub>

