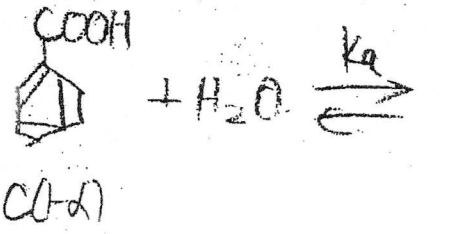
＜2000年 前期化学試験解答例＞

1. 1) 

C(1−α)　　Cα　　Cα

$[H_3O^+] \fallingdotseq C\alpha = 2.10\times10^{-3}$

$\alpha = \frac{2.10\times10^{-3}}{0.072} = 2.92\times10^{-2} \fallingdotseq \underline{2.9\times10^{-2}}$

2) $Ka = \frac{C\alpha\times C\alpha}{C(1-\alpha)} \fallingdotseq C\alpha^2$ 　$(\alpha \ll 1,\ \alpha - 1 \fallingdotseq 1)$

$Ka = C\alpha^2 = C'\alpha'^2$

$\left(\frac{\alpha'}{\alpha}\right)^2 = \frac{C}{C'} = 10$

$\left(\frac{\alpha'}{\alpha}\right) = 3.16 \fallingdotseq \underline{3.2}$ (倍)

$[H_3O^+]' \fallingdotseq C'\alpha'$

$\frac{[H_3O^+]'}{[H_3O^+]} = \frac{C'\alpha'}{C\alpha} = \frac{1}{10}\times3.16 \fallingdotseq \underline{0.32}$ (倍)

3) $Ka = C\alpha^2 = 0.072\times(2.92\times10^{-2})^2$

$= 0.614\times10^{-4} \fallingdotseq \underline{6.1\times10^{-5}}$ (mol dm^{-3})

2.

$$\begin{cases} NH_3 + H_2O \overset{K_b}{\rightleftharpoons} NH_4^+ + OH^- \\ C(1-\beta) \qquad\qquad C\beta \quad C\beta \\ NH_4Cl \longrightarrow NH_4^+ + Cl^- \\ C_s - C_s \qquad\qquad C_s \quad C_s \end{cases}$$

$$K_b = \frac{[NH_4^+][OH^-]}{[NH_3]} = \frac{(C\beta + C_s) \times C\beta}{C(1-\beta)}$$

$$\fallingdotseq (C\beta + C_s)\beta \quad , \quad (\beta \ll 1,\ 1-\beta \fallingdotseq 1)$$

$$K_b = C\beta^2 + C_s\beta \fallingdotseq C_s\beta \quad , \quad (\beta^2 \text{無視})$$

$$[OH^-] \fallingdotseq C\beta = C \times \frac{K_b}{C_s}$$

$$= \frac{0.10}{0.40} \times 1.79 \times 10^{-5}$$

$$= 0.448 \times 10^{-5} \fallingdotseq 4.5 \times 10^{-6} \ (mol\,dm^{-3})$$

フェノールフタレイン

$$\underset{\text{無色}}{HI_n} + H_2O \overset{K_{In}}{\rightleftharpoons} \underset{\text{赤色}}{I_n^-} + H_3O^+$$

$$C(1-\alpha) \qquad C\alpha \quad C\alpha$$

$$K_{In} = \frac{[I_n^-][H_3O^+]}{[HI_n]} \qquad \left(\frac{[I_n^-]}{[HI_n]} = \frac{C\alpha}{C(1-\alpha)} \fallingdotseq \alpha \right)$$

$$[H_3O^+] = \frac{[HI_n]}{[I_n^-]} K_{In} = \frac{K_{In}}{\alpha}$$

2. 統

$$[H_3O^+] = \frac{K_w}{[OH^-]}$$

$$= \frac{1.0\times10^{-14}}{4.48\times10^{-6}} = 2.05\times10^{-9}$$

$$[H_3O^+] = \frac{K_{Im}}{\alpha} = 2.05\times10^{-9}$$

$$\alpha = \frac{K_{Im}}{2.05\times10^{-9}} = \frac{3.2\times10^{-10}}{2.05\times10^{-9}}$$

$$= 0.156 \qquad 16\%$$

3.

$$\begin{cases} NH_4Cl \longrightarrow NH_4^+ + Cl^- \\ \quad c \quad\quad\; c \quad\; c \\ NH_4^+ + H_2O \overset{K_h}{\rightleftharpoons} NH_3 + H_3O^+ \\ c(1-h) \qquad\quad ch \quad\; ch \end{cases}$$

$$K_h = \frac{ch\times ch}{c(1-h)} \fallingdotseq ch^2 \qquad (h \ll 1,\ 1-h \doteq 1)$$

$$[H_3O^+] \doteq ch = \sqrt{ckh}$$

$$K_h = \frac{[NH_3][H_3O^+]}{[NH_4^+]} = \frac{[NH_3]\;K_w}{[NH_4^+][OH^-]}$$