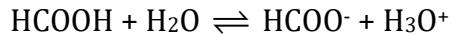


Άσκηση: 7.29

α) $\text{pH} = 2 \Rightarrow [\text{H}_3\text{O}^+] = 10^{-2} \text{ M}$



ι.ι. (M) $c - x \qquad x \qquad x = 10^{-2} \text{ M}$

$$K_a = \frac{x^2}{c-x} \approx \frac{x^2}{c} \Rightarrow 2 \cdot 10^{-4} = \frac{(10^{-2})^2}{c} \Rightarrow c = 0,5 \text{ M}$$

$$c = \frac{m}{M_r \cdot 0,1} \Rightarrow 0,5 = \frac{m}{46 \cdot 0,1} \Rightarrow m = 2,3 \text{ g} \Rightarrow 2,3\% \text{ w/v}$$

β) $[\text{HCOOH}] = 0,5 - x \approx 0,5 \text{ M}$

$$[\text{HCOO}^-] = x = 10^{-2} \text{ M}$$

$$[\text{H}_3\text{O}^+] = 10^{-2} + 10^{-12} \approx 10^{-2} \text{ M}$$

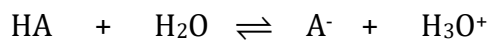
$$[\text{OH}^-] = 10^{-12} \text{ M} \quad (\text{από τον αυτοϊοντισμό του νερού})$$

$$[\text{H}_2\text{O}] = 55,5 \text{ M}$$

γ) $[\text{H}_3\text{O}^+]_{\text{H}_2\text{O}} = 10^{-12} \text{ M}$

Άσκηση 7.30

α) $c_{\text{HA}} = \frac{0,1}{0,5} = 0,2 \text{ M}$



ι.ι. (M) $0,2 - x \qquad x \qquad x$

$$K_a = \frac{x^2}{c-x} \approx \frac{x^2}{c} \qquad 5 \cdot 10^{-6} = \frac{(x)^2}{0,2} \Rightarrow x = 10^{-3} \text{ M}$$

$$\text{pH} = -\log [\text{H}_3\text{O}^+] = 3$$

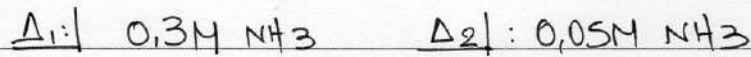
$$a = \frac{10^{-3}}{0,2} \Rightarrow a = 0,005 \text{ M}$$

β) $[\text{HA}] = 0,2 - x \approx 0,2 \text{ M}$

$$[\text{A}^-] = [\text{H}_3\text{O}^+] = 0,001 \text{ M}$$

$$[\text{OH}^-] = 10^{-11} \text{ M} \quad (\text{από τον αυτοϊοντισμό του νερού})$$

$$[\text{H}_2\text{O}] = 55,5 \text{ M}$$



$$\underline{\underline{A}} \Delta_1: K_b = \frac{a_1^2 \cdot c_1}{1-a_1} \approx a_1^2 \cdot c_1, \quad 1-a_1 \approx 1 \quad \frac{K_b}{c} < 10^{-2}$$

$$\text{apa: } K_b = a_1^2 \cdot 0,3 \quad (1)$$

$$\underline{\underline{A}} \Delta_2: K_b = \frac{a_2^2 \cdot c_2}{1-a_2} \approx a_2^2 \cdot c_2, \quad 1-a_2 \approx 1 \quad \frac{K_b}{c} < 10^{-2}$$

$$\text{apa: } K_b = a_2^2 \cdot 0,05 \quad (2)$$

$$\text{atau tulis (1) dan (2): } a_1^2 \cdot 0,3 = a_2^2 \cdot 0,05 \Rightarrow \frac{a_2}{a_1} = \sqrt{\frac{0,3}{0,05}}$$

$$\frac{a_2}{a_1} = \sqrt{6}$$

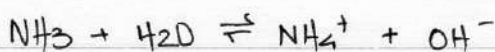
$$\underline{\underline{B}} \quad \begin{array}{l} \Delta_1 + \Delta_2 \Rightarrow \Delta_3 \\ V_1 + 4V_1 \Rightarrow V_3 = 5V_1 \end{array}$$

$$\underline{\underline{A}} \Delta_1: n_1 = 0,3V_1$$

$$\underline{\underline{A}} \Delta_2: n_2 = 0,05 \cdot 4V_1 = 0,2V_1$$

$$\underline{\underline{A}} \Delta_3: n_1 + n_2 = 0,3V_1 + 0,2V_1 = 0,5V_1 = n_3$$

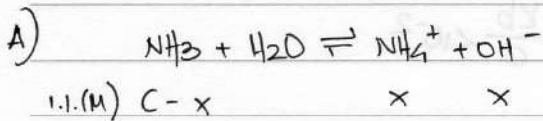
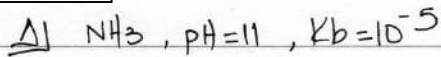
$$\Delta_{n\lambda}: 0,5V_1 = C_3 \cdot V_3 \Rightarrow 0,5V_1 = C_3 \cdot 5V_1 \Rightarrow C_3 = 0,1M$$



$$\left. \begin{array}{l} K_b = \frac{x^2}{0,1-x} \\ \frac{K_b}{0,1} < 10^{-2}, \quad 0,1-x \approx 0,1 \end{array} \right\} \quad 10^{-5} = \frac{x^2}{10^{-1}} \Rightarrow x = 10^{-3} \Rightarrow [\text{OH}^-] = 10^{-3}M \Rightarrow [\text{H}_3\text{O}^+] = 10^{-11}M$$

pH = 11

7.32

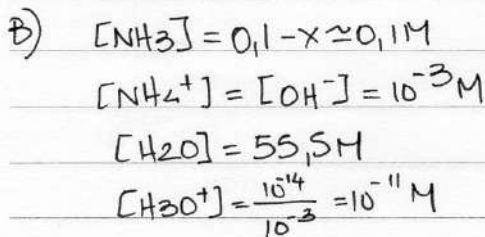


$\text{pH}=11 \Rightarrow \text{pOH}=3 \Rightarrow [\text{OH}^-]=10^{-3}\text{M}$

$K_b = \frac{x^2}{C-x}$ } $10^{-5} = \frac{(10^{-3})^2}{C} \Rightarrow C=0,1\text{M}$, άρα η προσέγγιση $C-x \approx C$ θεωρείται.

6€ 100ml ΔΙΟΣ: $C_{\text{NH}_3} = \frac{m_{\text{NH}_3}}{\text{Mr} \cdot V_{\text{ΔΙΟΣ}}} \Rightarrow 0,1 = \frac{m}{17 \cdot 0,1} \Rightarrow m=0,17\text{g}$

Άρα 0,17% w/w



7.33

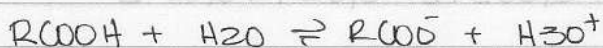
Δ

9,2g RCOOH

400ml, $\text{pH}=2$, $K_a=2 \cdot 10^{-4}$

a)

Το RCOOH είναι αδένες οξύ, άρα κατά τη διάλυση του στο H_2O ιοντίζεται σύμφωνα με την ισορροπία ιοντισμού:



$\text{pH}=2 \Rightarrow [\text{H}_3\text{O}^+]=10^{-2}\text{M} \Rightarrow x=10^{-2}\text{M}$, θεωρούμε $C-x \approx C$, Άρα:

$K_a \text{RCOOH} = \frac{x^2}{C-x} \approx \frac{x^2}{C} \Rightarrow 2 \cdot 10^{-4} = \frac{(10^{-2})^2}{C} \Rightarrow C=0,5\text{M}$

$0,5 \cdot 10^{-2} \approx 0,5$, η προσέγγιση δεκτή.

βαθμός 104116 μολι: $\alpha = \frac{x}{c} = \frac{10^{-2}}{0,5} = 0,02$ ή 2%

β) $C_2H_4O_2 = \frac{M_{R_{COOH}}}{M_r \cdot \nu} \Rightarrow 0,5 = \frac{9,2}{M_r \cdot 0,4} \Rightarrow M_r = 46$

Άρα για τον συντακτικό τύπο του οξέος ($C_nH_{2n}O_2$):

$$M_r = 14n + 32 = 46 \Rightarrow n = 1 \text{ δηλαδή } HCOOH$$