

ΑΠΑΝΤΗΣΕΙΣ

ΘΕΜΑ Α

A1) δ, A2) γ, A3) α, A4) β, A5) δ

ΘΕΜΑ Β

B1) α) F: $1s^2 2s^2 2p^5$

Na: $1s^2 2s^2 2p^6 3s^1$

K: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

$r_F < r_{Na} < r_K$

Το K έχει περισσότερες στιβάδες μετά το Na και λιγότερες το F.

β) Cr: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$

Cr: 4^η περίοδο (n=4) VIB ομάδα

Fe²⁺: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$

γ) F, Cl, H

F⁻: $1s^2 2s^2 2p^6$

Cl⁻: $1s^2 2s^2 2p^6 3s^2 3p^6$

H⁻: $1s^2$

B2) $\text{HCOOH} + \text{CH}_3\text{NH}_2 \longrightarrow \text{HCOO}^- \text{CH}_3 \text{NH}_3^+$

$\text{HCOO}^- \text{CH}_3 \text{NH}_3^+ \longrightarrow \text{HCOO}^- + \text{CH}_3\text{NH}_3^+$

$\text{HCOO}^- + \text{H}_2\text{O} \rightleftharpoons \text{HCOOH} + \text{OH}^-$

$\text{CH}_3\text{NH}_3^+ + \text{H}_2\text{O} \rightleftharpoons \text{CH}_3\text{NH}_2 + \text{H}_3\text{O}^+$

$$\text{Ka}_{\text{HCOOH}} = \text{Kb}_{\text{CH}_3\text{NH}_2} \quad \text{και} \quad \left. \begin{array}{l} \text{Ka}_{\text{CH}_3\text{NH}_3^+} = 10^{-10} \\ \text{Kb}_{\text{HCOO}^-} = 10^{-10} \end{array} \right\} \text{Ka}_{\text{CH}_3\text{NH}_3^+} = \text{Kb}_{\text{HCOO}^-}$$

Άρα το δ/μα είναι ουδέτερο.

β) $\text{HCOOH} + \text{NaOH} \rightarrow \text{HCOONa} + \text{H}_2\text{O}$

$\text{HCOONa} \rightarrow \text{HCOO}^- + \text{Na}^+$

$\text{HCOO}^- + \text{H}_2\text{O} \rightleftharpoons \text{HCOOH} + \text{OH}^-$

Άρα το δ/μ είναι βασικό.

B3) Το διάγραμμα (ii)

Από νόμο αραίωσης το Ostwald $a = \sqrt{\frac{\text{Ka}}{C}}$

Το a είναι αντιστρόφως ανάλογο της \sqrt{C}

άρα αν το C ↑ ⇒ a ↓

B4) α) Η αντίδραση είναι εξώθερμη διότι : $H_{\text{προϊόντων}} < H_{\text{αντιδρώντων}}$

β) i) $\Delta H = \beta - \alpha = 348 - 209 = 139$

άρα $\Delta H = -139 \text{ KJ/mol}$

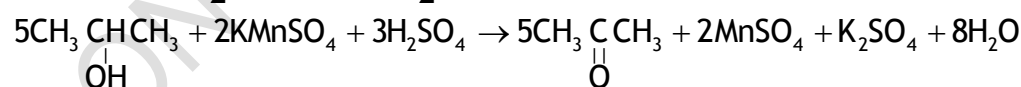
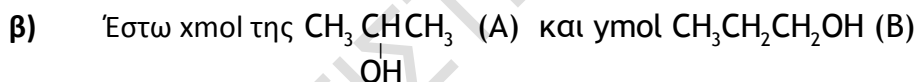
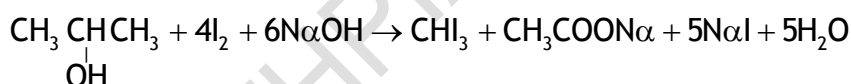
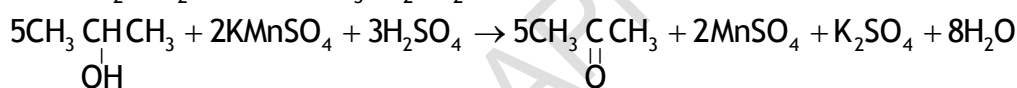
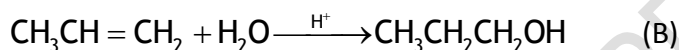
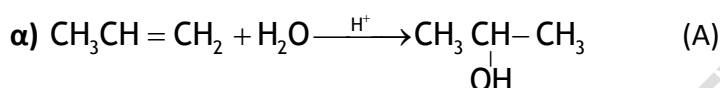
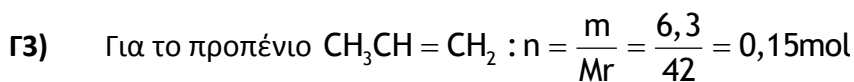
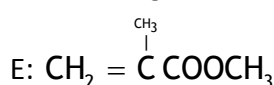
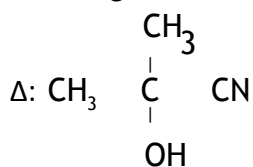
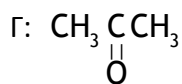
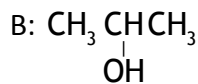
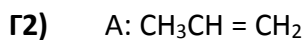
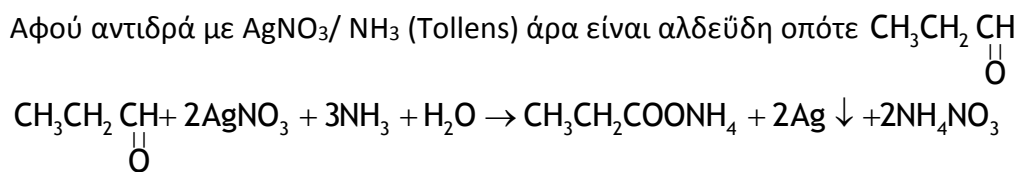
ii) $E_{\alpha} = \alpha = 209 \text{ KJ/mol}$

iii) $E_{\alpha} = \beta = 348 \text{ KJ/mol}$

ΘΕΜΑ Γ

Γ1) $C_v H_{2v} O$

$M_r = 58 \Rightarrow 14v + 16 = 58 \Rightarrow v=3$



$\frac{x}{2} \quad \frac{2}{5} \cdot \frac{x}{2} = \frac{x}{5}\text{mol}$



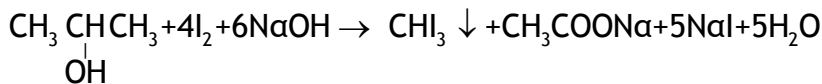
$\frac{y}{2}\text{mol} \quad \frac{4}{5} \cdot \frac{y}{2} = \frac{2y}{5}\text{mol}$

$n_{\text{KMnO}_4} = c \cdot v = 0,01 \cdot 2,8 = 0,028\text{mol} \Rightarrow \frac{x}{5} + \frac{2y}{5} = 0,028 \Rightarrow$

$\Rightarrow x + 2y = 0,14 \quad (1)$

2^ο μέρος $\frac{x}{2}$ mol A και $\frac{y}{2}$ mol B

Με I₂/NaOH αντιδρά μόνο το A



$\frac{x}{2}$ mol $\frac{x}{2}$ mol

$$n_{\text{ζημε}} = \frac{m}{M_r} = \frac{19,7}{394} = 0,05 \Rightarrow \frac{x}{2} = 0,05 \Rightarrow x = 0,1 \text{ mol } \text{CH}_3 \underset{\text{OH}}{\text{CH}} \text{CH}_3$$

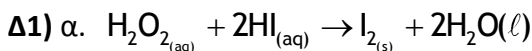
Από την (1) $y = 0,02 \text{ mol } \text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

γ) Συνολικά $x + y = 0,12 \text{ mol}$ προϊόντα.

Από τα $\frac{0,15 \text{ mol προπενίου μετατράπηκαν τα } 0,12 \text{ mol}}{100}$ $\alpha = ?$

$$\alpha = 80\%$$

ΘΕΜΑ Δ



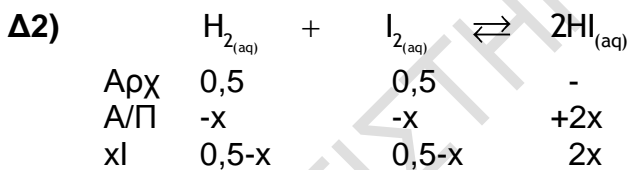
β. H₂O₂ : οξειδωτικό

HI : αναγωγικό

γ. $C_{\text{H}_2\text{O}_2} = \frac{m}{V} = \frac{17}{0,1} = 170 \text{ M}$

$$n_{\text{H}_2\text{O}_2} = c \cdot v = 170 \cdot 0,4 = 68 \text{ mol}$$

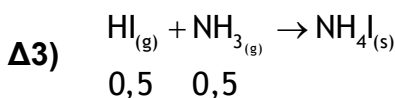
$$n_{\text{H}_2\text{O}_2} = n_{\text{I}_2} = 68 \text{ mol}$$



$$K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]} \Rightarrow 64 = \left(\frac{2x}{0,5-x} \right)^2 \Rightarrow \frac{2x}{0,5-x} = \pm 8 \Rightarrow$$

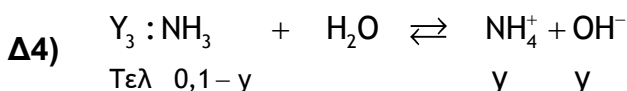
- $2x = 4 - 8x \Rightarrow x = 0,4 \text{ mol}$ ή
- $2x = -4 + 8x \Rightarrow x = \text{απορ.}$

Άρα στη ΧΙ: $n_{\text{H}_2} = n_{\text{I}_2} = 0,5 - 0,4 = 0,1 \text{ mol}$
 $n_{\text{HI}} = 0,8 \text{ mol}$



α) Η Χ.Ι δεν μετατοπίζεται,

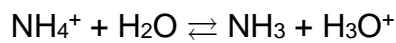
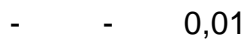
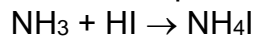
β) Το NH₄I είναι στερεό.



$$pH=11 \Rightarrow pOH=3 \Rightarrow y = 10^{-3}M$$

$$K_b = \frac{y^2}{0,1-y} = \frac{y^2}{0,1} = 10^{-5}$$

i) Έστω αντιδρούν πλήρως



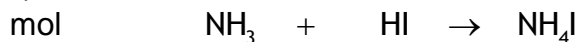
$$n_{NH_3} = 0,1 \cdot 0,1 = 0,01 \text{ mol}$$

$$n_{HI} = n$$

$$pH = 9$$

$$pH < 7 \text{ απορ}$$

ii) Άρα για να έχω $pH = 9$ πρέπει να περισσεύει NH_3 .



$$C_{NH_3} = \frac{0,01-n}{V} (M)$$

$$C_{NH_4I} = \frac{n}{V} (M)$$

$$pH'=9 \Rightarrow pOH'=5$$

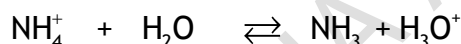
Από τύπο $p \cdot \Delta$

$$pOH' = pK_b + \log \frac{C_{\alpha}}{C_{\beta}} \Rightarrow C_{NH_3} = C_{NH_4I} \Rightarrow$$

$$\Rightarrow 0,01-n = n \Rightarrow n = 5 \cdot 10^{-3} \text{ mol}$$

Δ5) α)

$$C_{NH_4I} = \frac{0,01}{0,1} = 0,1M$$



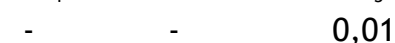
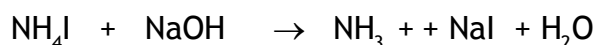
$$K_a = \frac{K_w}{K_b} = \frac{10^{-14}}{10^{-5}} = 10^{-9}$$

$$K_a = \frac{\omega^2}{0,1} \Rightarrow \omega = 10^{-5} M \text{ άρα } pH=5$$

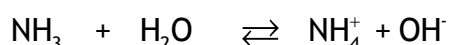
$$\beta) n_{NH_4I} = 0,01 \cdot \text{mol}$$

$$n_{NaOH} = n$$

i) Έστω αντιδρούν πλήρως $n=0,01 \text{ mol}$



$$C_{NH_3} = \frac{0,01}{0,1} = 0,1M$$



$$K_b = \frac{z^2}{0,1} \Rightarrow z = 10^{-3} M \text{ άρα } pOH=3 \text{ όποτε } pH=11 \text{ απορ.}$$

ii) Άρα για να έχω $pH=9$ πρέπει να περισσεύει NH_4I

mol	NH_4I	+	NaOH	\rightarrow	NH_3	+	NaI	+	H_2O
Αρχ	0,01		n		-				
Α/Π	-n		-n		+n		n		n
Τελ	0,01-n		-		n		n		n

$$\text{pH}=9 \Rightarrow \text{pOH} = 5$$

$$\left. \begin{aligned} c_{\text{NH}_4\text{I}} &= \frac{0,01-n}{v} \\ c_{\text{NH}_3} &= \frac{n}{v} \end{aligned} \right\} p \cdot \Delta$$

$$\text{pOH} = \text{pKb} + \log \frac{c_{\alpha}}{c_{\beta}} \Rightarrow$$

$$c_{\text{NH}_4\text{I}} = c_{\text{NH}_3} \Rightarrow 0,01-n = n \Rightarrow$$

$$n = 0,005 \text{ mol}$$

ΦΡΟΝΤΙΣΤΗΡΙΑ ΑΡΓΥΡΗ ΣΙΡΔΑΡΗ