

ΘΕΜΑ Α

A₁) β A₂) α A₃) γ A₄) δ A₅) δ

ΘΕΜΑ Β

B₁) α) ${}_{26}\text{Fe}^{2+} : 1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$ $n=3$ άρα λάθος

β) ${}_{20}\text{Ca} : 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

$\boxed{\uparrow\downarrow}$ 4s είναι παραμαγνητικό

${}_{28}\text{Ni} : 1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$

$\boxed{\uparrow\downarrow\uparrow\downarrow\uparrow\uparrow}$ 3d είναι παραμαγνητικό

άρα α είναι λάθος.

B₂) α → 4

 β → 5

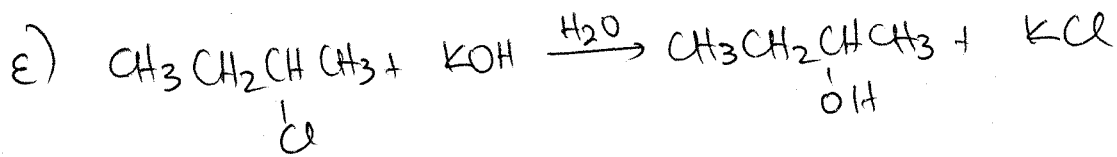
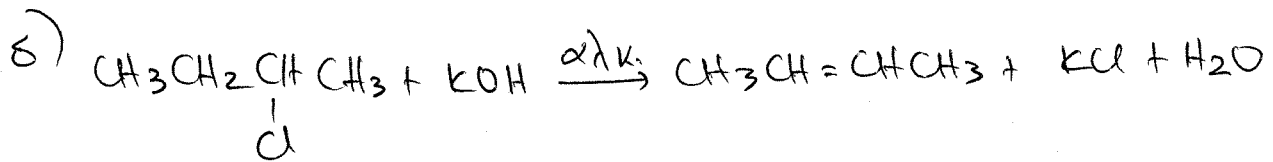
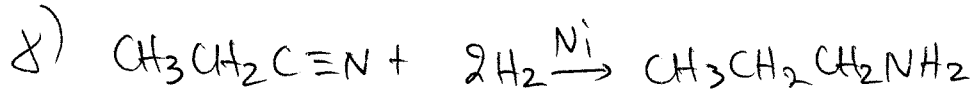
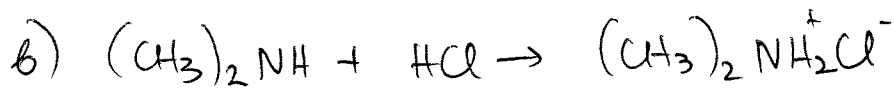
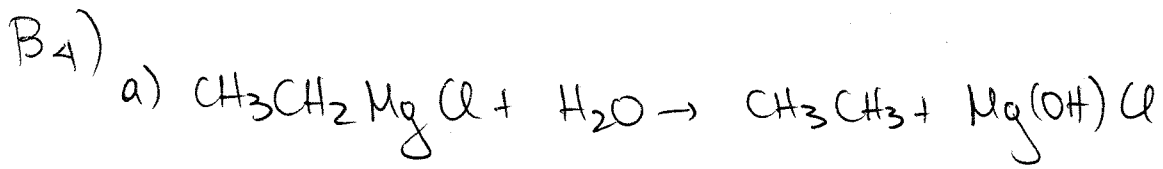
 γ → 1

 δ → 3

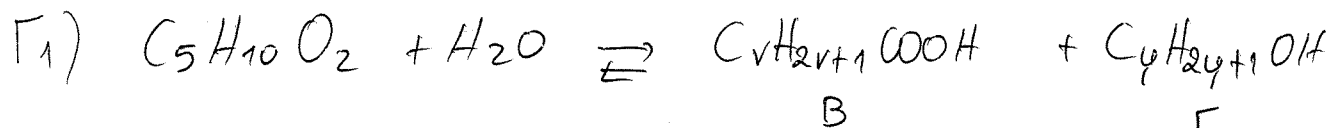
B₃) α) Για Β: $E_{i1} \ll E_{i2} < E_{i3}$ άρα έχει 1e⁻ εξωτερική στοιβάδα οπότε ΙΑομάδα

β) Κατά την απογύρευση του 2^{ου} e⁻ στο Β αλλάζουμε στοιβάδα, γιατί παρατηρείται μεγάλη αύξηση της ενέργειας ιοντισμού, οπότε ισχύει $E_{i2B} > E_{i2Γ}$

γ) Όποιο έχει μεγαλύτερη E_{i1} έχει μικρότερη αυτίνα
άρα $r_A < r_{Γ} < r_B$



ΘΕΜΑ Γ

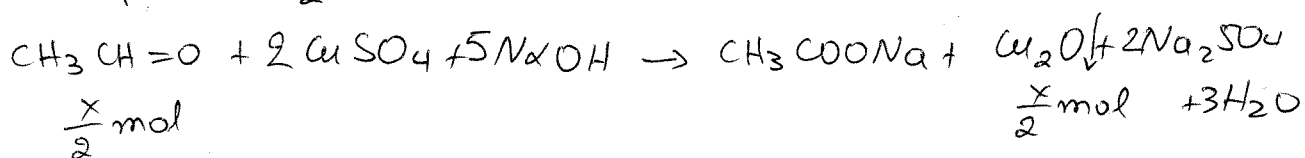
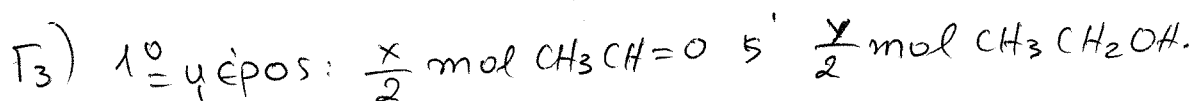
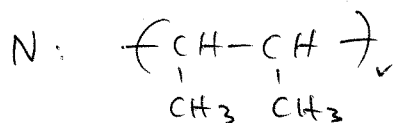
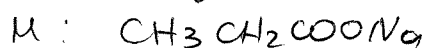
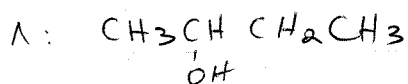
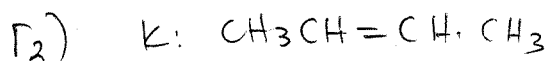
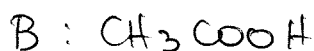
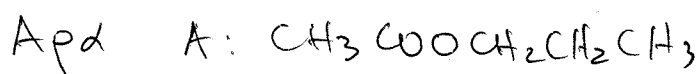


$$Mr_B = Mr_\Gamma \Rightarrow 14v + 46 = 14\gamma + 18 \Rightarrow 14(\gamma - v) = 46 - 18 =$$

$$14(\gamma - v) = 28 \Rightarrow \gamma - v = 2$$

$$v + 1 + \gamma = 5 \Rightarrow v + \gamma = 4$$

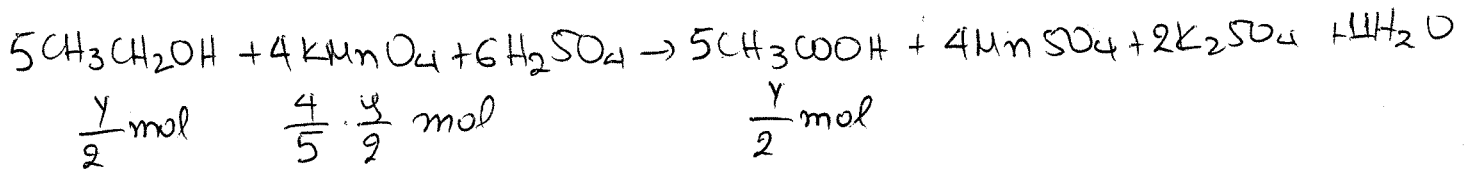
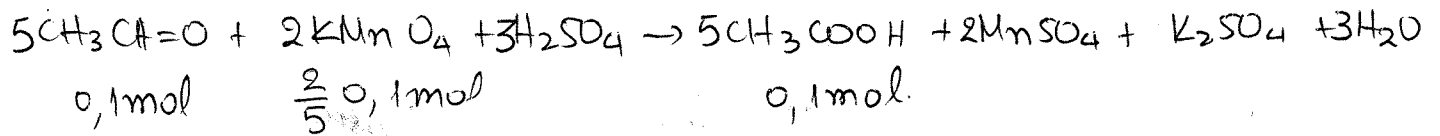
$$\begin{array}{r} 2\gamma = 6 \Rightarrow \gamma = 3 \\ v = 1 \end{array}$$



$$n_{Cu_2O} = \frac{m}{Mr} = \frac{14,3}{143} \Rightarrow \frac{x}{2} = 0,1 \Rightarrow x = 0,2 \text{ mol}$$

$$2^{\circ} = \text{γέρος} \quad \frac{x}{2} \text{ mol CH}_3\text{CH=O} \quad \leftrightarrow \quad \frac{y}{2} \text{ mol CH}_3\text{CH}_2\text{OH}$$

0,1 mol



$$\Gamma_{\text{CH}_3\text{COOH}}: \quad n = \frac{m}{M_r} = \frac{18}{60} \Rightarrow n = 0,3 \text{ mol} \Rightarrow$$

$$\Rightarrow 0,1 + \frac{y}{2} = 0,3 \Rightarrow \frac{y}{2} = 0,2 \Rightarrow \boxed{y = 0,4 \text{ mol}}$$

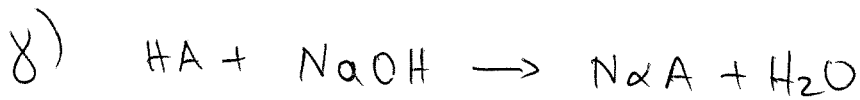
$$n_{\text{KMnO}_4} = \frac{2}{5} \cdot 0,1 + \frac{4}{5} \cdot 0,2 = \frac{0,2}{5} + \frac{0,8}{5} = \frac{1}{5} = 0,2 \text{ mol.}$$

$$c = \frac{n}{V} \Rightarrow 0,2 = \frac{0,2}{V} \Rightarrow V = 1 \text{ L}$$

ΘΕΜΑ Δ

Δ1) α) Αφού το πρότυπο δισα είναι βάσιυό, η ομομέτρηση είναι αλληλαίμετρα

β) Το ομομετρούμενο μετράται σε ~~κωνίτη~~ ^{γιφώνιο} και το πρότυπο σε προχοΐδα.



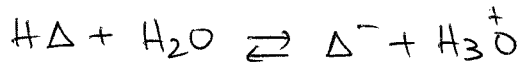
Για πλήρη εξουδετέρωση: $n_{\text{HA}} = n_{\text{NaOH}} \Rightarrow$

$$\Rightarrow C_{\text{HA}} \cdot V_{\text{HA}} = C_{\text{NaOH}} \cdot V_{\text{NaOH}} \Rightarrow C_{\text{HA}} \cdot 0,02 = 0,1 \cdot 0,02 \Rightarrow$$

$$\boxed{C_{\text{HA}} = 0,1 \text{ M}}$$

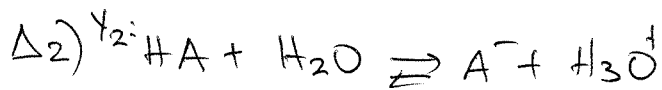
$$\delta) \text{p}K_{\text{a}} = 5 \Rightarrow K_{\text{aHA}} = 10^{-5}$$

$$\text{pH}_{\text{Y}_2} = 4 \Rightarrow [\text{H}_3\text{O}^+] = 10^{-4} \text{ M}$$



$$K_{\text{aHA}} = \frac{[\text{A}^-][\text{H}_3\text{O}^+]}{[\text{HA}]} \Rightarrow 10^{-5} = \frac{[\text{A}^-] \cdot 10^{-4}}{[\text{HA}]} \Rightarrow \frac{[\text{HA}]}{[\text{A}^-]} = \frac{10^{-4}}{10^{-5}} \Rightarrow$$

$$\frac{[\text{HA}]}{[\text{A}^-]} = \frac{10}{1}$$



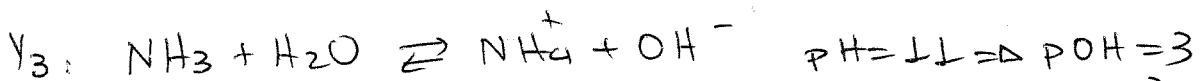
$$0,1 - x$$

$$x$$

$$x$$

$$\text{pH} = 4 \Rightarrow x = 10^{-4} \text{ M}$$

$$K_{\text{aHA}} = \frac{x^2}{0,1} \Rightarrow K_{\text{aHA}} = \frac{10^{-8}}{0,1} \Rightarrow \boxed{K_{\text{aHA}} = 10^{-7}}$$



$$0,1 - y$$

$$y$$

$$y$$

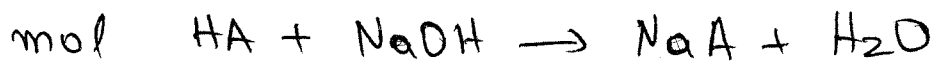
$$[\text{OH}^-] = y = 10^{-3} \text{ M}$$

$$K_{\text{bNH}_3} = \frac{y^2}{0,1} = \frac{10^{-6}}{0,1} = 10^{-5} \Rightarrow \boxed{K_{\text{bNH}_3} = 10^{-5}}$$

$$\Delta 3) \quad n_{HA} = C_{HA} \cdot V_1 = 0,1 V_1 \text{ mol}$$

$$n_{NaOH} = C_{NaOH} \cdot V_2 = 0,1 V_2 \text{ mol}$$

Για P.Δ πρέπει να περισεύει HA



$$\text{Αρχ} \quad 0,1 V_1 \quad 0,1 V_2 \quad - \quad -$$

$$\text{Τελ} \quad 0,1(V_1 - V_2) \quad - \quad 0,1 V_2$$

$$[HA]: C_1' = \frac{0,1(V_1 - V_2)}{V_1 + V_2} \quad \text{και} \quad [NaA] = \frac{0,1 V_2}{V_1 + V_2} = C_2'$$

$$\text{Για P.Δ: } pH = pK_a + \log \frac{C_2'}{C_1'} \Rightarrow C_1' = C_2' = \Delta$$

$$\frac{0,1(V_1 - V_2)}{V_1 + V_2} = \frac{0,1 V_2}{V_1 + V_2} \Rightarrow 0,1 V_1 = 0,2 V_2 \Rightarrow \frac{V_1}{V_2} = \frac{2}{1}$$

$$\Delta 4) \quad \gamma_5: \quad HA \quad C_1' = \frac{0,1}{3} \text{ M} \quad \text{και} \quad NaA \quad C_2' = \frac{0,1}{3} \text{ M}$$

$$n_{HA} = 0,011 \text{ mol} \quad n_{HCl} = 0,1 V_1' \text{ mol}$$

$$n_{NaA} = 0,011 \text{ mol}$$

Για να έχω P.Δ πρέπει να περισεύει το NaA



$$\text{Αρχ} \quad 0,1 V_1' \quad 0,011 \quad 0,011 \quad -$$

$$\text{Τελ} \quad - \quad 0,011 - 0,1 V_1' \quad 0,011 + 0,1 V_1'$$

$$\text{Το } pH = 6 \quad [NaA] = C_2'' = \frac{0,011 - 0,1 V_1'}{V_{\text{τελ}}}$$

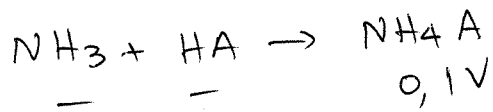
$$[HA] = C_1'' = \frac{0,011 + 0,1 V_1'}{V_{\text{τελ}}}$$

$$pH = pK_a + \log \frac{C_1''}{C_2''} \Rightarrow \frac{C_1''}{C_2''} = \frac{1}{10} \Rightarrow C_2'' = 10 C_1'' \Rightarrow$$

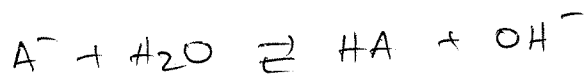
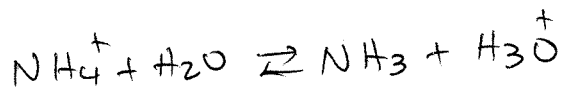
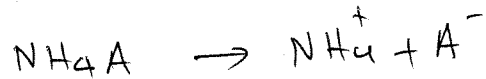
$$0,011 + 0,1 V_1' = 0,11 - V_1' \Rightarrow V_2' = 0,09 \text{ L} \approx 90 \text{ mL}$$

$$\Delta 5) \quad n_{HA} = 0,1 \text{ V mol}$$

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



$$[NH_4A] = \frac{0,1 \text{ V}}{2 \text{ V}} = 0,05 \text{ M}$$



$$K_{aHA} = 10^{-7} \quad K_{bA^-} = \frac{K_w}{K_a} = \frac{10^{-14}}{10^{-7}} \Rightarrow K_{bA^-} = 10^{-7}$$

$$K_{bNH_3} = 10^{-5} \quad K_{aNH_4^+} = \frac{K_w}{K_b} = \frac{10^{-14}}{10^{-5}} \Rightarrow K_{aNH_4^+} = 10^{-9}$$

Άρα $K_{bNH_3} > K_{aHA}$ και $K_{bA^-} > K_{aNH_4^+}$
Άρα το διάλυμα είναι βασικό

