

AK2 Seminar 2

Zadanie 1.

$$m(\text{urozak}) = 0,5000 \text{ g}$$

$$V(\text{HCl}) = 50 \text{ mL}$$

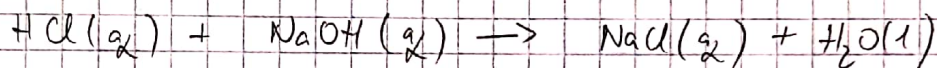
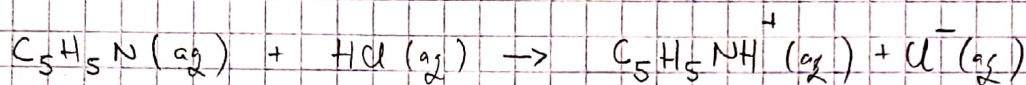
$$c(\text{HCl}) = 0,1000 \text{ mol dm}^{-3}$$

$$\left. \begin{array}{l} V(\text{HCl}) = 50 \text{ mL} \\ c(\text{HCl}) = 0,1000 \text{ mol dm}^{-3} \end{array} \right\} \begin{array}{l} n(\text{HCl})_{\text{uk}} = 50 \cdot 10^{-3} \text{ dm}^3 \cdot 0,1000 \text{ mol dm}^{-3} \\ = 5 \cdot 10^{-3} \text{ mol} \end{array}$$

$$V(\text{NaOH}) = 9,1 \text{ mL}$$

$$c(\text{NaOH}) = 0,1000 \text{ mol dm}^{-3}$$

$$\left. \begin{array}{l} V(\text{NaOH}) = 9,1 \text{ mL} \\ c(\text{NaOH}) = 0,1000 \text{ mol dm}^{-3} \end{array} \right\} \begin{array}{l} n(\text{NaOH}) = 9,1 \cdot 10^{-3} \text{ dm}^3 \cdot 0,1000 \text{ mol dm}^{-3} \\ = 9,1 \cdot 10^{-4} \text{ mol} \end{array}$$



$$\begin{aligned} n(\text{py}) &= n_{\text{REAG}}(\text{HCl}) = n_{\text{uk}}(\text{HCl}) - n_{\text{suw.}}(\text{HCl}) = n_{\text{uk}}(\text{HCl}) - n(\text{NaOH}) \\ &= 5 \cdot 10^{-3} \text{ mol} - 9,1 \cdot 10^{-4} \text{ mol} = 4,09 \cdot 10^{-3} \text{ mol} \end{aligned}$$

$$m(\text{py}) = 4,09 \cdot 10^{-3} \text{ mol} \cdot 79,1 \text{ g mol}^{-1} = 0,323 \text{ g}$$

$$w(\text{py}) = \frac{0,323 \text{ g}}{0,5000 \text{ g}} = 64,7\%$$

$$m(\text{urozak}) = 0,5000 \text{ g}$$

$$V(\text{AgNO}_3) = 50 \text{ mL}$$

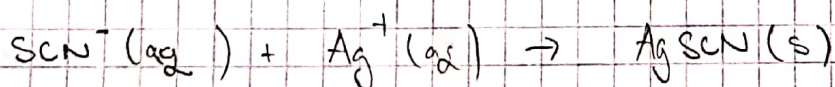
$$c(\text{AgNO}_3) = 0,1000 \text{ mol dm}^{-3}$$

$$\left. \begin{array}{l} V(\text{AgNO}_3) = 50 \text{ mL} \\ c(\text{AgNO}_3) = 0,1000 \text{ mol dm}^{-3} \end{array} \right\} \begin{array}{l} n_{\text{uk}}(\text{AgNO}_3) = 50 \cdot 10^{-3} \text{ dm}^3 \cdot 0,1000 \text{ mol dm}^{-3} \\ = 5 \cdot 10^{-3} \text{ mol} \end{array}$$

$$V(\text{NH}_4\text{SCN}) = 29,50 \text{ mL}$$

$$c(\text{NH}_4\text{SCN}) = 0,1000 \text{ mol dm}^{-3}$$

$$\left. \begin{array}{l} V(\text{NH}_4\text{SCN}) = 29,50 \text{ mL} \\ c(\text{NH}_4\text{SCN}) = 0,1000 \text{ mol dm}^{-3} \end{array} \right\} \begin{array}{l} n(\text{NH}_4\text{SCN}) = 29,50 \cdot 10^{-3} \text{ dm}^3 \cdot 0,1000 \text{ mol dm}^{-3} \\ = 2,95 \cdot 10^{-3} \text{ mol} \end{array}$$



$$\begin{aligned} n(\text{SCN}^-) &= n_{\text{REAG}}(\text{AgNO}_3) = n_{\text{uk}}(\text{AgNO}_3) - n_{\text{suw.}}(\text{AgNO}_3) \\ &= n_{\text{uk}}(\text{AgNO}_3) - n(\text{NH}_4\text{SCN}) = 5 \cdot 10^{-3} \text{ mol} - 2,95 \cdot 10^{-3} \text{ mol} \\ &= 2,05 \cdot 10^{-3} \text{ mol} \end{aligned}$$

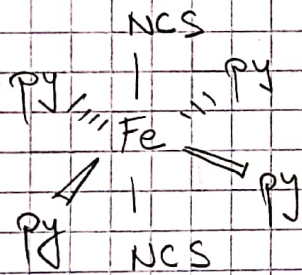
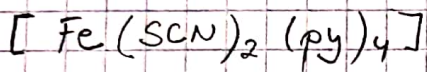
$$m(\text{SCN}^-) = 2,05 \cdot 10^{-3} \text{ mol} \cdot 58,078 \text{ g mol}^{-1} = 0,119 \text{ g}$$

$$w(\text{SCN}^-) = \frac{0,119 \text{ g}}{0,5000 \text{ g}} = 23,8\%$$

$$w(\text{Fe}) = 100 - w(\text{py}) - w(\text{SCN}^-) = 11,5\%$$

$$\frac{11,5 \text{ g}}{55,85 \text{ g mol}^{-1}} : \frac{23,8 \text{ g}}{58,078 \text{ g mol}^{-1}} : \frac{64,7}{79,1 \text{ g mol}^{-1}} = 0,206 \text{ mol} : 0,410 \text{ mol} : 0,818 \text{ mol} : 0,206 \text{ mol}$$

$$= 1 : 2 : 4$$



Zadatak 2.

$$a = 735 \text{ pm}$$

$$b = 936 \text{ pm}$$

$$c = 659 \text{ pm}$$

$$\alpha = 86,56^\circ$$

$$\beta = 113,23^\circ$$

$$\gamma = 125,8^\circ$$

$$z = 1$$

$$\rho = 1,51 \text{ g cm}^{-3}$$

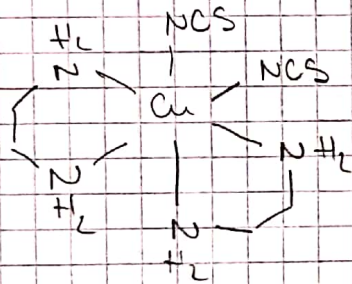
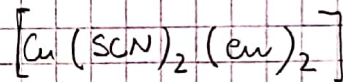
$$V = abc \cdot \sqrt{1 - \cos^2 \alpha - \cos^2 \beta - \cos^2 \gamma + 2 \cos \alpha \cos \beta \cos \gamma}$$

$$= 735 \cdot 10^{-8} \text{ cm} \cdot 936 \cdot 10^{-8} \text{ cm} \cdot 659 \cdot 10^{-8} \text{ cm} \cdot \sqrt{1 - \cos^2(86,56) - \cos^2(113,23) - \cos^2(125,8) + 2 \cdot \cos(86,56) \cdot \cos(113,23) \cdot \cos(125,8)}$$

$$= 3,289 \cdot 10^{-22} \text{ cm}^3$$

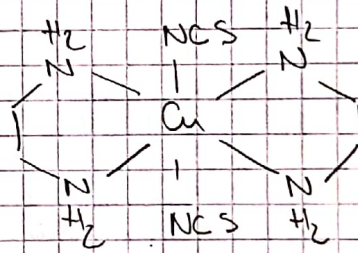
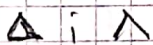
$$M = \frac{V \cdot \rho \cdot N_A}{z} = \frac{3,289 \cdot 10^{-22} \text{ cm}^3 \cdot 1,51 \text{ g cm}^{-3} \cdot 6,022 \cdot 10^{23} \text{ mol}^{-1}}{1}$$

$$= 299,07 \text{ g mol}^{-1}$$



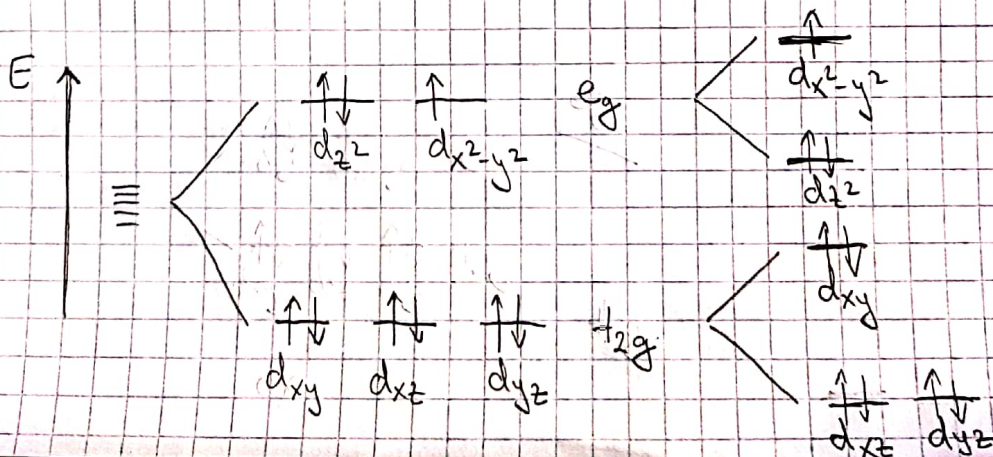
cis -

→ optički izomeri



trans - bis(etiendiamin)bis(tiocianato-N) bakar(II)

Jahn-Tellerov efekt za trans izomer



Zadatok 3.

KOMPLEKS B:

$$m(\text{uroak}) = 0,1096 \text{ g}$$

$$m(\text{BaSO}_4) = 0,2333 \text{ g}$$

$$n(\text{SCN}^-) = n(\text{BaSO}_4) = \frac{0,2333 \text{ g}}{233,356 \text{ g mol}^{-1}} = 9,997 \cdot 10^{-4} \text{ mol}$$

$$m(\text{SCN}^-) = 9,997 \cdot 10^{-4} \text{ mol} \cdot 58,078 \text{ g mol}^{-1} = 0,05806 \text{ g}$$

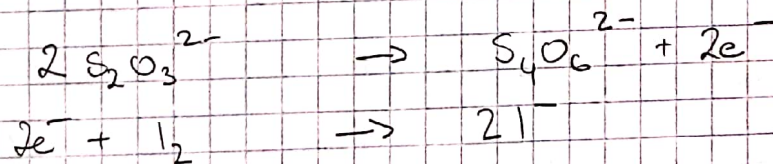
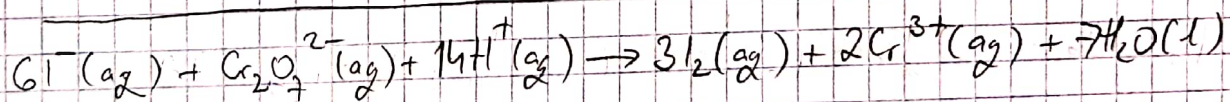
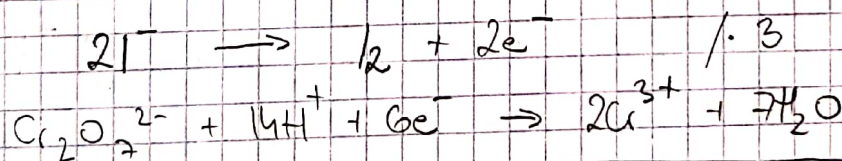
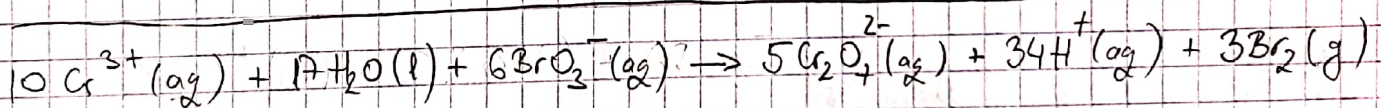
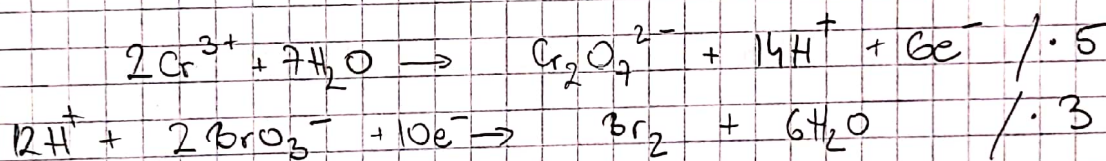
$$w(\text{SCN}^-) = \frac{0,05806 \text{ g}}{0,1096 \text{ g}} = 52,97\%$$

$$m(\text{uroak}) = 0,2193 \text{ g}$$

$$V(\text{Na}_2\text{S}_2\text{O}_3) = 10 \text{ mL}$$

$$c(\text{Na}_2\text{S}_2\text{O}_3) = 0,1 \text{ mol dm}^{-3}$$

$$n(\text{S}_2\text{O}_3^{2-}) = 1 \cdot 10^{-3} \text{ mol}$$



$$n(\text{Cr}^{3+}) = 2n(\text{Cr}_2\text{O}_7^{2-}) = \frac{2}{3}n(\text{I}_2) = \frac{2}{3} \cdot \frac{1}{2}n(\text{S}_2\text{O}_3^{2-}) = \frac{1}{3}n(\text{S}_2\text{O}_3^{2-})$$

$$n(\text{Cr}^{3+}) = \frac{1}{3} \cdot 1 \cdot 10^{-3} \text{ mol} = 3,33 \cdot 10^{-4} \text{ mol}$$

$$m(\text{Cr}^{3+}) = 3,33 \cdot 10^{-4} \text{ mol} \cdot 52,00 \text{ g mol}^{-1} = 0,01733 \text{ g}$$

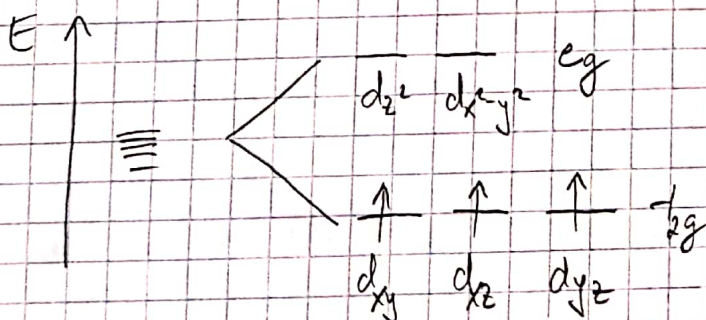
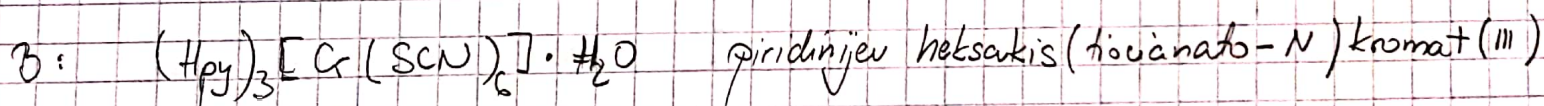
$$w(\text{Cr}) = \frac{0,01733 \text{ g}}{0,2193 \text{ g}} = 7,90 \%$$

$$w(\text{Hpy}^+) = 100 - 52,97 - 7,90 = 39,13 \%$$

$$\frac{7,90 \text{ g}}{52 \text{ g mol}^{-1}} : \frac{52,97 \text{ g}}{58,078 \text{ g mol}^{-1}} : \frac{39,13 \text{ g}}{80,107 \text{ g mol}^{-1}} =$$

$$= 0,1519 \text{ mol} : 0,91205 \text{ mol} : 0,4884 \text{ mol} \quad / : 0,1519$$

$$\approx 1 : 6 : 3$$



Kompleks je paramagnetičan!

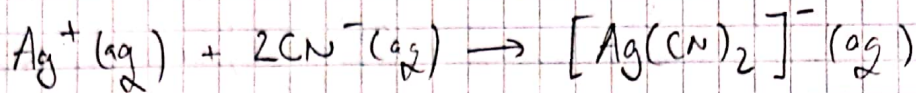
Tadatak 4.

$$m(\text{uroak}) = 0,1314 \text{ g}$$

$$V(\text{AgNO}_3) = 11,95 \text{ mL}$$

$$c(\text{AgNO}_3) = 0,1012 \text{ mol/dm}^3$$

$$\left. \begin{array}{l} \\ \\ \end{array} \right\} n(\text{AgNO}_3) = 11,95 \cdot 10^{-3} \text{ dm}^3 \cdot 0,1012 \text{ mol/dm}^3 \\ = 1,209 \cdot 10^{-3} \text{ mol}$$

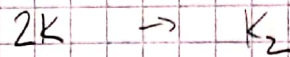


$$n(\text{CN}^-) = 2n(\text{AgNO}_3) = 2 \cdot 1,209 \cdot 10^{-3} \text{ mol} = 2,418 \cdot 10^{-3} \text{ mol}$$

$$m(\text{CN}^-) = 2,418 \cdot 10^{-3} \text{ mol} \cdot 26,018 \text{ g/mol} = 0,0629 \text{ g}$$

$$w(\text{CN}^-) = \frac{0,0629 \text{ g}}{0,1314 \text{ g}} = 47,8 \%$$

$$m(\text{uroak}) = 0,1013 \text{ g}$$



$$m(\text{K}_2\text{SO}_4) = 0,081 \text{ g}$$

$$\frac{n(\text{K})}{n(\text{K}_2)} = \frac{2}{1}$$

$$n(\text{K}) = 2n(\text{K}_2\text{SO}_4) = 2 \cdot \frac{0,081 \text{ g}}{174,259 \text{ g/mol}} = 9,3 \cdot 10^{-4} \text{ mol}$$

$$m(\text{K}) = 9,3 \cdot 10^{-4} \text{ mol} \cdot 39,09 \text{ g/mol} = 0,036 \text{ g}$$

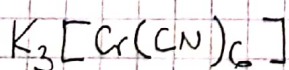
$$w(\text{K}) = \frac{0,036 \text{ g}}{0,1013 \text{ g}} = 35,8 \%$$

$$w(\text{Cr}) = 100 - 35,8 - 47,8 = 16,4 \%$$

$$\frac{16,4 \text{ g}}{52,00 \text{ g/mol}} : \frac{35,87 \text{ g}}{39,09 \text{ g/mol}} : \frac{47,8 \text{ g}}{26,018 \text{ g/mol}}$$

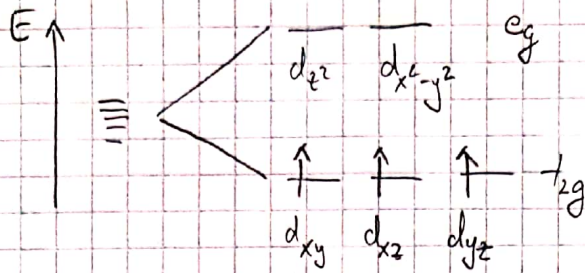
$$0,315 \text{ mol} : 0,9176 : 1,837 \text{ mol} / : 0,315$$

$$1 : 3 : 6$$



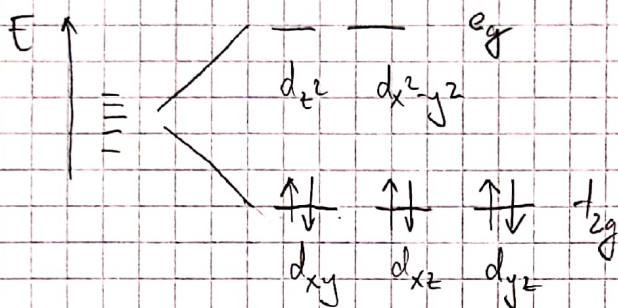
Kalijer heksaciano kromat(III)

Cr(III) :



Kompleks Cr(III) je paramagnetičan

Fe(II) : $K_4[Fe(CN)_6]$



Kompleks Fe(II) je diamagnetičan

Zadatak 5.

$$\Delta_o([Fe(H_2O)_6]^{2+}) < \Delta_o([Fe(CN)_6]^{4-}) < \Delta_o([Fe(CN)_6]^{3-})$$

Prema spektroskopskom nizu liganata CN^- jači cijepa liganosko polje pa će Δ_o za CN^- biti veće od Δ_o za H_2O . Za isti ligand Δ_o je veći s porastom naboja metalnog iona. Povećanjem naboja smanjuje se radijus zbog čega su ligandi više privučeni većem naboju.