

Domaći zadatak 6, Uvod u laboratorijski rad,

1. Koliko će kalcijum-sulfata iskristalisati iz 250 g rastvora pri promeni temperature od 80°C do 20°C. Rastvorljivost na 80°C je 55, a na 20°C je 20?
2. Izračunati koncentraciju fosfatnog jona u zasićenom rastvoru magnezijum-fosfata, ako je $K_{sp}(\text{Mg}_3(\text{PO}_4)_2) = 5,2 \cdot 10^{-24} \text{ M}^5$.
3. Izračunati proizvod rastvorljivosti Ag_2SO_4 ako je ravnotežna koncentracija sulfata $2,52 \cdot 10^{-2} \text{ M}$.
4. Da li će doći do taloženja nikel(II)-hidroksida pri mešanju 100 mL 0,05M rastvora nikel(II)-hlorida i 300 mL 0,03 M rastvora natrijum-hidroksida, ako je $K_{sp}(\text{Ni}(\text{OH})_2) = 6 \cdot 10^{-16} \text{ M}^3$?
5. Da li će doći do taloženja barijum-sulfata prilikom dodatka 10 mg barijum-hlorida u 300 mL 0,5 M rastvora natrijum-sulfata, ako je $K_{sp}(\text{BaSO}_4) = 1,1 \cdot 10^{-10} \text{ M}^2$?
6. Izračunati zapreminu 6 M rastvora natrijum-hlorida potrebnu za pripremu 200 mL 0,5 M rastvora.
7. Izračunati maseni udeo svake komponente u sistemu koji sadrži 478 g vode, 25 g kalcijum-hidroksida i 100 g natrijum bromida.
8. Izračunati molaritet rastvora glicina ($\text{C}_2\text{H}_5\text{NO}_2$) dobijenog rastvaranjem 63,8 g ove aminokiseline u 500 mL vode.

1. $R_{30^\circ} = 55$

$R_{20^\circ} = 20$

$\Delta w \downarrow (CaSO_4) = ?$

$w_R(30^\circ) = 250g$

$w_{CaSO_4}(30^\circ) : w_R(30^\circ) = R_{30^\circ} : (R_{30^\circ} + 100g)$

$w_{CaSO_4}(30^\circ) : 250g = 55g : 155g$

$w_{CaSO_4}(30^\circ) = 88,71g$

$w_{H_2O} = w_R(30^\circ) - w_{CaSO_4}(30^\circ) = 250g - 88,71g = 161,29g$

$w_{CaSO_4}(20^\circ) : w_{H_2O} = R_{20^\circ} : 100g$

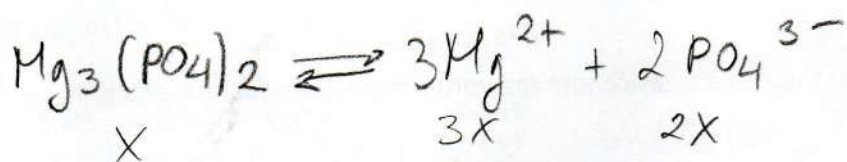
$w_{CaSO_4}(20^\circ) : 161,29g = 20 : 100g$

$$M_{20}(\text{CaSO}_4) = 32,258 \text{ g}$$

$$\Delta M_{\downarrow}(\text{CaCO}_3) = M_{80}(\text{CaSO}_4) - M_{20}(\text{CaSO}_4) = 88,71 \text{ g} - 32,258 \text{ g} = 56,45 \text{ g}$$

$$\textcircled{2} \quad K_{SP}(\text{Mg}_3(\text{PO}_4)_2) = 5,2 \cdot 10^{-24} \text{ M}^5$$

$$[\text{PO}_4^{3-}] = ?$$



$$K_{SP}(\text{Mg}_3(\text{PO}_4)_2) = [\text{Mg}^{2+}]^3 \cdot [\text{PO}_4^{3-}]^2 = (3x)^3 \cdot (2x)^2$$
$$= 27x^3 \cdot 4x^2 = 108x^5$$

$$108x^5 = 5,2 \cdot 10^{-24} \text{ M}^5$$

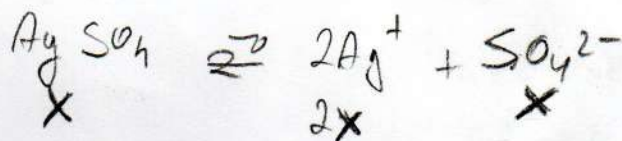
$$x^5 = 0,481 \cdot 10^{-25} \text{ M}^5$$

$$x = 0,364 \cdot 10^{-5} \text{ M}$$

$$[\text{PO}_4^{3-}] = 2 \cdot x = 2 \cdot 0,364 \cdot 10^{-5} \text{ M} = 1,728 \cdot 10^{-5} \text{ M}$$

$$\textcircled{3} \quad K_{SP}(\text{Ag}_2\text{SO}_4) = ?$$

$$[\text{SO}_4^{2-}] = 2,52 \cdot 10^{-2} \text{ M}$$



$$[\text{Ag}^+] = 2 \cdot [\text{SO}_4^{2-}] = 2 \cdot 2,52 \cdot 10^{-2} \text{ M} = 5,04 \cdot 10^{-2} \text{ M}$$

$$K_{SP}(\text{Ag}_2\text{SO}_4) = [\text{SO}_4^{2-}] \cdot [\text{Ag}^+]^2 = 2,52 \cdot 10^{-2} \text{ M} \cdot (5,04 \cdot 10^{-2})^2$$

$$K_{SP}(\text{Ag}_2\text{SO}_4) = 64,012 \cdot 10^{-6} \text{ M}^3$$

$$V(\text{NiCl}_2) = 100 \text{ ml} \quad \left. \begin{array}{l} n(\text{Ni}^{2+}) = V(\text{NiCl}_2) \cdot c(\text{NiCl}_2) = 0,1 \text{ L} \cdot 0,05 \text{ M} \\ c(\text{NiCl}_2) = 0,05 \text{ M} \end{array} \right\} n(\text{Ni}^{2+}) = 0,005 \text{ mol}$$

$$V(\text{NaOH}) = 300 \text{ ml} \quad \left. \begin{array}{l} n(\text{OH}^-) = V(\text{NaOH}) \cdot c(\text{NaOH}) = 0,3 \text{ L} \cdot 0,03 \text{ M} \\ c(\text{NaOH}) = 0,03 \text{ M} \end{array} \right\} n(\text{OH}^-) = 0,009 \text{ mol}$$

$$K_{SP}(\text{Ni}(\text{OH})_2) = 6 \cdot 10^{-16} \text{ M}^3$$

$$V_u = V(\text{NiCl}_2) + V(\text{NaOH}) = 0,1 \text{ L} + 0,3 \text{ L} = 0,4 \text{ L}$$

$$c(\text{Ni}^{2+}) = \frac{n(\text{Ni}^{2+})}{V_u} = \frac{0,005 \text{ mol}}{0,4 \text{ L}} = 0,0125 \text{ M}$$

$$c(\text{OH}^-) = \frac{n(\text{OH}^-)}{V_u} = \frac{0,009 \text{ mol}}{0,4 \text{ L}} = 0,0225 \text{ M}$$

$$K_{SP}(\text{Ni}(\text{OH})_2) = [\text{Ni}^{2+}] \cdot [\text{OH}^-]^2 = 0,0125 \text{ M} \cdot (0,0225 \text{ M})^2$$

$$K_{SP}(\text{Ni}(\text{OH})_2) = 6,3 \cdot 10^{-6} \text{ M}^3 \rightarrow \text{doka je go uvrnemo 10 d}$$

5. $m(\text{BaCl}_2) = 10 \text{ mg}$
 $V_R(\text{Na}_2\text{SO}_4) = 300 \text{ ml}$
 $c_R(\text{Na}_2\text{SO}_4) = 0,5 \text{ M}$
 $K_{SP}(\text{BaSO}_4) = 1,1 \cdot 10^{-10} \text{ M}^2$

$$c(\text{SO}_4^{2-}) = c_R(\text{Na}_2\text{SO}_4) = 0,5 \text{ M}$$

$$K_{SP}(\text{BaSO}_4) = [\text{Ba}^{2+}] \cdot [\text{SO}_4^{2-}]^2$$

$$K_{SP}(\text{BaSO}_4) = 1,1 \cdot 10^{-10} \text{ M}^2 \cdot 0,5 \text{ M} = 8 \cdot 10^{-5} \text{ M}$$

ΔOK je go uvrnemo 10 d

$$M(\text{BaCl}_2) = 137,3 \text{ g} + 2 \cdot 35,5 \text{ g} = 208,3$$

$$n(\text{Ba}^{2+}) = n(\text{BaCl}_2) = \frac{m(\text{BaCl}_2)}{M(\text{BaCl}_2)}$$

$$n(\text{Ba}^{2+}) = \frac{10 \text{ mg}}{208,3 \text{ g/mol}} = 4,8 \cdot 10^{-5} \text{ mol}$$

$$c(\text{Ba}^{2+}) = \frac{n(\text{Ba}^{2+})}{V(\text{Na}_2\text{SO}_4)} = \frac{4,8 \cdot 10^{-5}}{0,3}$$

$$c(\text{Ba}^{2+}) = 16 \cdot 10^{-5} \text{ M}$$

⑥ $c_p(\text{NaCl}) = 6 \text{ M}$
 $V_p(\text{NaCl}) = ?$
 $V_k(\text{NaCl}) = 200 \text{ mL}$
 $c_k(\text{NaCl}) = 0,5 \text{ M}$

$$c_p \cdot V_p = c_k \cdot V_k$$

$$V_p = \frac{c_k V_k}{c_p}$$

$$V_p = \frac{200 \text{ mL} \cdot 0,5 \text{ M}}{6 \text{ M}} = 16,67 \text{ mL}$$

⑦ $w(\text{H}_2\text{O}) = ?$
 $w(\text{Ca}(\text{OH})_2) = ?$
 $w(\text{NaBr}) = ?$

$$m(\text{H}_2\text{O}) = 478 \text{ g}$$

$$m(\text{Ca}(\text{OH})_2) = 25 \text{ g}$$

$$m(\text{NaBr}) = 100 \text{ g}$$

$$m_R = m(\text{H}_2\text{O}) + m(\text{Ca}(\text{OH})_2) + m(\text{NaBr}) = 478 \text{ g} + 25 \text{ g} + 100 \text{ g}$$

$$m_R = 603 \text{ g}$$

$$w(\text{H}_2\text{O}) = \frac{m(\text{H}_2\text{O})}{m_R} \cdot 100\% = \frac{478 \text{ g}}{603} \cdot 100\% = 79,27\%$$

$$w(\text{Ca}(\text{OH})_2) = \frac{m(\text{Ca}(\text{OH})_2)}{m_R} \cdot 100\% = \frac{25 \text{ g}}{603 \text{ g}} \cdot 100\% = 4,15\%$$

$$w(\text{NaBr}) = \frac{m(\text{NaBr})}{m_R} \cdot 100\% = \frac{100 \text{ g}}{603 \text{ g}} \cdot 100\% = 16,58\%$$

⑧ $c(\text{C}_2\text{H}_5\text{NO}_2) = ?$

$$m(\text{C}_2\text{H}_5\text{NO}_2) = 63,8 \text{ g}$$

$$V(\text{H}_2\text{O}) = 500 \text{ mL}$$

$$M(\text{C}_2\text{H}_5\text{NO}_2) = 2 \cdot 12 + 5 \cdot 1 + 1 \cdot 14 + 2 \cdot 16 = 24 + 5 + 14 + 32$$

$$M(\text{C}_2\text{H}_5\text{NO}_2) = 75 \text{ g/mol}$$

$$c(\text{C}_2\text{H}_5\text{NO}_2) = \frac{m(\text{C}_2\text{H}_5\text{NO}_2)}{M(\text{C}_2\text{H}_5\text{NO}_2) \cdot V(\text{H}_2\text{O})} = \frac{63,8 \text{ g}}{75 \text{ g/mol} \cdot 0,5 \text{ L}}$$

$$c(\text{C}_2\text{H}_5\text{NO}_2) = 1,70 \text{ M}$$