

Tallinna XIII koolinoorte keemiaolümpiaadi koolivoor
2012/ 2013 õ.a

Ülesannete lahendused*

10. klass

1. (10)



b. Vettsisaldav segu jagunes kaheks osaks. (1)

1. kiht- tetraklorometaan (alumine osa) (2)

2. kiht-soolhappe ja tetraklorometaani lahus (ülemine osa)

c. $m(\text{HCl}) = \frac{100\text{g} \times 3,65\%}{100\%} = 3,65\text{g}$. (1)

d. $V(\text{HCl}(\text{g})) = \frac{3,65\text{g}}{36,5\text{g/mol}} \times 22,4\text{dm}^3/\text{mol} = 2,24\text{dm}^3$ (1)

e. $V(\text{Cl}_2 + \text{CH}_4) = 2,24\text{dm}^3 + \frac{2,24}{4}\text{dm}^3 = 2,8\text{dm}^3$ (2)

f. $m(\text{CCl}_4) = \frac{0,1\text{mol}}{4} \times 154\text{g/mol} = 3,85\text{g}$ (1)

10p

2. (10)

a.

$$m_{\text{vesi}}^{5\text{‰}} + m_{\text{sool}} = 1000\text{ g}$$

$$m_{\text{sool}} = 1000\text{ g} \times 0,005 = 5\text{ g}$$

$$m_{\text{vesi}}^{5\text{‰}} = 1000\text{ g} - 2 \times 5\text{ g} = 990\text{ g} \quad (1)$$

b.

$$m_{\text{vesi}}^{5\text{‰}} = 1000\text{ g} - 5\text{ g} = 995\text{ g}$$

$$m_{\text{vesi}}^{35\text{‰}} = \frac{5\text{ g}}{0,035} - 5\text{ g} \sim 137,9\text{ g}$$

$$\Delta m_{\text{vesi}} = 995\text{ g} - 137,9\text{ g} = 857,1\text{ g} \quad (3)$$

c.

i.

$$m_{\text{sool}} = 1000\text{ g} \times 0,0065 = 6,5\text{ g} \quad (0,5)$$

$$m_{\text{vesi}} = 1000\text{ g} - 6,5\text{ g} = 993,5\text{ g} \quad (0,5)$$

ii. $m_{\text{vesi}}^{35\text{‰}} = \frac{6,5\text{ g}}{0,035} - 6,5\text{ g} \sim 179,2\text{ g}$ (1)

$$m_{\text{vesi}} = 1000\text{ g} - 6,5\text{ g} - 179,2\text{ g} = 814,3\text{ g} \quad (1)$$

d.

$$n(\text{Na}^+)_{0,65\%} + n(\text{Cl}^-)_{0,65\%} + n(\text{K}^+) + n(\text{Cl}^-) = n(\text{Na}^+)_{0,90\%} + n(\text{Cl}^-)_{0,90\%}$$

$$2n(\text{Na}^+)_{0,65\%} + 2n(\text{K}^+) = 2n(\text{Na}^+)_{0,90\%} \quad (1)$$

$$n(\text{K}^+) = \frac{(9,0 \text{ g} - 6,5 \text{ g})}{58,5 \frac{\text{g}}{\text{mol}}} \sim 0,0427 \text{ mol} \quad (1)$$

$$m(\text{KCl}) = 0,0427 \text{ mol} \times 74,5 \text{ g/mol} \sim 3,2 \text{ g} \quad (1)$$

10p

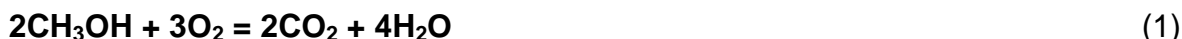
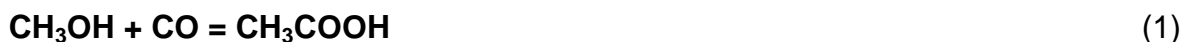
3. (10)

a. Äädikhape, Уксусная кислота - CH_3COOH ;

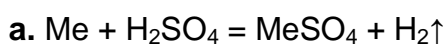
A- CH_3OH ;

B - CO ; C - H_2 ; D - CO_2 ; E - H_2O ; F - HCOOH (3,5)

b.



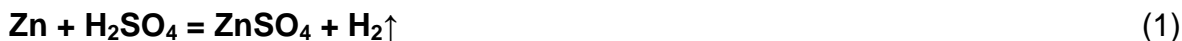
4. (10)



$$n(\text{H}_2) = \frac{4,48 \text{ dm}^3}{22,4 \frac{\text{dm}^3}{\text{mol}}} = 0,200 \text{ mol}$$

$$M(\text{Me}) = \frac{13,0 \text{ g}}{0,200 \text{ mol}} = 65,0 \frac{\text{g}}{\text{mol}}$$

Me = Zn – tsink, sool - ZnSO_4 – tsinksulfaat, сульфат цинка (2)



b.

$$\text{i. } n(\text{ZnSO}_4) = 0,200 \text{ mol} \quad (1)$$

$$\text{ii. } m(\text{ZnSO}_4) = 0,200 \text{ mol} \times 161 \frac{\text{g}}{\text{mol}} = 32,2 \text{ g} \quad (1)$$

c.

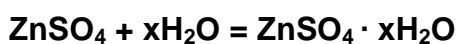
$$\text{i. } m(\text{ZnSO}_4 \text{ (lahus)}) = 237 \text{ cm}^3 \times 1,1308 \frac{\text{g}}{\text{cm}^3} \sim 268 \text{ g} \quad (1)$$

$$\text{ii. } P(\text{ZnSO}_4) = \frac{32,2 \text{ g}}{268 \text{ g}} \times 100\% = 12,0\% \quad (1)$$

$$\text{iii. } n(\text{H}_2\text{O}) = \frac{(268 \text{ g} - 32,2 \text{ g})}{18 \frac{\text{g}}{\text{mol}}} = 13,1 \text{ mol}$$

$$C_{x\text{ZnSO}_4} = \frac{0,200 \text{ mol}}{0,200 \text{ mol} + 13,1 \text{ mol}} = 0,0150 \quad (1)$$

d.



$$M(\text{ZnSO}_4 \cdot x\text{H}_2\text{O}) = \frac{57,4 \text{ g}}{0,200 \text{ mol}} = 287 \frac{\text{g}}{\text{mol}}$$

$$M(\text{ZnSO}_4 \cdot x\text{H}_2\text{O}) = M(\text{ZnSO}_4) + x M(\text{H}_2\text{O})$$

$$161 + x \cdot 18 = 287$$

$$x = 7$$

$$\text{Kristallhüdraadi valem: } \text{ZnSO}_4 \cdot 7\text{H}_2\text{O} \quad (1)$$

Формула кристаллогидрата: $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$

$$m(\text{H}_2\text{O}) = 0,200 \text{ mol} \times 7 \times 18 \frac{\text{g}}{\text{mol}} = 25,2 \text{ g}$$

(1)
10p

* Keemiaolümpiaadi koolivooru komisjon võib iseseisvalt hinnata võimalikke alternatiivseid lahendusvariante.