

1996/97 õa keemiaolümpiaadi piirkondliku vooru ülesannete lahendused
11. klass

1. 1) A. $\text{KF} + \text{H}_2\text{SO}_4 \xrightarrow{\text{t}^0} \text{KHSO}_4 + \text{HF} \uparrow$
 B. $\text{KCl} + \text{H}_2\text{SO}_4 \xrightarrow{\text{t}^0} \text{KHSO}_4 + \text{HCl} \uparrow$
 C. $2\text{KBr} + 3\text{H}_2\text{SO}_4 \longrightarrow \text{SO}_2 \uparrow + \text{Br}_2 + 2\text{KHSO}_4 + 2\text{H}_2\text{O}$
 D. $8\text{KI} + 9\text{H}_2\text{SO}_4 \longrightarrow 4\text{I}_2 + \text{H}_2\text{S} \uparrow + 4\text{H}_2\text{O} + 8\text{KHSO}_4$

2) Kuumutama peab katsklaase **A** ja **B**, sest HF ja HCl lahustuvad vees väga hästi.

2. 1) $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2 \uparrow$
 $\text{Cu} + 2\text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + 2\text{H}_2\text{O} + \text{SO}_2 \uparrow$
 2) $\text{Zn} \Leftrightarrow \text{H}_2 \quad n(\text{Zn}) = \frac{1}{1} \cdot 1,12 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} = \mathbf{0,0500 \text{ mol}}$
 $\text{Cu} \Leftrightarrow \text{SO}_2 \quad n(\text{Cu}) = \frac{1}{1} \cdot 2,24 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} = \mathbf{0,100 \text{ mol}}$
 3) $m(\text{Zn}) = 0,0500 \text{ mol} \cdot 65,4 \text{ g/mol} = 3,27 \text{ g}$
 $m(\text{Cu}) = 0,100 \text{ mol} \cdot 63,5 \text{ g/mol} = 6,35 \text{ g}$

9,62 g

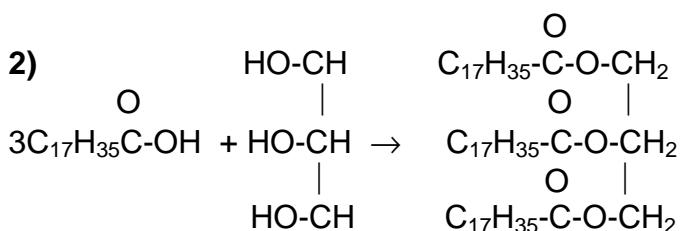
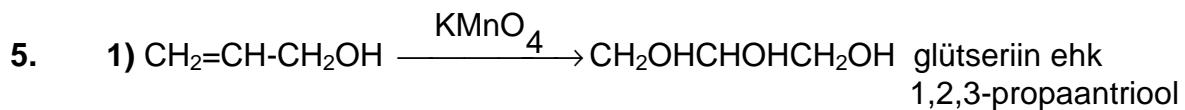
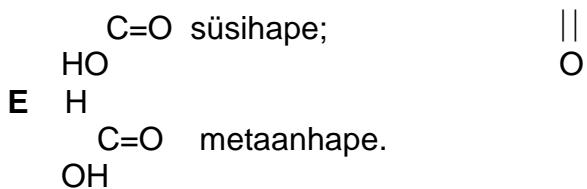
$$\%(\text{Zn}) = \frac{3,27}{9,62} \cdot 100 = \mathbf{34,0} \qquad \%(\text{Cu}) = \frac{6,35}{9,62} \cdot 100 = \mathbf{66,0}$$

4) Zn redutseerijana on võimeline happes olevat oksüdeerunud vesinikku redutseerima, vask aga mitte (Zn asub pingereas vesinikust vasakul, vask aga paremal). Oksüdeeriva happena oksüdeerib H_2SO_4 vase Cu^{++} ionideks.

3. 1) A - H_2O , B - F_2 , C - OF_2 , D - HF , E - H_2SiF_6
 2) $\text{H}_2\text{O} + 2\text{F}_2 \rightarrow \text{OF}_2 + 2\text{HF}$
 $6\text{HF} + \text{SiO}_2 \rightarrow \text{H}_2\text{SiF}_6 + 2\text{H}_2\text{O}$
 II -I I IV -I
 3) OF_2 -fluoroksiid, H_2SiF_6 -heksafluororänihape.
 4) $n(\text{OF}_2) = \frac{1,00 \cdot 10^5 \text{ N/m}^2 \cdot 0,0224 \text{ m}^3}{8,314 \text{ N} \cdot \text{m} \cdot \text{mol}^{-1} \cdot \text{K}^{-1} \cdot 289 \text{ K}} = \mathbf{0,904 \text{ mol}}$
 $M(\text{OF}_2) = \frac{48,85 \text{ g}}{0,904 \text{ mol}} = \mathbf{54,0 \text{ g/mol}}$

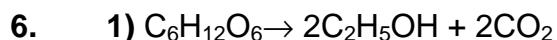
5) $54,0 \text{ g} \cdot 0,7037 = 38,0 \text{ g}$ (vastab kahele moolile fluorile)
 $54,0 \text{ g} \cdot 0,2963 = 16,0 \text{ g}$ (vastab ühele moolile hapnikule)

4. 1) A CH_3 metüülsüklopropaan; tsüklobutaan;
 $\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}_3$ 1-buteen; $\text{CH}_3-\overset{|}{\text{C}}=\text{CH}_2$ 2-metüülpropeen;
 $\begin{array}{c} \text{CH}_3 \\ | \\ \text{C}=\text{C} \\ | \\ \text{H} \end{array}$ cis-buteen; $\begin{array}{c} \text{CH}_3 & \text{H} \\ | & | \\ \text{C}=\text{C} \\ | & | \\ \text{H} & \text{CH}_3 \end{array}$ trans-buteen
 B $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_3$ butaan; $\text{CH}_3-\overset{|}{\text{CH}}-\text{CH}_3$ 2-metüülpropaan ehk
 $\begin{array}{c} & | \\ & \text{CH}_3 \end{array}$ isobutaan
 2) C HO D H-C-H metanaal;



3) $\mathbf{A} \Leftrightarrow x$

$$x \Leftrightarrow y \quad n(y) = \frac{1}{1}(1 - 0,25) \cdot \frac{1}{1} \cdot 1,25\text{mol} \cdot 0,70 = 0,656 \approx \mathbf{0,66 \text{ mol}}$$



$$2) m(\text{C}_2\text{H}_5\text{OH}) = 0,750\text{cm}^3 \cdot (0,11 - 0,08) \cdot 0,793 \text{ g/cm}^3 = 17,8 \approx \mathbf{20 \text{ g}}$$

$$3) n(\text{CO}_2) = \frac{2}{2} \cdot 17,8\text{g} \cdot \frac{1\text{mol}}{46\text{g}} = 0,387 \approx \mathbf{0,4 \text{ mol}}$$

$$4) C(\text{CO}_2, \text{ sampanjas}) = 0,387\text{mol} \cdot \frac{0,75}{0,80} \cdot \frac{1}{0,80\text{dm}^3} = 0,454 \approx \mathbf{0,5 \text{ mol / dm}^3}$$

$$5) n(\text{CO}_2, \text{gaasina}) = 0,387 \cdot \frac{0,05}{0,80} = \mathbf{0,0242 \text{ mol}}$$

$$p = \frac{0,0242\text{mol} \cdot 0,082\text{atm} \cdot \text{dm}^3 \cdot \text{mol}^{-1} \cdot \text{K}^{-1} \cdot 288\text{K}}{0,05\text{dm}^3} = 11,4 \approx \mathbf{10 \text{ atm}}$$