

2007/2008 õ.a. keemiaolümpiaadi piirkonnavooru ülesannete lahendused

11. klass

1. a) i) $R = \frac{0,08206 \text{ atm dm}^3}{1 \text{ mol K}} \cdot \frac{1,01325 \text{ bar}}{1 \text{ atm}} = 0,08315 \frac{\text{bar dm}^3}{\text{mol K}}$ (0,5)

ii) $R = \frac{0,08315 \text{ bar dm}^3}{1 \text{ mol K}} \cdot \frac{100000 \text{ Pa}}{1 \text{ bar}} \cdot \frac{1 \text{ m}^3}{1000 \text{ dm}^3} = 8,315 \frac{\text{Pa m}^3}{\text{mol K}}$ (0,5) 1

b) $V(\text{CO}_2) = 0,5 \text{ dm}^3 \cdot 0,0004 = 0,0002 \text{ dm}^3$ (0,5)

$n(\text{CO}_2) = 1 \text{ atm} \cdot 0,0002 \text{ dm}^3 \cdot \frac{1 \text{ mol K}}{0,08206 \text{ atm dm}^3} \cdot \frac{1}{293 \text{ K}} = 8,3 \cdot 10^{-6} \text{ mol}$ (1,5)

$N(^{14}\text{CO}_2) = 8,3 \cdot 10^{-6} \text{ mol} \cdot \frac{6,02 \cdot 10^{23}}{1 \text{ mol}} \cdot \frac{1}{10^{12}} = 5 \cdot 10^6$ (1) 3

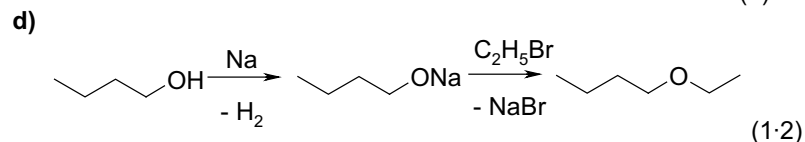
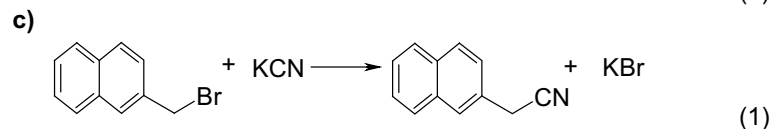
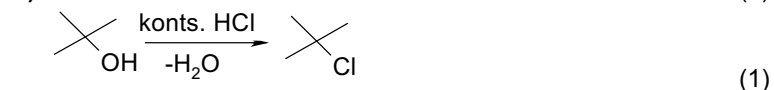
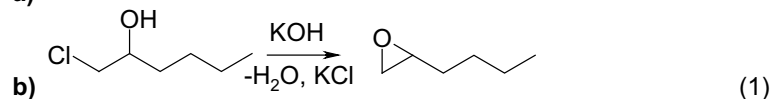
c) 1 moolile polümeerile vastav vee hulk

$\frac{20000 \text{ g}}{1 \text{ mol}} \cdot \frac{1 \text{ mol}}{1 - 0,0018} \cdot 0,0018 \cdot \frac{1 \text{ g}}{18 \text{ mol}} = 2,0 \text{ mol}$ (2)

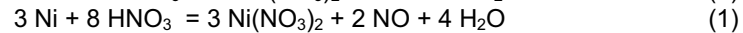
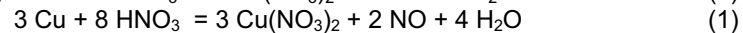
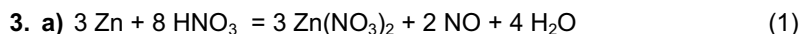
$X(\text{H}_2\text{O}) = \frac{2 \text{ mol}}{(1 + 2) \text{ mol}} \cdot 100 = 67$ (1) 3

7 p

2. a)



5 p



$\%(\text{Ni}) = 0,738 \text{ g} \cdot \frac{1 \text{ mol}}{288,7 \text{ g}} \cdot \frac{58,69 \text{ g}}{1 \text{ mol}} \cdot \frac{1}{1,00 \text{ g}} \cdot 100 = 15,0$ (1,5) 4,5

b) $n(\text{Ni}) = 1,00 \text{ g} \cdot 0,15 \cdot \frac{1 \text{ mol}}{58,69 \text{ g}} = 0,002556 \text{ mol}$ (1)

$n(\text{Ni, Cu, Zn}) = 24 \text{ cm}^3 \cdot \frac{1 \text{ dm}^3}{1000 \text{ cm}^3} \cdot \frac{0,0331 \text{ mol}}{1 \text{ dm}^3} \cdot \frac{100 \text{ cm}^3}{5 \text{ cm}^3} = 0,01589 \text{ mol}$ (1,5)

$n(\text{Cu, Zn}) = 0,01589 \text{ mol} - 0,002556 = 0,01333 \text{ mol}$ (0,5)

$m(\text{Cu, Zn}) = 1,00 \text{ g} \cdot (1 - 0,15) = 0,85 \text{ g}$ (1)

$n(\text{Cu}) \cdot \frac{63,55 \text{ g}}{1 \text{ mol}} + (0,01333 - n(\text{Cu})) \cdot \frac{65,38 \text{ g}}{1 \text{ mol}} = 0,85 \text{ g}$ (2)

$-\frac{1,83 \text{ g}}{1 \text{ mol}} n(\text{Cu}) = -0,0215 \text{ g} \Rightarrow n(\text{Cu}) = 0,0118$ (1)

$\%(\text{Cu}) = 0,0118 \text{ mol} \cdot \frac{63,55 \text{ g}}{1 \text{ mol}} \cdot \frac{1}{1,00 \text{ g}} \cdot 100 = 74,7 \approx 75$ (1)

$\%(\text{Zn}) = 100 - 15 - 75 = 10$ (0,5) 8,5
13 p

4. a) $n(\text{C}) = 2,4 \text{ g} \cdot \frac{1 \text{ mol}}{12 \text{ g}} = 0,2 \text{ mol}$ (0,5)

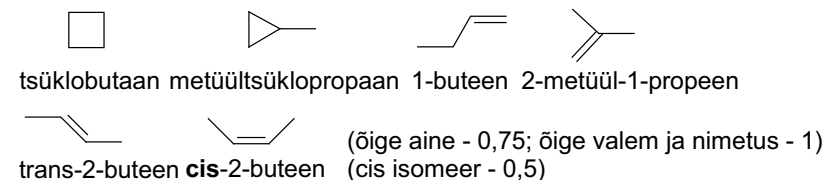
$n(\text{CO}_2) = 13,44 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} = 0,6 \text{ mol}$ (0,5)

$n(\text{H}_2\text{O}) = 14,43 \text{ cm}^3 \cdot \frac{0,9982 \text{ g}}{1 \text{ cm}^3} \cdot \frac{1 \text{ mol}}{18 \text{ g}} = 0,8 \text{ mol}$ (0,5)

$n_2(\text{C}) = 0,2 \text{ mol} + 0,6 \text{ mol} = 0,8 \text{ mol}$ (0,5) $n_2(\text{H}) = 2 \cdot 0,8 \text{ mol} = 1,6 \text{ mol}$ (0,5)

$N(\text{C}) = \frac{0,8 \text{ mol}}{0,2 \text{ mol}} = 4$ (0,5) $N(\text{H}) = \frac{1,6 \text{ mol}}{0,2 \text{ mol}} = 8$ C_4H_8 (0,5) 3,5

b)

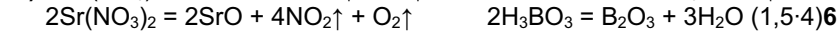
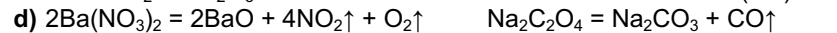
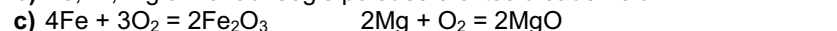


5,5

9 p

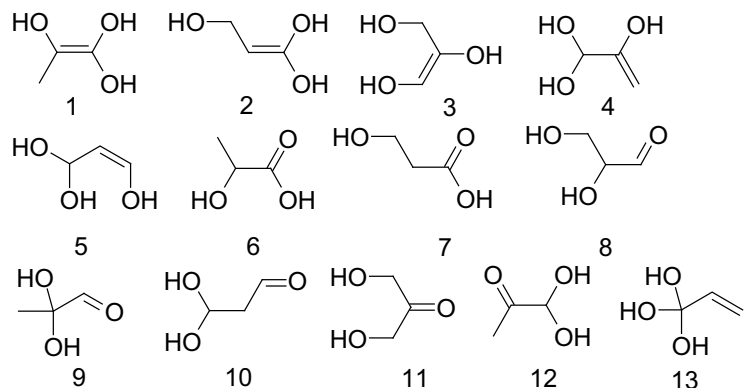
5. a) KClO_3 – kaaliumkloraat 1

b) Fe, Al, Mg annavad leegis põledes efektseid sädemeid 1



13 p

6. a) $N(C) = \frac{90 \cdot 0,4}{12} = 3,0$ $N(H) = \frac{90 \cdot 0,0671}{1} = 6,0$ $N(O) = \frac{90 \cdot 0,533}{16} = 3,0$
C₃H₆O₃ (1,5)



(0,5·13) **8**

- b) i) Aines **A** peab olema asümmeetriline süsinik (kiraalne tsester). (1)
 ii) Kiraalne tsester esineb ainult molekulides 6 ja 8. (1) **2**
- c) i) Aines **A** peab olema märgatavalt happeliste omadustega funktsionaalrühm, näitkes karboksüülrühm. (0,5)
 ii) 6. molekul (0,5) **1**

d) i) Kõigile tingimustele vastavad molekuli 6 mõlemad stereoisomeerid:



(2S)-2-hüdroksüpropanhape (2R)-2-hüdroksüpropanhape
 Tegemist on piimhappega. (1,5)

- ii) Aine **A** akumulatsioon jänese kovalihastesse anaeroobse metabolismi tagajärjel. Piimhape tekkis lõvi eest ära jooksmise füüsilisest pingutusest, jääkproduktina. (0,5) **2**

13 p