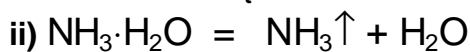
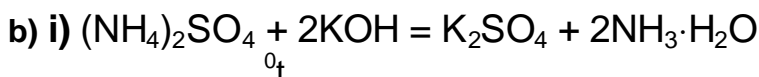
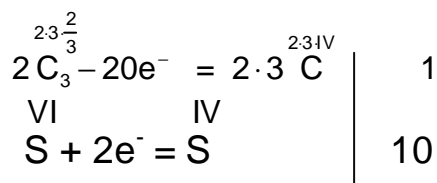
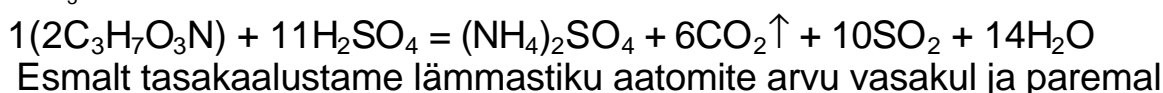
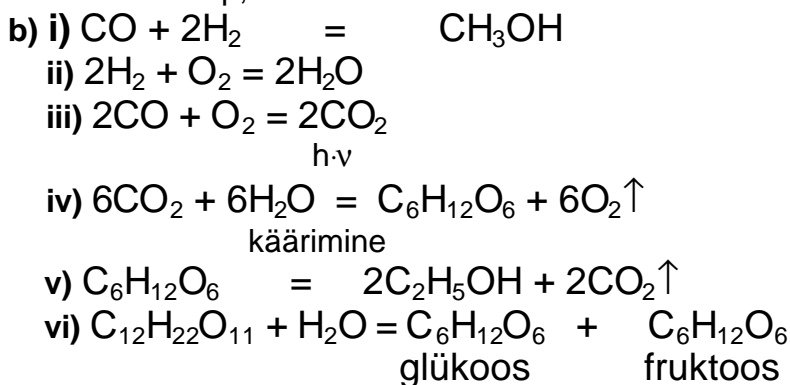


2003/2004 õa keemiaolümpiaadi lõppvooru ülesannete lahendused
10. klass

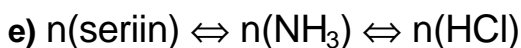
1. a) **A** – CH₃OH, metanool
B – CO, süsinikmonooksiid
C – H₂, vesinik
D – C₂H₅OH, etanool
E – CO₂, süsinikdioksiid
 p, katalüsaator
- F** – H₂O, vesi
X – C₆H₁₂O₆, glükoos
Y – C₁₂H₂₂O₁₁, sahharoos
Z – C₆H₁₂O₆, fruktoos



c) $c(\text{NaOH}) = \frac{1}{1 \text{ dm}^3} \cdot 1 \text{ dm}^3 \cdot \frac{1000 \text{ g}}{\text{dm}^3} \cdot 0,004 \cdot \frac{1 \text{ mol}}{40,0 \text{ g}} = 0,100 \text{ mol/dm}^3 = \mathbf{0,100 \text{ M}}$

$c(\text{HCl, A}) = \frac{1}{1} \cdot 10,0 \text{ cm}^3 \cdot 0,1 \text{ M} \cdot \frac{1}{10,0 \text{ cm}^3} = \mathbf{0,100 \text{ M}}$

d) $c(\text{HCl, B}) = \frac{1}{1} \cdot 12,0 \text{ cm}^3 \cdot 0,1 \text{ M} \cdot \frac{1}{50,0 \text{ cm}^3} = \mathbf{0,024 \text{ M}}$



$n(\text{NH}_3) = 0,05 \text{ dm}^3 \cdot 0,1 \text{ mol/dm}^3 - 0,1 \text{ dm}^3 \cdot 0,024 \text{ mol/dm}^3 = 0,0026 \text{ mol}$

$M(\text{C}_3\text{H}_7\text{O}_3\text{N}) = 105 \text{ g/mol}$

$m(\text{seriin}) = 0,0026 \text{ mol} \cdot 105 \text{ g/mol} = 0,273 \text{ g}$

$\%(\text{seriin}) = \frac{0,273 \text{ g}}{0,500 \text{ g}} \cdot 100 = \mathbf{54,6}$



Y – S, väävel

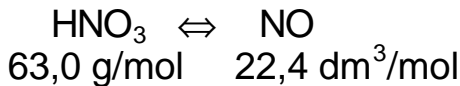
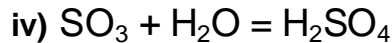
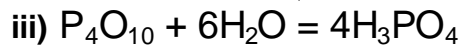
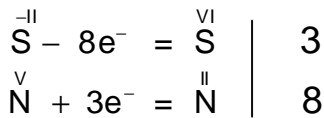
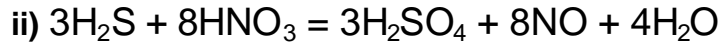
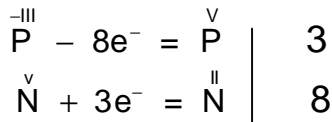
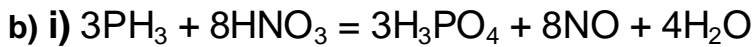
D – H₂SO₄, väävelhape

A – PH₃, fosfiin, 34 g/mol

E – P₄O₁₀, tetrafosfordekaoksiid,
14 aatomit molekulis

B – H₂S, divesiniksulfiid, 34 g/mol

F – SO₃, vääveltrioksiid,
4 aatomit molekulis



$$\begin{aligned} V(\text{NO}) &= \frac{1}{1} \cdot 1 \text{ L} \cdot \frac{1000 \text{ cm}^3}{1 \text{ L}} \cdot 1,387 \text{ g/cm}^3 \cdot 0,640 \cdot \frac{1 \text{ mol}}{63,0 \text{ g}} \cdot 22,4 \text{ dm}^3/\text{mol} = \\ &= 315,6 \text{ dm}^3 \approx \mathbf{316 \text{ dm}^3} \end{aligned}$$

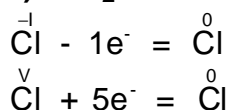
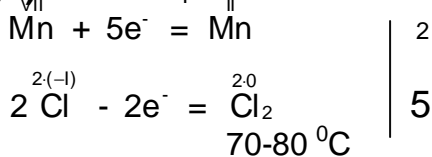


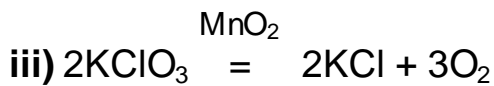
$$\begin{aligned} \text{b) } \Delta H_c(\text{glükoos}) &= [6 \text{ mol} \cdot (-393,5 \text{ kJ/mol}) + 6 \text{ mol} \cdot (-285,8 \text{ kJ/mol}) - \\ &\quad - 1 \text{ mol} \cdot (-1268 \text{ kJ/mol})] \cdot \frac{1}{\text{mol}} = \mathbf{-2808 \text{ kJ/mol}} \end{aligned}$$

$$\begin{aligned} \text{c) Energia(süda)} &= 1,00 \text{ J/löök} \cdot 365 \text{ päeva} \cdot \frac{24 \text{ h}}{\text{päev}} \cdot \frac{60 \text{ min}}{\text{h}} \cdot 70 \text{ lööki/min} = \\ &= 3,68 \cdot 10^7 \text{ J} \end{aligned}$$

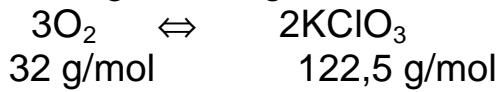
$$m(\text{glükoos}) = 3,68 \cdot 10^7 \text{ J} \cdot \frac{1 \text{ mol}}{2,808 \cdot 10^6 \text{ J}} \cdot 180 \text{ g/mol} = 2358 \text{ g} = 2,36 \text{ kg}$$

$$\begin{aligned} \text{d) } N(\text{hingetõmme}) &= \frac{6}{1} \cdot 2358 \text{ g} \cdot 1 \text{ mol}/180 \text{ g} \cdot 25,4 \text{ dm}^3/\text{mol} \cdot \frac{1}{0,05} \cdot \frac{1}{0,5 \text{ dm}^3} = 79900 \sim \\ &\sim \mathbf{80000} \end{aligned}$$





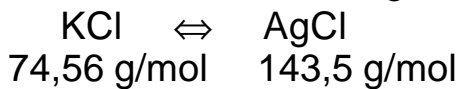
$$\text{b) i) } 25,80 \text{ g} - 22,43 \text{ g} = m$$



$$m(\text{KClO}_3) = \frac{2}{3} \cdot 3,37 \text{ g} \cdot \frac{1 \text{ mol}}{32 \text{ g}} \cdot 122,5 \text{ g/mol} = \mathbf{8,60 \text{ g}}$$

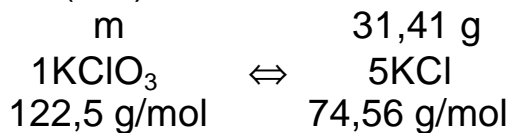
$$\text{ii) } m(\text{KCl}) = 25,80 \text{ g} - 8,60 \text{ g} = \mathbf{17,20 \text{ g}}$$

$$\text{c) } m = 27,35 \text{ g}$$



$$m(\text{KCl}) = \frac{1}{1} \cdot 27,35 \text{ g} \cdot \frac{1 \text{ mol}}{143,5 \text{ g}} \cdot 74,56 \text{ g/mol} = \mathbf{14,21 \text{ g}}$$

$$\text{d) } \Sigma m(\text{KCl}) = 17,20 + 14,21 = 31,41 \text{ g}$$



$$m(\text{KClO}_3) = \frac{1}{5} \cdot 31,41 \text{ g} \cdot \frac{1 \text{ mol}}{74,56 \text{ g}} \cdot 122,5 \text{ g/mol} = \mathbf{10,32 \text{ g}}$$

$$m(\text{KClO}_3, \text{Z}) = 10,32 \text{ g} - 8,60 \text{ g} = \mathbf{1,72 \text{ g}}$$

$$\text{e) } m(\text{H}_2\text{O}) = 65,90 \text{ g} - 14,21 \text{ g} - 1,72 \text{ g} = 49,97 \text{ g}$$

$$\text{i) } L(\text{KCl}) = 14,21 \text{ g} \cdot \frac{1}{49,97} \cdot 100 = \mathbf{28,44 \text{ g}}$$

$$\text{ii) } L(\text{KClO}_3) = 1,72 \text{ g} \cdot \frac{1}{49,97} \cdot 100 = \mathbf{3,44 \text{ g}}$$

6. a) A – CO₂, süsinikdioksiid

B – SO₃, vääveltrioksiid

C – H₂S, divesiniksulfiid

X – MgCO₃, magneesiumkarbonaat

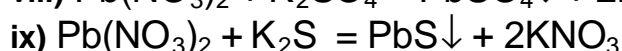
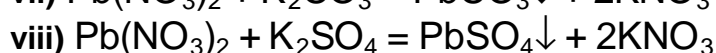
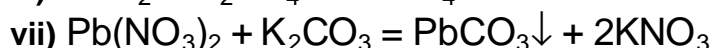
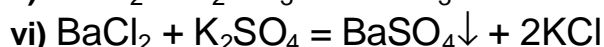
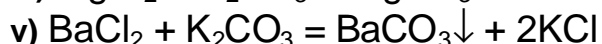
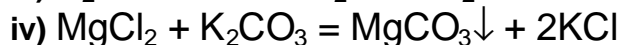
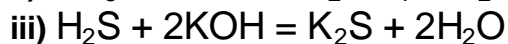
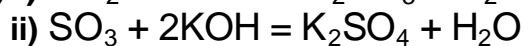
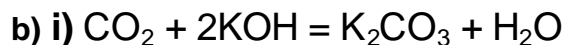
Y – BaCO₃, baariumkarbonaat

Z – BaSO₄, baariumsulfaat

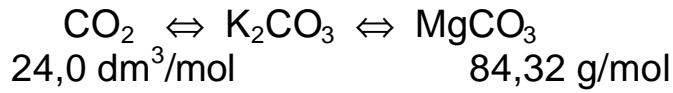
P – PbCO₃, pliiikarbonaat

Q – PbSO₄, pliiisulfaat

R – PbS, pliiisulfiid



$$\text{c) i) } \qquad \qquad \qquad \text{V} \qquad \qquad \qquad 3 \cdot 11,24 \text{ g}$$

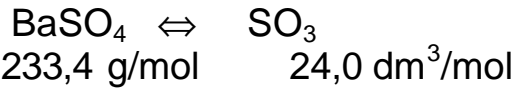


$$V(\text{CO}_2) = \frac{1}{1} \cdot 11,24 \text{ g} \cdot \frac{1 \text{ mol}}{84,32 \text{ g}} \cdot 3 \cdot 24,0 \text{ dm}^3 / \text{mol} = 0,1333 \text{ mol} \cdot 3 \cdot 24,0 \text{ dm}^3 / \text{mol} = \mathbf{9,60 \text{ dm}^3}$$

$$\text{ii) } m(\text{BaCO}_3) = \frac{1}{1} \cdot 0,1333 \text{ mol} \cdot 197,3 \text{ g/mol} = 26,30 \text{ g}$$

$$m(\text{BaSO}_4) = 119,9 \text{ g} - 26,3 \text{ g} = 93,6 \text{ g}$$

$$3 \cdot 93,6 \text{ g} \quad \quad \quad \text{V}$$



$$V(\text{SO}_3) = \frac{1}{1} \cdot 93,6 \text{ g} \cdot \frac{1 \text{ mol}}{233,4 \text{ g}} \cdot 3 \cdot 24,0 \text{ dm}^3 / \text{mol} = 0,401 \text{ mol} \cdot 3 \cdot 24,0 \text{ dm}^3 / \text{mol} =$$

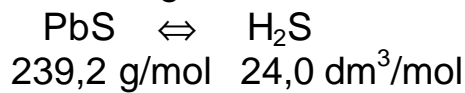
$$= \mathbf{28,9 \text{ dm}^3}$$

$$\text{iii) } m(\text{PbCO}_3) = \frac{1}{1} \cdot 0,1333 \text{ mol} \cdot 267,2 \text{ g/mol} = 35,62 \text{ g}$$

$$m(\text{PbSO}_4) = \frac{1}{1} \cdot 0,401 \text{ mol} \cdot 303,3 \text{ g/mol} = 121,6 \text{ g}$$

$$m(\text{PbS}) = 171,2 \text{ g} - 35,62 \text{ g} - 121,6 \text{ g} = 14,0 \text{ g}$$

$$3 \cdot 14,0 \text{ g} \quad \quad \quad \text{V}$$



$$V(\text{H}_2\text{S}) = \frac{1}{1} \cdot 14,0 \text{ g} \cdot \frac{1 \text{ mol}}{239,2 \text{ g}} \cdot 3 \cdot 24,0 \text{ dm}^3 / \text{mol} = \mathbf{4,21 \text{ dm}^3}$$