

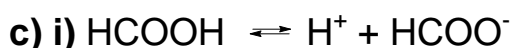
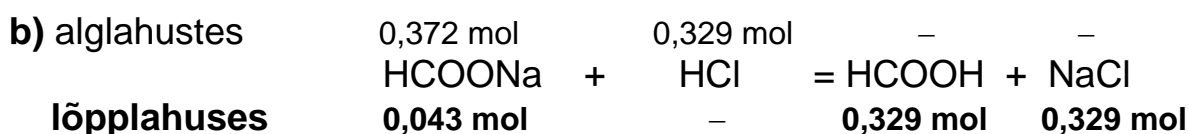
**2001/2002 õa keemiaolümpiaadi piirkonnavooru
ülesannete lahendused
11. klass**

1. a) i) $n(\text{HCOONa}) = 0,500 \text{ dm}^3 \cdot 1012 \text{ g/dm}^3 \cdot 0,05 \cdot \frac{1 \text{ mol}}{68,0 \text{ g}} = \mathbf{0,372 \text{ mol}}$

$n(\text{HCl}) = 1,20 \text{ dm}^3 \cdot 1003 \text{ g/dm}^3 \cdot 0,01 \cdot \frac{1 \text{ mol}}{36,5 \text{ g}} = \mathbf{0,329 \text{ mol}}$

ii) $c(\text{HCOONa}) = \frac{0,372 \text{ mol}}{0,500 \text{ dm}^3} = \mathbf{0,744 \text{ mol/dm}^3}$

$c(\text{HCl}) = \frac{0,329 \text{ mol}}{1,20 \text{ dm}^3} = \mathbf{0,275 \text{ mol/dm}^3}$

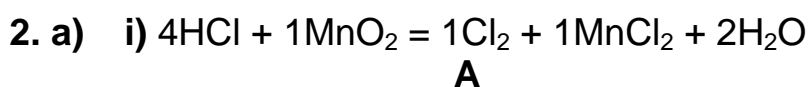


ii) $K_a = \frac{[\text{H}^+] \cdot [\text{HCOO}^-]}{[\text{HCOOH}]}$

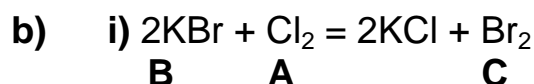
d) $[\text{H}^+] = K_a \cdot \frac{c_{\text{hape}}}{c_{\text{sool}}} \Rightarrow K_a \cdot \frac{n(\text{hape})}{n(\text{sool})}$

$[\text{H}^+] = 1,80 \cdot 10^{-4} \text{ mol/dm}^3 \cdot \frac{0,329}{0,043} = \mathbf{1,38 \cdot 10^{-3} \text{ M}}$

e) $\text{pH} = -\lg 1,38 \cdot 10^{-3} = 2,86 \sim \mathbf{2,9}$



ii) $n(\text{Cl}_2) = \frac{1}{4} \cdot 75,0 \text{ cm}^3 \cdot 1,15 \text{ g/cm}^3 \cdot 0,8 \cdot 0,3 \cdot \frac{1 \text{ mol}}{36,5 \text{ g}} = 0,1418 \text{ mol} \approx \mathbf{0,142 \text{ mol}}$



- ii) A – Cl₂, kloor
B – KBr, kaaliumbromiid
C – Br₂, broom

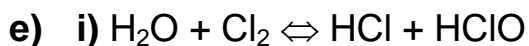
c) i) $n(\text{Br}_2) = \frac{1}{1} \cdot 0,142 \text{ mol} = \mathbf{0,142 \text{ mol}}$

$$\text{ii) } n(\text{KBr}) = \frac{2}{1} \cdot 0,142 \text{ mol} = \mathbf{0,284 \text{ mol}}$$

$$\text{d) } m(\text{KBr}) = 0,284 \text{ mol} \cdot 119 \text{ g/mol} = 33,796 \text{ g}$$

$$m(\text{lahus}) = 33,796 \text{ g} \cdot \frac{100\%}{5\%} = 675,92$$

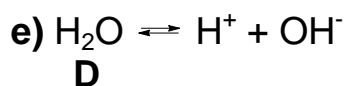
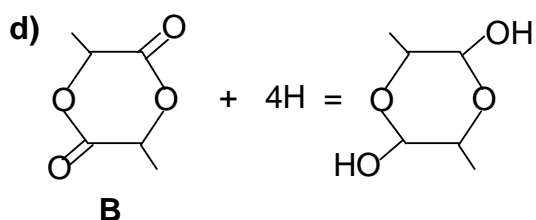
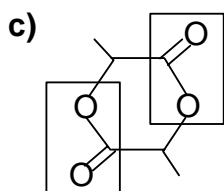
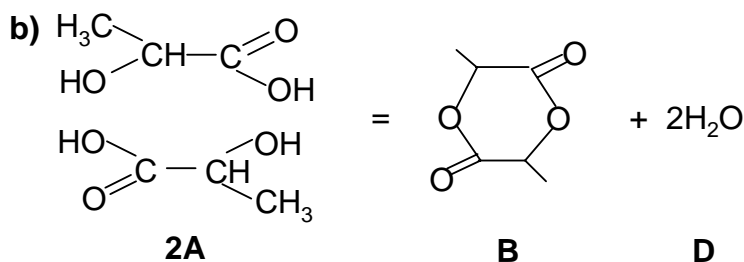
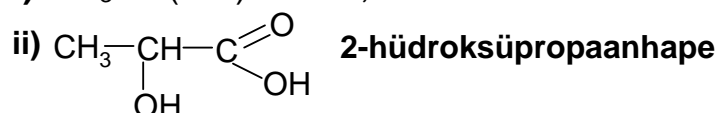
$$m(\text{H}_2\text{O}) = 675,92 \text{ g} - 33,796 \text{ g} = 642,12 \approx \mathbf{642 \text{ g}}$$



ii) HCl, vesinikkloriid

HClO, hüpokloorishape

$$\text{f) } \%(\text{HCl} + \text{HClO}) = \frac{0,015 \text{ mol} \cdot 36,5 \text{ g/mol} + 0,015 \text{ mol} \cdot 52,5 \text{ g/mol}}{100 \text{ g} + 0,015 \text{ mol} \cdot 71 \text{ g/mol}} \cdot 100 = 1,3$$



$$4. \text{ a) i) } m(\text{CuSO}_4) = 3,82 \text{ g (kr - h)} \cdot \frac{160 \text{ g (vv)}}{250 \text{ g (kr - h)}} = \mathbf{2,44 \text{ g}}$$

$$\text{ii) } m(\text{H}_2\text{O}) = 3,82 \text{ g} - 2,44 \text{ g} = \mathbf{1,38 \text{ g}}$$

$$\text{b) } m(\text{CuSO}_4, \text{ küllastunud lahusest}) = 2,44 \text{ g} - 2,00 \text{ g} = 0,44 \text{ g}$$

$$\mathbf{L(\text{CuSO}_4)} = \frac{0,44 \text{ g}}{1,38 \text{ g}} \cdot 100 \text{ g} = \mathbf{32 \text{ g}}$$

$$\text{c) } \%(\text{CuSO}_4, \mathbf{B}) = \frac{17,5 \text{ g}}{117,5 \text{ g}} \cdot 100 = 14,9$$

$$0,149 = \frac{75 \text{ g} \cdot 0,1 + X \cdot \frac{160}{250}}{75 \text{ g} + X}$$

$$\mathbf{X = 7,5 \text{ g (CuSO}_4 \cdot 5\text{H}_2\text{O})}$$

5. a) i) Moodustunud karbiidi **A** valemist ja ühendi **D** amfoteersusest järeldub:

X – Al, alumiinium

A – Al₄C₃, alumiiniumkarbiid

B – CH₄, metaan

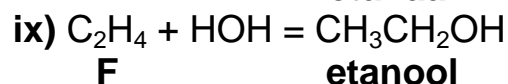
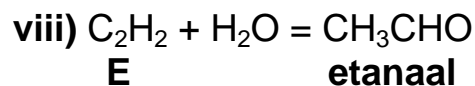
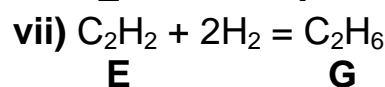
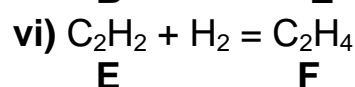
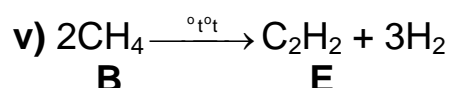
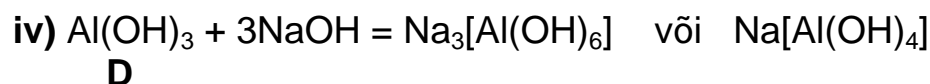
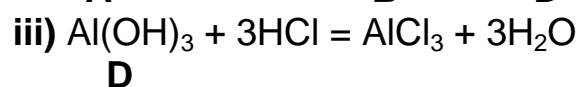
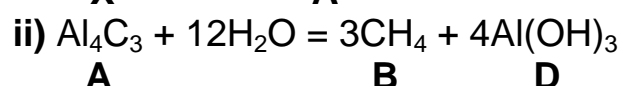
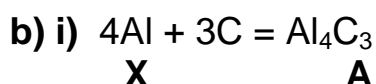
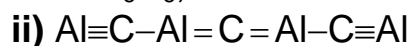
D – Al(OH)₃, alumiiniumhüdroksiid

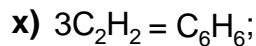
E – C₂H₂, etüün

F – C₂H₄, eteen

G – C₂H₆, etaan

I – C₆H₆, benseen





c) $M(\text{CH}_4) = 16 \text{ g/mol}$, kõige kergem orgaaniline molekul

$$M(\text{C}_2\text{H}_2) = 16 \text{ g/mol} \cdot 1,625 = 26 \text{ g/mol}$$

$$M(\text{C}_2\text{H}_4) = (26 \text{ g} + 2 \text{ g}) \frac{1}{\text{mol}} = 28 \text{ g/mol}$$

$$M(\text{C}_2\text{H}_6) = (26 \text{ g} + 4 \text{ g}) \frac{1}{\text{mol}} = 30 \text{ g/mol}$$

6. a) $m(\text{Y}) \Leftrightarrow 2,03 \text{ (Ag)}$

$$107,9 + \mathbf{A} \Leftrightarrow 107,9$$

$$\frac{m}{107,9 + \mathbf{A}} = \frac{2,03}{107,9}$$

$m(\text{X}) \Leftrightarrow 2,00 \text{ (Hg)}$

$$200,6 + 2\mathbf{A} \Leftrightarrow 200,6$$

$$\frac{m}{200,6 + 2\mathbf{A}} = \frac{2,00}{200,6}$$

$$\frac{200,6 + 2\mathbf{A}}{107,9 + \mathbf{A}} = \frac{2,03}{107,9} \cdot \frac{200,6}{2,00}$$

$$\frac{200,6 + 2\mathbf{A}}{107,9 + \mathbf{A}} = 1,887$$

$$200,6 + 2\mathbf{A} = 203,6 + 1,887\mathbf{A}$$

$$0,113\mathbf{A} = 3,0$$

$$\mathbf{A} = 26,5$$

$$M_r(\mathbf{A}) = \mathbf{26}$$

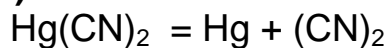
Märkus: Valem mass (molekulmass) on suhteline mass, kus ühikud taanduvad. Seepärast pole vaja untse ümber teisendada.

b) i) $\text{HA} - \text{HCN}$, vesiniksüaniidhape

ii) $M(\mathbf{B}) = 44 \text{ g/mol} \cdot 1,182 = 52 \text{ g/mol}$

$\mathbf{B} - (\text{CN})_2$, ditsüaan

c) i) $\overset{\circ}{\text{t}}\overset{\circ}{\text{t}}$



ii) $\overset{\circ}{\text{t}}\overset{\circ}{\text{t}}$

