

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

1. a) X – Ca, kaltsium

Y – C, süsinik

A – CaO, kaltsiumoksiid

B – Ca(OH)₂, kaltsiumhüdroksiid

C – CO₂, süsinikdioksiid

D – H₂CO₃, süsihape

E – CaCO₃, kaltsiumkarbonaat

F – H₂O, vesi

K – CaCl₂, kaltsiumkloriid

L – Ca(HCO₃), kaltsiumvesinikkarbonaat

b) i) $2\text{Ca} + \text{O}_2 = 2\text{CaO}$

ii) $\text{CaO} + \text{H}_2\text{O} = \text{Ca(OH)}_2$

iii) $\text{C} + \text{O}_2 = \text{CO}_2$

iv) $\text{CO}_2 + \text{H}_2\text{O} = \text{H}_2\text{CO}_3$

v) $\text{H}_2\text{CO}_3 + \text{Ca(OH)}_2 = \text{CaCO}_3\downarrow + 2\text{H}_2\text{O}$
_{↑_t ↓_t}

vi) $\text{CaCO}_3 = \text{CaO} + \text{CO}_2\uparrow$

vii) $\text{CaCO}_3 + 2\text{HCl} = \text{CO}_2\uparrow + \text{CaCl}_2 + \text{H}_2\text{O}$

viii) $2\text{HCl} + \text{CaO} = \text{CaCl}_2 + \text{H}_2\text{O}$

ix) $\text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2 = \text{Ca(HCO}_3)_2$

2. a) i) karastusjook "Fanta"; ii) pudeli avamine.

b) A – CO₂, süsinikdioksiid, süsihappegaas

B – H₂O, vesi

C – H₂CO₃, süsihape

D – C₁₂H₂₂O₁₁, sahharoos

c) i) **CaCO₃·MgCO₃**, kaltsiumkarbonaat-magneesiumkarbonaat

ii) **dolomiit**

3. a) i) **A – Ca(H₂PO₄)₂·CaSO₄**

ii) **B – Ca(H₂PO₄)₂**

iii) **C – CaHPO₄**

b) $M_r(\text{P}_2\text{O}_5) = 2 \cdot 31,0 + 5 \cdot 16,0 = 142$

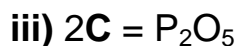
$M_r(\text{A}) = 234 + 136 = 370$

i) $\text{A} \Leftrightarrow \text{P}_2\text{O}_5$

$\%(\text{P}_2\text{O}_5, \text{A}) = \frac{142}{370} \cdot 100 = 38,3$

ii) $\text{B} \Leftrightarrow \text{P}_2\text{O}_5$

$$\%(\text{P}_2\text{O}_5, \text{B}) = \frac{142}{234} \cdot 100 = 60,7$$



$$\%(\text{P}_2\text{O}_5, \text{C}) = \frac{142}{276} \cdot 100 = 51,4$$

c) i) $m(\text{A}) = 1,00 \text{ kg} \cdot \frac{100\%}{38,3\%} = 2,86 \text{ kg}$

ii) $m(\text{B}) = 1,00 \text{ kg} \cdot \frac{1}{0,607} = 1,65 \text{ kg}$

iii) $m(\text{C}) = 1,00 \text{ kg} \cdot \frac{1}{0,514} = 1,95 \text{ kg}$

4. a) $M(\text{A}) = 2,016 \text{ g/mol} \cdot 106,35 = 214,4 \text{ g/mol}$

b) i) $m(\text{Cl}) = 214,4 \text{ g} \cdot 0,6617 = 141,9 \text{ g}$

$$n(\text{Cl}) = 141,9 \text{ g} \cdot \frac{1 \text{ mol}}{35,45 \text{ g}} = 4,003 \text{ mol} \approx 4 \text{ mol}$$

ii) $m(\text{X}) = 214,4 \text{ g} - 141,9 \text{ g} = 72,5 \text{ g}$

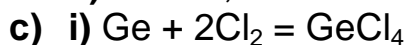
Kloriidides on kloori oksüdatsiooniaste -I. Kloriidide valemid on XCl_n , millest järeldub, et ühendis **A** on üks elemendi **X** aatom oksüdatsiooniastmega IV.

$$A_r(\text{X}) = 72,5$$

iii) **X** – Ge, germaanium

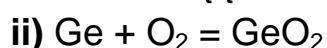
iv) **4 elektroni**

v) $N = 72,61 - 32 \approx 41$ neutronit

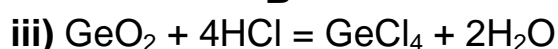


A

^ot^ot



B



B

A

Märkus: GeCl_4 juurde ei tohi lenduvuse noolt kirjutada, sest see keeb toatemperatuurist kõrgemal temperatuuril

5. a) i) $n(\text{gaas}) = 9,77 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} = 0,436 \text{ mol}$

ii) Mõlemas reaktsioonis saab eraldunud gaasiks olla H_2 , vesinik.

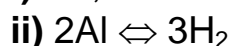
b) Lahuse massi kasv võrdub metalli massi ja eraldunud vesiniku massi vahega.

$$6,97 \text{ g} = m(\text{X}) - m(\text{H}_2)$$

$$m(\text{H}_2) = 9,77 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} \cdot 2,02 \text{ g/mol} = 0,881 \text{ g}$$

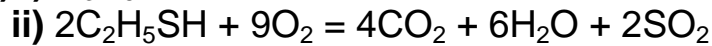
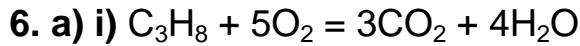
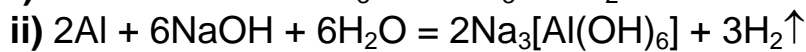
$$m(\text{X}) = 6,97 \text{ g} + 0,88 \text{ g} = 7,85 \text{ g}$$

c) i) **Al**, alumiinium

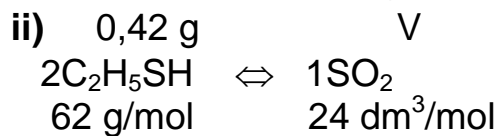


$$n(\text{Al}) = \frac{2}{3} \cdot 0,436 \text{ mol} = 0,2906 \text{ mol} \approx 0,291 \text{ mol}$$

$$M(\text{Al}) = \frac{7,85 \text{ g}}{0,2906 \text{ mol}} = \mathbf{27,0 \text{ g/mol}}$$

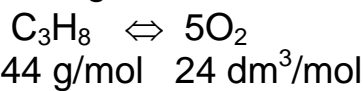


b) i) $m(\text{C}_2\text{H}_5\text{SH}) = \frac{21 \text{ kg}}{1000 \text{ kg}} \cdot 20,0 \text{ g} = \mathbf{0,42 \text{ g}}$



$$V(\text{SO}_2) = 0,42 \text{ g} \cdot \frac{1 \text{ mol}}{62 \text{ g}} \cdot 24,0 \text{ dm}^3 / \text{mol} = \mathbf{0,163 \text{ dm}^3}$$

c) $21 \cdot 10^3 \text{ g} \quad v \cdot 0,21$



$$V(\text{õhk}) = \frac{5}{1} \cdot 21 \cdot 10^3 \text{ g} \cdot \frac{1 \text{ mol}}{44 \text{ g}} \cdot 24,0 \text{ dm}^3 / \text{mol} \cdot \frac{1}{0,21} = \mathbf{2,73 \cdot 10^5 \text{ dm}^3}$$

$$\% \text{vol}(\text{SO}_2) = \frac{0,163 \text{ dm}^3}{2,73 \cdot 10^5 \text{ dm}^3} \cdot 100 = \mathbf{5,97 \cdot 10^{-5}}$$