

**2002/2003 õa keemiaolümpiaadi piirkonnavooru
ülesannete lahendused
10. klass**

1. a) gaasilise

b) kristallvõre lõhkumine ja hüdraatide (solvaatide) moodustumine.

-III V

c) NH_4NO_3

d) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$

e) i) $2\text{H}_2 + \text{O}_2 = 2\text{H}_2\text{O} \quad \Delta H < 0$, eksotermiline

ii) $2\text{H}_2\text{O} = 2\text{H}_2 + \text{O}_2 \quad \Delta H > 0$, endotermiline

f) i) Na, pH>7, moodustub alus
Cl₂, pH<7, moodustub (kaks) hapet
S₈, pH=7, ei lahustu vees

ii) SiO₂, pH=7, ei lahustu vees
CaO, pH>7, moodustub alus
SO₂; pH<7, moodustub hape

iii) Fe(OH)₃, pH=7, ei lahustu vees
HCl, pH<7, vees lahustuv hape
NaOH, pH>7, vees lahustuv alus
CH₃COOH, pH<7, vees lahustuv hape

iv) NH₄Cl, pH<7, tugeva happe ja nõrga aluse sool
NaCl, pH=7, tugeva happe ja tugeva aluse sool
Na₂CO₃, pH>7, tugeva aluse ja nõrga happe sool

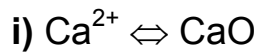
2. a) i) $\text{Ca(OH)}_2 + 2\text{HCl} = \text{CaCl}_2 + 2\text{H}_2\text{O}$
 $\text{CaCO}_3 + 2\text{HCl} = \text{CaCl}_2 + \text{CO}_2\uparrow + \text{H}_2\text{O}$

ii) SiO₂

b) $\text{Ca}^{2+} \Leftrightarrow \text{EDTA}$

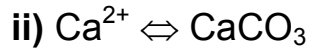
$$c(\text{Ca}^{2+}) = \frac{1}{1} \cdot 0,0250 \text{ mol/dm}^3 \cdot 20,0 \text{ cm}^3 \cdot \frac{1}{5,00 \text{ cm}^3} = 0,100 \text{ mol/dm}^3$$

$$n(\text{Ca}^{2+}) = 100 \text{ ml} \cdot \frac{1 \text{ dm}^3}{1000 \text{ ml}} \cdot 0,100 \text{ mol/dm}^3 = 0,0100 \text{ mol}$$



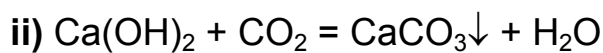
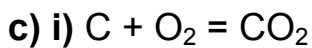
$$m(\text{CaO}) = 0,0100 \text{ mol} \cdot 56,1 \text{ g/mol} = 0,561 \text{ g}$$

$$\%(\text{CaO}) = \frac{0,561 \text{ g}}{3,00 \text{ g}} \cdot 100 = 18,7$$



$$m(\text{CaCO}_3) = 0,0100 \text{ mol} \cdot 100 \text{ g/mol} = 1,00 \text{ g}$$

$$\%(\text{CaCO}_3) = \frac{1,00 \text{ g}}{3,00 \text{ g}} \cdot 100 = 33,3$$

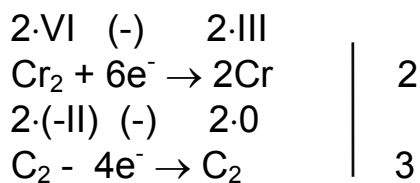
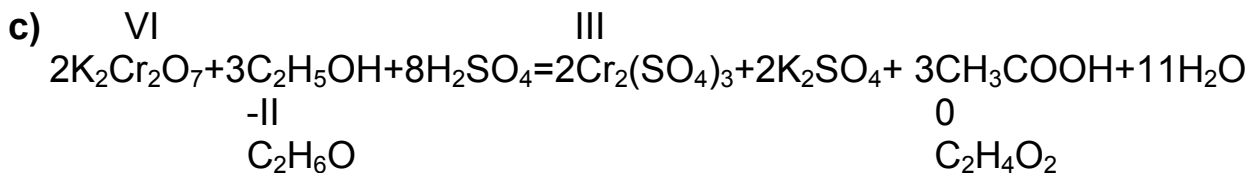
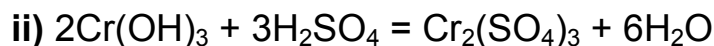


3. a) **A** – $\text{K}_2\text{Cr}_2\text{O}_7$, kaaliumdikromaat

B – $\text{Cr}_2(\text{SO}_4)_3$, kroom(III)sulfaat

C – $\text{Cr}(\text{OH})_3$, kroom(III)hüdroksiid

D – K_2CrO_4 , kaaliumkromaat



4. a) Ühendi **A** valem on X_2O_2

$$M(\text{X}) = 32 \text{ g/mol} \cdot \frac{1}{41\%} \cdot 59\% \cdot \frac{1}{2} = 23 \text{ g/mol}$$

X – Na, naatrium

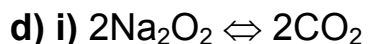
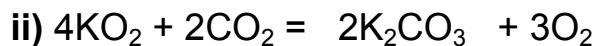
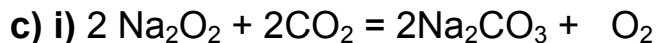
Ühendi **B** valem on YO_2

$$M(\text{Y}) = 32 \text{ g/mol} \cdot \frac{1}{45\%} \cdot 55\% = 39 \text{ g/mol}$$

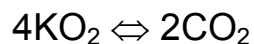
Y – K, kaalium

b) **A** – Na₂O₂, naatriumperoksiid

B – KO₂, kaaliumhüperoksiid



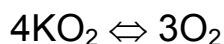
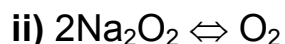
$$M(\text{Na}_2\text{O}_2) = 78,0 \text{ g/mol}$$



$$M(\text{KO}_2) = 71,1 \text{ g/mol}$$

$$n(\text{CO}_2) = \frac{2}{2} \cdot \frac{1000 \text{ g}}{78,0 \text{ g/mol}} = 12,8 \text{ mol}$$

$$m(\text{KO}_2) = \frac{4}{2} \cdot 12,8 \text{ mol} \cdot 71,1 \text{ g/mol} = 1820 \text{ g} = \mathbf{1,82 \text{ kg}}$$



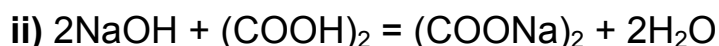
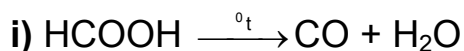
$$m(\text{KO}_2) = \frac{4}{3} \cdot \frac{1}{2} \cdot \frac{1000 \text{ g}}{78,0 \text{ g/mol}} \cdot 71,1 \text{ g/mol} = 607,6 \text{ g} \approx \mathbf{0,608 \text{ kg}}$$

5. a) **A** – HCOOH, sipelghape

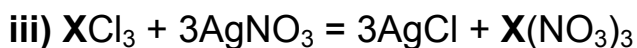
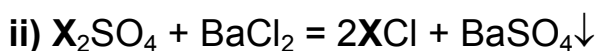
B – CO, süsinikmonooksiid

C – H₂O, vesi

b) (COOH)₂

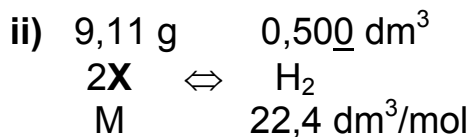


6. a) Metall **X** oksüdatsiooniaste soolas **D** on I ja soolas **E** on III. Seda tõestavad järgmised andmed: $1\text{B} \Leftrightarrow 2\text{D}$; $1\text{E} \Leftrightarrow 3\text{AgNO}_3$. Sama vooluga sama koguse metalli saamiseks soolast **E** kulub aega kolm korda rohkem kui soolast **D**.



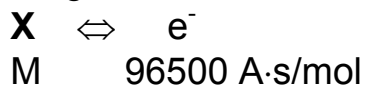
c) i) **G** – X₂O₃

$$M(\mathbf{X}) = 16 \text{ g/mol} \cdot 3 \cdot \frac{1}{10,53\%} \cdot 89,47\% \cdot \frac{1}{2} = 203,9 \text{ g/mol} \approx \mathbf{204 \text{ g/mol}}$$



$$9,11 \text{ g} = \frac{2}{1} \cdot 0,500 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} \cdot M(\mathbf{X})$$

$$M(\mathbf{X}) = \mathbf{204 \text{ g/mol}}$$



$$10,0 \text{ g} = \frac{1}{1} \cdot \frac{10,0 \text{ A} \cdot 473 \text{ s}}{96500 \text{ A} \cdot \text{s/mol}} \cdot M(\mathbf{X})$$

$$M(\mathbf{X}) = \mathbf{204 \text{ g/mol}}$$

d) \mathbf{X} – Tl, tallium

A – H₂SO₄, väävelhape

B – Tl₂SO₄, tallium(I)sulfaat

C – BaCl₂, baariumkloriid

D – TlCl, tallium(I)kloriid

E – TlCl₃, tallium(III)kloriid

F - AgCl, hõbekloriid

G – Tl₂O₃, tallium(III)oksiid