

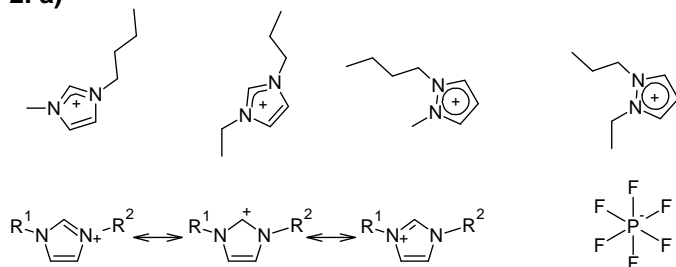
2011/2012 õ.a. keemiaolümpiaadi piirkonnavooru ülesannete lahendused  
11. klass

- 1.a) X- Ta, Tantaal (1p)  
Y- HF, vesinikfluoriid (1p)
- b) 1.  $3\text{Ta} + 5\text{HNO}_3 + 21\text{HF} = 3\text{H}_2[\text{TaF}_7] + 5\text{NO} + 10\text{H}_2\text{O}$  (1p)  
2.  $3\text{Ta}_2\text{O}_5 + 10\text{Al} = 6\text{Ta} + 5\text{Al}_2\text{O}_3$  (1p)  
3.  $2\text{Ta} + 5\text{Cl}_2 = 2\text{TaCl}_5$  (1p)  
4.  $\text{Ta}_2\text{O}_5 + 14\text{HF} = 2\text{H}_2[\text{TaF}_7] + 5\text{H}_2\text{O}$  (1p)  
5.  $2\text{H}_2[\text{TaF}_7] + 14\text{NH}_4\text{OH} = \text{Ta}_2\text{O}_5\downarrow + 14\text{NH}_4\text{F} + 9\text{H}_2\text{O}$  (1p)  
6.  $\text{Ta}_2\text{O}_5 + 5\text{CCl}_4 = 2\text{TaCl}_5 + 5\text{COCl}_2$  (1p)  
7.  $\text{H}_2[\text{TaF}_7] + 2\text{KF} = \text{K}_2[\text{TaF}_7] + 2\text{HF}$  (1p)  
8.  $\text{TaCl}_5 + 5\text{HF} + 2\text{KF} = \text{K}_2[\text{TaF}_7] + 5\text{HCl}$  (1p)  
9.  $\text{K}_2[\text{TaF}_7] + 5\text{Na} = \text{Ta} + 2\text{KF} + 5\text{NaF}$  (1p)

Õige reaktsioonivõrrand (üks vale ühend -0,25p) 0,75p+ tasakaalustamine (vaid õige reaktsioonivõrrandi korral) 0,25 p

(kokku 11p)

2. a)



(6\*1p=6p)

- b)  $\text{PF}_6^- + \text{H}_2\text{O} \rightarrow \text{PF}_5\text{OH}^- + \text{HF}$  (1,5p)  
 $6\text{HF} + \text{SiO}_2 \rightarrow \text{H}_2\text{SiF}_6 + 2\text{H}_2\text{O}$  (1,5p)  
c)  $\text{H}_2\text{SiF}_6 + \text{Na}_2\text{O} \rightarrow \text{Na}_2\text{SiF}_6 + \text{H}_2\text{O}$  (1,5p)  
 $\text{Na}_2\text{SiF}_6$  - Naatriumheksafluorosilikaat (0,5p)

(kokku 11p)

3. a) Kloroalkaani üldvalem on  $\text{C}_n\text{H}_{2n+1}\text{Cl}$ . Seega:

$$\frac{35,45}{12,01 \cdot n + 1,01 \cdot (2n + 1) + 35,45} = 0,3326$$

$$12,01n + 2,02n + 1,01 + 35,45 = 106,58$$

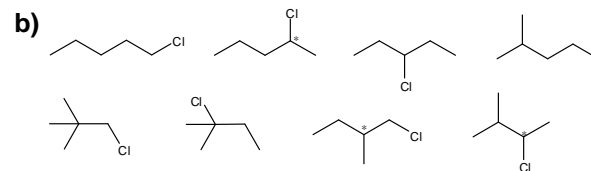
$$14,03n = 70,12$$

$$n = 5$$

(2p)

Ühendi brutovalem on  $\text{C}_5\text{H}_{11}\text{Cl}$

(1p)



(8\*0,5p=4p)

asümmeetria tsentri tähistamata jätmise - 0,25 punkti

c) 1-kloro-2-metüülbutaan

(1p)

(kokku 8p)

4. a)

- X - Mg (0,5p)  
A - MgO (0,5p)  
B - H<sub>2</sub> (0,5p)  
C - Mg(OH)<sub>2</sub> (0,5p)  
D - Ca (0,5p)  
E - Ca(HCO<sub>3</sub>)<sub>2</sub> (0,5p)  
F - CaCO<sub>3</sub> (0,5p)  
G - Ca<sub>3</sub>N<sub>2</sub> (0,5p)  
H - NH<sub>3</sub> (0,5p)

b)i)  $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$  (0,5p)

ii)  $\text{Mg} + 2\text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2 + \text{H}_2\uparrow$  (0,5p)

iii)  $\text{RCl} + \text{Mg} \rightarrow \text{R} - \text{Mg} - \text{Cl}$  (1p)

iv)  $\text{Ca}(\text{HCO}_3)_2 \rightarrow \text{CaCO}_3\downarrow + \text{CO}_2\uparrow + \text{H}_2\text{O}$  (0,5p)

v)  $3\text{Ca} + \text{N}_2 \rightarrow \text{Ca}_3\text{N}_2$  (1p)

vi)  $\text{Ca}_3\text{N}_2 + 6\text{H}_2\text{O} \rightarrow 3\text{Ca}(\text{OH})_2 + 2\text{NH}_3\uparrow$  (1p)

(kokku 9p)

5. a) Kuna aine tekib põletamisel, siis teine element selles aines on hapnik.

Seega hapnikusisaldus on 25,8%.  $M(\text{O})=16$ . Aine valem  $\text{X}_a\text{O}_b$

Kui  $b=1$ , siis  $M(\text{F})=62$ . Kui  $a=1$ , siis  $M(\text{X})=46$  pole olemas. Kui  $a=2$ , siis

$M(\text{X})=23$ , seega X on Na. Seega F on Na<sub>2</sub>O (1,5p)

- b) A NaI (0,25p)  
B I<sub>2</sub> (0,25p)  
C NaOH (0,25p)  
D Na<sub>2</sub>CO<sub>3</sub> (0,25p)  
E Na<sub>2</sub>O<sub>2</sub> (0,25p)  
G O<sub>2</sub> (0,25p)  
H HI (0,25p)  
Y I (0,25p)

(8\*0,25p=2p)

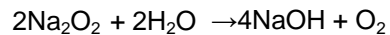
c)  $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$  (0,5p)

$2\text{NaOH} + \text{CO}_2 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$  (0,5p)

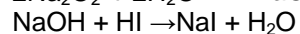
$2\text{Na} + \text{O}_2 \rightarrow \text{Na}_2\text{O}_2$  (0,5p)

$4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$  (0,5p)

$\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$  (0,5p)



(0,5p)



(0,5p)

(7\*0,5p=3,5p)

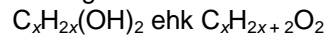
d) Keemiline reaktsioon:  $2\text{Na} + \text{I}_2 \rightarrow 2\text{NaI}$

Füüsikaline protsess:  $\text{I}_2$  sublimatsioon.

(0,5+0,5p)

(kokku 8p)

6. a) Kuna glükoolis on kaks OH-rühma, siis aine C üldvalem on:



$$M_r(\text{C}_x\text{H}_{2x+2}\text{O}_2) = 12,01 \cdot x + 1,01 \cdot (2x+2) + 16 \cdot 2$$

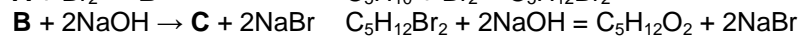
$$\%(\text{O}) = \frac{16 \cdot 2}{12,01 \cdot x + 1,01 \cdot (2x+2) + 16 \cdot 2} \cdot 100 = \frac{3200}{14,03x + 34,02} = 30,7$$

$$x = \frac{3200 - 30,7 \cdot 34,02}{30,7 \cdot 14,03} = 5,00 \quad (2)$$

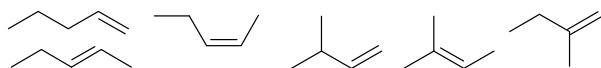
C –  $\text{C}_5\text{H}_{12}\text{O}_2$ , pentaandiool (0,5 + 0,5p)

A –  $\text{C}_5\text{H}_{10}$ , penteen (0,5 + 0,5p)

B –  $\text{C}_5\text{H}_{12}\text{Br}_2$ , dibromopentaan (0,5 + 0,5p)

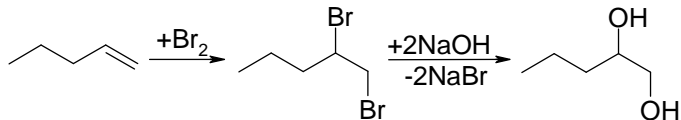


b)



(6\*0,5p=3p)

c) Näiteks:



(2\*1p=2p)

$$\text{d)} \quad m(\text{C}_5\text{H}_{10}(\text{OH})_2) = \frac{1}{1} \cdot \frac{1}{1} \cdot 10,4 \text{ g} \cdot \frac{1 \text{ mol}}{104,17 \text{ g}} \cdot \frac{70,15 \text{ g}}{1 \text{ mol}} = 7,00 \text{ g} \quad (2,5\text{p})$$

$$\%(\text{lisandid}) = \frac{7,50 \text{ g} - 7,00 \text{ g}}{7,5 \text{ g}} \cdot 100 = 6,7 \quad (0,5\text{p})$$

(kokku 13p)