

**2001/2002 õa keemiaolümpiaadi lõppvooru ülesannete lahendused**  
**10. klass**

1. a)  $m(\text{CuSO}_4 \cdot 5\text{H}_2\text{O}) = x$

$$\text{Küllastunud lahuses } m(\text{CuSO}_4) = x \cdot \frac{160}{250} = 0,640x$$

$$m(\text{H}_2\text{O}) = 100 \text{ g} + x \cdot \frac{5 \cdot 18}{250} = 100 \text{ g} + 0,360x$$

$$L(\text{CuSO}_4) = 17,2 \text{ g}$$

$$L(\text{CuSO}_4) = \frac{0,640x}{100 \text{ g} + 0,360x} \cdot 100 \text{ g}$$

Lahustuvus näitab lahustunud aine grammide arvu täpselt 100 g vees.

$$\frac{0,640x}{100 \text{ g} + 0,360x} = 0,172$$

$$17,2 \text{ g} = 0,578x$$

Küllastunud lahuse jaoks vajalik

$$m(\text{CuSO}_4 \cdot 5\text{H}_2\text{O}) = x = 29,76 \text{ g} \approx \mathbf{29,8 \text{ g}}$$

b) Lahuse protsendilise sisalduse saab leida vahetult lahustuvuse andmetest.

$$\%(\text{CuSO}_4) = \frac{17,2}{100 + 17,2} \cdot 100 = 14,67 \approx \mathbf{14,7}$$

c)  $m(\text{küllastunud lahus}) = 100 \text{ g} + 29,8 \text{ g} = \mathbf{129,8 \text{ g}}$

d)  $m(\text{CuSO}_4) = 129,8 \cdot 0,147 = 19,08 \approx 19,1 \text{ g}$

$$m(\text{CuSO}_4) = 29,8 \text{ g} \cdot 0,64 = 19,07 \approx \mathbf{19,1 \text{ g}}$$

2. a)  $n(X) = 67,2 \cdot 10^{-3} \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} = 3,00 \cdot 10^{-3} \text{ mol}$

$$n(\text{KOH}) = 60,0 \cdot 10^{-3} \text{ dm}^3 \cdot 0,100 \text{ mol/dm}^3 = 6,00 \cdot 10^{-3} \text{ mol}$$

Mõlemad happed on kaheprootonilised.

$$M(\text{happe A kaltsiumi sool}) = 408 \cdot 10^{-3} \text{ g} \cdot \frac{1}{3,00 \cdot 10^{-3} \text{ mol}} = 136 \text{ g/mol}$$

$$M(\text{anioon A}) = 136 \text{ g/mol} - 40 \text{ g/mol} = 96 \text{ g/mol}$$

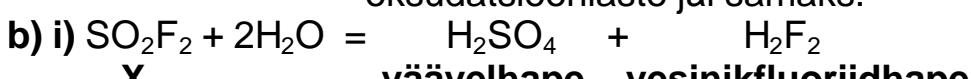


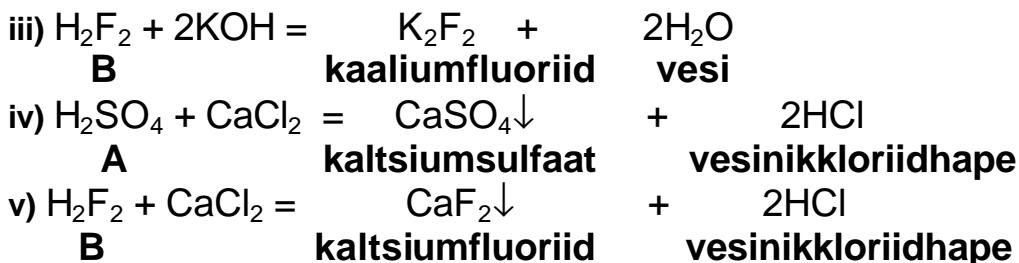
$$M(\text{happe B kaltsiumi sool}) = 234 \cdot 10^{-3} \text{ g} \cdot \frac{1}{3,00 \cdot 10^{-3} \text{ mol}} = 78 \text{ g/mol}$$

$$M(\text{anioon B}) = 78 \text{ g/mol} - 40 \text{ g/mol} = 38 \text{ g/mol}$$

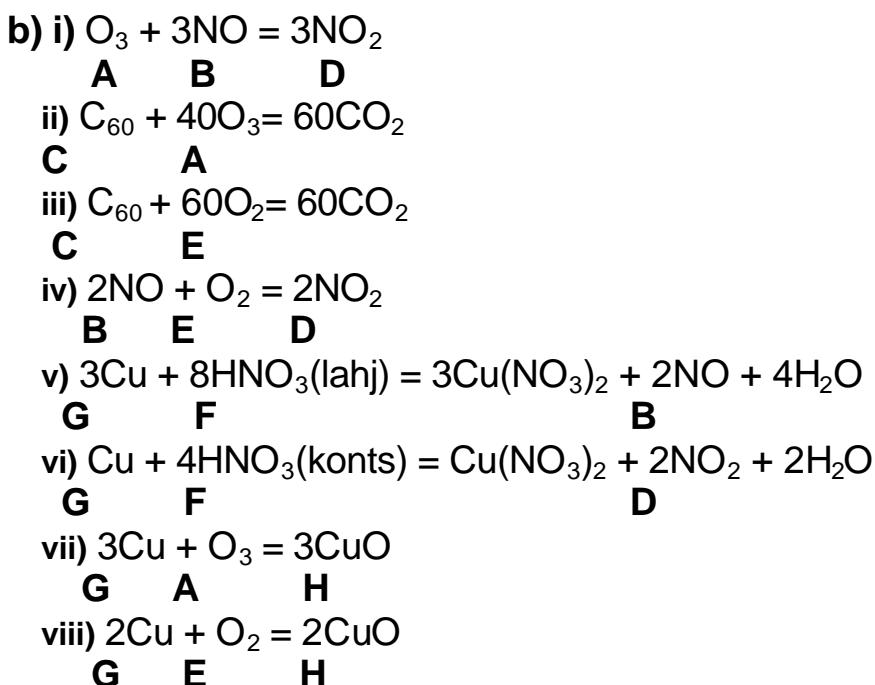


Aine X –  $\text{SO}_2\text{F}_2$ , sest gaas X oli viie-aatomiline ja elementide oksüdatsiooniaste jäi samaks.





- 3. a)** A – O<sub>3</sub>, osoon, gaas, lihtaine, mürgine  
B – NO, lämmastikmonooksiid, gaas, mürgine  
C – C<sub>60</sub>, fullereen, tahke, lihtaine  
D – NO<sub>2</sub>, lämmastikdioksiid, gaas, mürgine  
E – O<sub>2</sub>, hapnik, gaas, lihtaine  
F – HNO<sub>3</sub>, lämmastikhape  
G – Cu, vask  
H – CuO, vask(II)oksiid



$$\text{b) i)} n(N) = 35 \text{ g} \cdot \frac{1 \text{ mol}}{14 \text{ g}} = 2,5 \text{ mol}$$

$$n(O) = 60 \text{ g} \cdot \frac{1 \text{ mol}}{16 \text{ g}} = 3,75 \text{ mol}$$

$$n(H) = 5 \text{ g} \cdot \frac{1 \text{ mol}}{1 \text{ g}} = 5 \text{ mol}$$

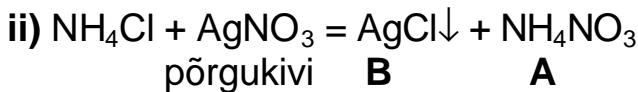
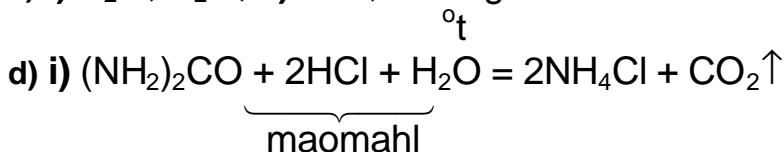
Väikseimad täisarvud saame siis, kui moolide arvud jagame arvuga 2. Lihtsaim brutoyalem on seega  $\text{N}_2\text{H}_4\text{O}_3$ .

### EXPERIMENTAL

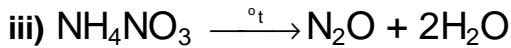
### ii) ammoniumnitraat

125

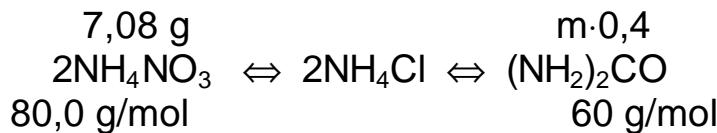
c) i)  $\text{H}_2\text{O}$ ,  $\text{N}_2\text{O}$ ; ii) vesi, naerugaas



B A



e) Veerand untsi on  $28,35 \text{ g}/4 = 7,08 \text{ g}$



$$m[(\text{NH}_2)_2\text{CO}] = \frac{1}{2} \cdot 7,08 \text{ g} \cdot \frac{1 \text{ mol}}{80,0 \text{ g}} \cdot 60 \text{ g/mol} \cdot \frac{1}{0,4} \cdot \frac{1 \text{ unts}}{28,35 \text{ g}} = 0,234 \text{ untsi}$$

f) Ei saa, sest tina reageerib soolhappega:  $\text{Sn} + 2\text{HCl} = \text{SnCl}_2 + \text{H}_2 \uparrow$

Katel võib liiga ruttu lekkima hakata.

g)  $\text{AgCl}$  laguneb aeglaselt valguse toimel, seepärast viiakse katse läbi hämaras.

5. a) i) Element A – Rb, rubiidium

ii)  $M_r(\text{Rb}) = 85; N(\text{elektron}) = 85 - 37 = 48$   
 $48 - 37 = 11$

b) i)  $4\text{Rb} + \text{O}_2 = 2\text{Rb}_2\text{O}$

A B – rubiidiumoksiid

ii)  $2\text{Rb} + \text{O}_2 = \text{Rb}_2\text{O}_2$

A C – rubiidiumperoksiid

iii)  $\text{Rb} + \text{O}_2 = \text{RbO}_2$

A D – rubiidiumhüperoksiid

iv)  $2\text{Rb} + 3\text{O}_2 = 2\text{RbO}_3$

A E – rubiidiumosoniid

v)  $2\text{RbO}_3 + \text{Rb} = 3\text{RbO}_2$

E A D

vi)  $\text{RbO}_2 + \text{Rb} = \text{Rb}_2\text{O}_2$

D A C

vii)  $\text{Rb}_2\text{O}_2 + 2\text{Rb} = 2\text{Rb}_2\text{O}$

C A B

viii)  $4\text{RbO}_2 + 2\text{CO}_2 = 2\text{Rb}_2\text{CO}_3 + 3\text{O}_2$

D F – süsinik- G – rubiidium- I – hapnik  
dioksiid karbonaat

6. a) NG (vedelik) segatakse peenpulbriliste aineteega (puidujahu, talk vm), mis neelavad juhuslikult lagunenud NG molekulist moodustunud energia ega lase tekkida ahelreaktsiooni.

b) i) A – NaOH, naatriumhüdroksiid

X –  $\text{CH}_2\text{OHCHOHCH}_2\text{OH}$ , glütserool, 1,2,3-propaantriool

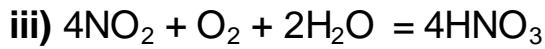
ii) **B** – seep; (rasvhappe) sool  
elektrikaar



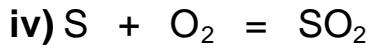
lämmastik hapnik **C** – lämmastikoksiid



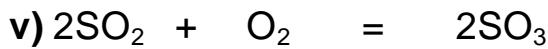
**C** **D** – lämmastikdioksiid



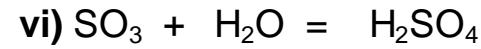
**D** vesi **Y** – lämmastikhape



väävel **E** – vääveldioksiid  
katalüsaator



**E** **F** - vääveltrioksiid



**F** **Z** – väävelhape

