

**2004/2005 õa keemiaolümpiaadi piirkonnavooru
ülesannete lahendused
9. klass**

- 1. a) i)** $100 \text{ cm}^2 < 1 \text{ m}^2$, pindala; **ii)** $1 \text{ kg/dm}^3 = 1 \text{ g/cm}^3$, tihedus;
iii) $86400 \text{ s} = 1$ ööpäev; aeg; **iv)** $10000 \text{ cm}^3 > 1 \text{ L}$; ruumala
- b) i)** $2\text{H}_2 + \text{O}_2 = 2\text{H}_2\text{O}$, ei ; **ii)** $2\text{NaOH} + \text{CO}_2 = \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$, jah;
iii) $3\text{H}_2 + \text{N}_2 = 2\text{NH}_3$, ei; **iv)** $\text{C} + \text{O}_2 = \text{CO}_2$, ei
 2·(-II) (-) 2·0
- c) i)** $2\text{O} - 4\text{e}^- = \text{O}_2$ oksüdeerumine
 2·0 (-) 2·(-II)
- ii)** $\text{O}_2 + 4\text{e}^- = 2\text{O}$ redutseerumine
 -II (-) VI
- iii)** $\text{S} - 8\text{e}^- = \text{S}$ oksüdeerumine
 v (-) -III
- iv)** $\text{N} + 8\text{e}^- = \text{N}$ redutseerumine
- d)** SiO_2 – neutraalne, sest SiO_2 ei lahustu vees
 SO_2 – happeline, sest moodustub väävlishape
 Na_2O – aluseline, sest moodustub NaOH
 NaCl – neutraalne, sest NaCl on tugeva happe ja tugeva aluse sool
 AlCl_3 – happeline, nõrga aluse ja tugeva happe sool
 Na_2CO_3 – aluseline, tugeva aluse ja nõrga happe sool

2. a) i) $A_r(\text{mittemetall}) = 16 \cdot \frac{27,3}{72,7} = 6$ ei sobi

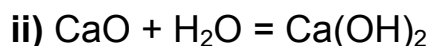
$A_r(\text{mittemetall}) = 2 \cdot 16 \cdot \frac{27,3}{72,7} = 12$ Mittemetall on **C**

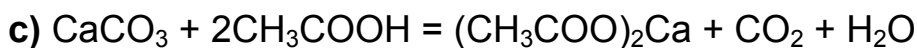
ii) $A_r(\text{metall}) = 16 \cdot \frac{71,5}{28,5} = 40,1$ Metall on **Ca**

iii) B – CO_2 , süsinikdioksiid

D – CaO , kaltsiumoksiid

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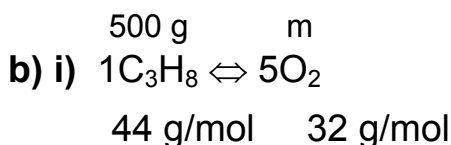
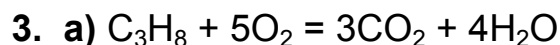




d) $M_r[(\text{CH}_3\text{COO})_2\text{Ca}] = 4 \cdot 12 + 6 \cdot 1 + 4 \cdot 16 + 40 = 158$

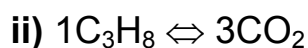
$$\%(\text{Ca}) = \frac{40}{158} \cdot 100 = 25,3 \approx \mathbf{25}$$

e) $m(\text{CaCO}_3) = 0,90 \cdot \frac{4}{3}\pi(0,25)^3 \text{ cm}^3 \cdot 2,68 \text{ g/cm}^3 = \sim \mathbf{0,16 \text{ g}}$

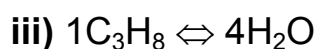


$$n(\text{C}_3\text{H}_8) = 500 \text{ g} \cdot \frac{1 \text{ mol}}{44 \text{ g}} = 11,36 \text{ mol}$$

$$m(\text{O}_2) = \frac{5}{1} \cdot 500 \text{ g} \cdot \frac{1 \text{ mol}}{44 \text{ g}} \cdot 32 \text{ g/mol} = 1818 \text{ g} \approx \mathbf{1800 \text{ g}}$$



$$m(\text{CO}_2) = \frac{3}{1} \cdot 11,36 \text{ mol} \cdot 44 \text{ g/mol} = \mathbf{1500 \text{ g}}$$



$$m(\text{H}_2\text{O}) = \frac{4}{1} \cdot 11,36 \text{ mol} \cdot 18 \text{ g/mol} = 818 \text{ g} \approx \mathbf{820 \text{ g}}$$

c) Lämmastiku mass ei muutu

$$m(\text{N}_2) = 30000 \text{ dm}^3 \cdot 1,29 \text{ g/dm}^3 \cdot 0,76 = 29412 \text{ g}$$

Enne gaasi põlemist oli hapnikku

$$m(\text{O}_2) = 30000 \text{ dm}^3 \cdot 1,29 \text{ g/dm}^3 \cdot 0,24 = 9288 \text{ g}$$

Peale gaasi põlemist oli hapnikku

$$m'(\text{O}_2) = 9288 \text{ g} - 1818 \text{ g} = 7470 \text{ g}$$

$$\%(\text{CO}_2) = \frac{1500}{29412 + 7470 + 1500} \cdot 100 = \approx \mathbf{3,9}$$

d) Gaaside korral on mahu- ja mooliprotsent sama.

$$n(\text{N}_2) = 29412 \text{ g} \cdot \frac{1 \text{ mol}}{28 \text{ g}} = 1050 \text{ mol}$$

$$n'(\text{O}_2) = 7470 \text{ g} \cdot \frac{1 \text{ mol}}{32 \text{ g}} = 233 \text{ mol}$$

$$n(\text{CO}_2) = 1500 \text{ g} \cdot \frac{1 \text{ mol}}{44 \text{ g}} = 34 \text{ mol}$$

$$\% \text{vol}(\text{CO}_2) = \frac{34}{34 + 233 + 1050} \cdot 100 = \mathbf{2,6}$$

Tähelepanu: Gaaside ruumalaid pole vaja leida, sest $V(\text{gaas}) = n(\text{gaas}) \cdot V_M$.
Mahuprotsendi leidmisel molaarruumalad taanduvad.

4. a) **A** – H₂O, vesi

B – H₂S, divesiniksulfiid

C – Na₂S, naatriumsulfiid

D – MgS, magneesiumsulfiid

Q – H₂, vesinik

X – O, hapnik

Y – S, väävel

b) **A:** neutraalne, lõhnatu, mittemürgine, mittelenduv

B: happeline, mädamuna lõhnaga, mürgine, lenduv (gaas)

c) i) $2\text{H}_2\text{O} + 2\text{Na} = 2\text{NaOH} + \text{H}_2\uparrow$

ii) $\text{H}_2\text{S} + 2\text{NaOH} = \text{Na}_2\text{S} + 2\text{H}_2\text{O}$

iii) $\text{O}_2 + 2\text{Mg} = 2\text{MgO}$

iv) $\text{S} + \text{Mg} = \text{MgS}$

5. a) $m(\text{smaragd}) = 3,00 \text{ ct} \cdot \frac{0,200 \text{ g}}{1 \text{ ct}} = 0,600 \text{ g}$

i) $m(\text{A}) = 0,600 \text{ g} \cdot \frac{0,45}{100} = 0,0027 \text{ g}$

$V(\text{A}) = 0,0027 \text{ g} \cdot \frac{1 \text{ mol}}{44 \text{ g}} \cdot \frac{22400 \text{ cm}^3}{\text{mol}} = 1,37 \text{ cm}^3 \approx \mathbf{1,4 \text{ cm}^3}$

ii) $m(\text{B}) = 0,600 \text{ g} \cdot \frac{0,95}{100} = 0,0057 \text{ g}$

$n(\text{B}) = 0,0057 \text{ g} \cdot \frac{1 \text{ mol}}{120 \text{ g}} = 0,0000475 \text{ mol} \approx \mathbf{0,000048 \text{ mol} = 4,8 \cdot 10^{-5} \text{ mol}}$

b) **A** – CO₂, süsinikdioksiid

C – Fe₂O₃, raud(III)oksiid

D – SO₂, vääveldioksiid

E – SO₃, vääveltrioksiid

Z – Fe(NO₃)₃, raud(III)nitraat

B – FeS₂

c) i) $2\text{SO}_2 + \text{O}_2 = 2\text{SO}_3$

ii) $\text{SO}_3 + \text{H}_2\text{O} = \text{H}_2\text{SO}_4$

iii) $\text{Fe}_2\text{O}_3 + 6\text{HNO}_3 = 2\text{Fe}(\text{NO}_3)_3 + 3\text{H}_2\text{O}$

$$\text{d) \%(\text{Fe})} = \frac{55,9}{242} \cdot 100 = \mathbf{23,1}$$



$$m(\text{Fe}) = \frac{1}{1} \cdot 0,0000475 \text{ mol} \cdot 55,85 \text{ g/mol} = 0,002652 \text{ g}$$

$$\%(\text{Fe}) = \frac{0,002652}{0,600} \cdot 100 \approx \mathbf{0,44}$$

$$\text{ii) } V(\text{smaragd}) = 0,600 \text{ g} \cdot \frac{1 \text{ cm}^3}{2,75 \text{ g}} = \mathbf{0,218 \text{ cm}^3}$$

6. a) i) Soola **B** molekul peab sisaldama metalli, mille oksüdatsiooniaste on II, sest metalli ja H_2 suhe on 1 : 1. Järelikult soola **B** valem on ACl_2 .

$$A_r(\mathbf{A}) = 2 \cdot 35,45 \cdot \frac{47,98}{52,02} = 65,39$$

ii) **A** – Zn, tsink

b) **B** – ZnCl_2 , tsinkkloriid

C – $\text{Zn}(\text{NO}_3)_2$, tsinknitraat

D – $\text{Zn}(\text{OH})_2$, tsinkhüdroksoiid

E – CO_2 , süsinikdioksiid

F – ZnCO_3 , tsinkkarbonaat

G – ZnO , tsinkoksiid

H – CO , süsinikmonooksiid

X – AgNO_3 , hõbenitraat

Y – AgCl , hõbekloriid

