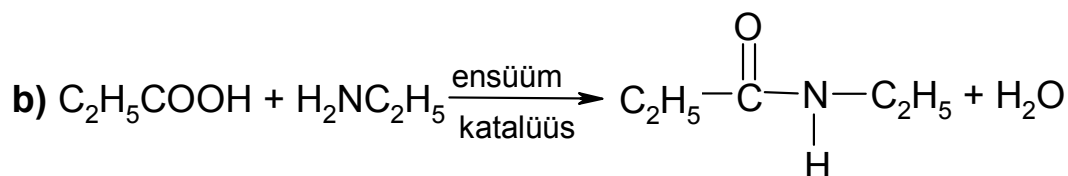
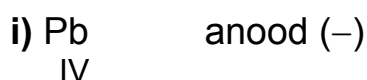


**2005/2006 õa keemiaolümpiaadi piirkonnavooru
ülesannete lahendused
12. klass**

1. a) $0,082 \frac{\text{mol}}{\text{L}} \cdot \frac{10^6 \mu\text{mol}}{\text{mol}} \cdot \frac{\text{L}}{1000 \text{ mL}} = 82 \frac{\mu\text{mol}}{\text{mL}}$



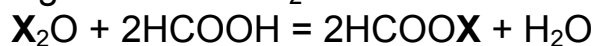
$$[\text{Ag}_2\text{CrO}_4] = \frac{1}{2} \cdot 10 \cdot 10^{-6} \text{ mol/L} = 5,0 \cdot 10^{-7} \text{ mol/L}$$



f) üks mool elektrone

2. a) $m(\text{D}) = 2,55 \text{ g} \cdot (1 - 0,7647) = 0,60 \text{ g}$

Olgu oksiid **D** – **X₂O**



$$n(\text{HCOOH}) = 8,00 \text{ g} \cdot 0,23 \cdot \frac{1 \text{ mol}}{46,0 \text{ g}} = 0,040 \text{ mol}$$

$$M(\text{X}_2\text{O}) = \frac{0,60 \text{ g}}{\frac{1}{2} \cdot 0,040 \text{ mol}} = 30 \text{ g/mol}$$

$$A_r(\text{X}) = \frac{30 - 16}{2} = 7$$

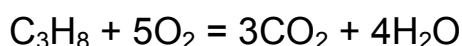
X – Li, liitium

X₂O – Li₂O

b) Propaaniga võis reageerida hapnik, sest moodustunud gaas (CO₂) andis Ba(OH)₂ lahusega valge sademe.

B – O₂, hapnik

c) $n(\text{O}_2 + \text{C}) = 2,55 \text{ g} \cdot 0,7647 \cdot \frac{1 \text{ mol}}{29 \text{ g}} \cdot \frac{1}{2,24} = 0,030 \text{ mol}$



$$n(\text{O}_2) = \frac{5}{1} \cdot 0,0908 \text{ L} \cdot \frac{1 \text{ mol}}{22,7 \text{ L}} = 0,020 \text{ mol}$$

$$n(\text{C}) = 0,030 \text{ mol} - 0,020 \text{ mol} = 0,01 \text{ mol}$$

d) i) $0,01 \text{ mol} \cdot M(\text{C}) + 0,02 \text{ mol} \cdot 32 \text{ g/mol} = 0,03 \text{ mol} \cdot 29 \text{ g/mol} \cdot 2,24$

$$0,01 \text{ mol} \cdot M(\text{C}) + 0,640 \text{ g} = 1,949 \text{ g}$$

$$M(\text{C}) = \frac{1,309 \text{ g}}{0,01 \text{ mol}} \approx 131 \text{ g/mol}$$

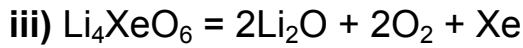
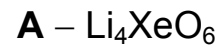
C – Xe, ksenoon

$$\text{ii) } n(\mathbf{D}) = \frac{1}{2} \cdot 0,04 \text{ mol} = 0,02 \text{ mol}$$

$$n(\text{Li}) = \frac{2}{1} \cdot 0,02 \text{ mol} = 0,04 \text{ mol}$$

$$n(\text{O}) = \frac{2}{1} \cdot 0,02 \text{ mol} + \frac{1}{2} \cdot 0,04 \text{ mol} = 0,06 \text{ mol}$$

$$n(\text{Xe}) = 0,01 \text{ mol}$$



3. a) **A** – NH₄F, ammooniumfluoriid

B – NH₄Cl, ammooniumkloriid

C – NH₄Br, ammooniumbromiid

D – NH₄I, ammooniumjodiid

E – NH₃, ammoniaak

F – NH₄HF₂, ammooniumvesinikfluoriid

G – HCl, vesinikkloriid

H – HBr, vesinikbromiid

I – H₂, vesinik

J – I₂, jood

K – HF, vesinikfluoriid

L – NH₄HSO₄, ammooniumvesiniksulfaat

$$\%(\mathbf{S}) = \frac{32,1}{115} \cdot 100 = \mathbf{27,9}$$

M – Br₂, broom

N – SO₂, vääveldioksiid

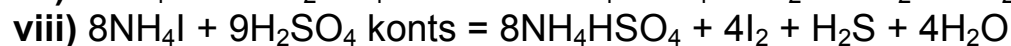
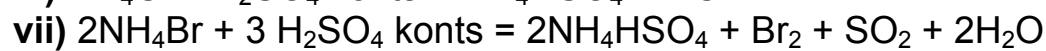
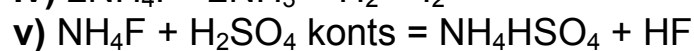
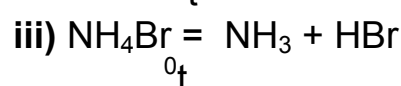
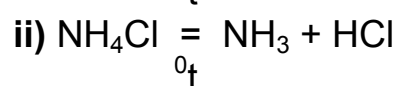
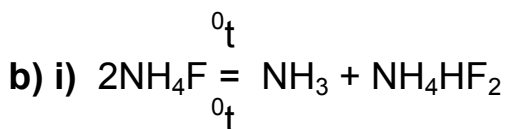
$$\%(\mathbf{S}) = \frac{32}{64} \cdot 100 = \mathbf{50}$$

O – H₂S, divesiniksulfiid

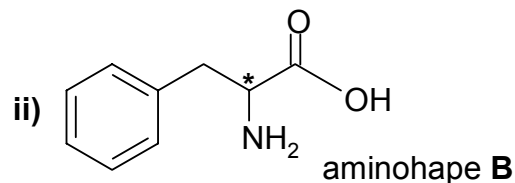
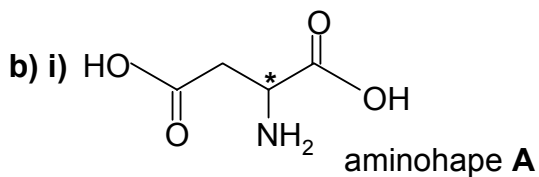
$$\%(\mathbf{S}) = \frac{32}{34} \cdot 100 = \mathbf{94}$$

P – CuCl₂, vask(II)kloriid

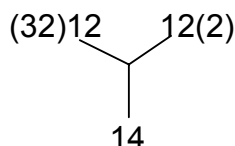
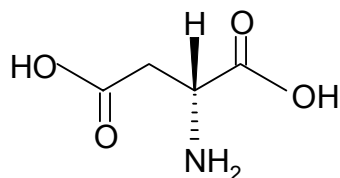
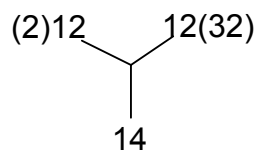
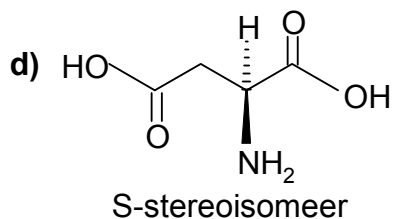
Q – N₂, lämmastik



4. a) i) $C_{14}H_{18}O_5N_2$
 ii) $-CH_2COOH$
 iii) $C_6H_5CH_2-$
 iv) CH_3OH



- c) i) Ühendis **D** on esterside $-COO-$
 ii) Aminohapped on seotud peptiidside mega $-C(O)NH-$

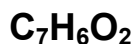


5. a) i) $N(O) = 2$ aatomit (karboksüülhape)

$$M_r(\mathbf{A}) = \frac{32}{0,262} = 122,1$$

$$N(C) = 122,1 \cdot 0,689 \cdot \frac{1\text{aatom}}{12} = 7 \text{ aatomit}$$

$$N(H) = 122,1 \cdot 0,049 \cdot \frac{1\text{aatom}}{1} = 6 \text{ aatomit}$$

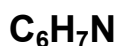


- ii) $N(N) = 1$ aatom (amiin)

$$M_r(\mathbf{D}) = \frac{14}{0,1505} = 93$$

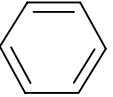
$$N(C) = 93 \cdot 0,774 \cdot \frac{1\text{aatom}}{12} = 6 \text{ aatomit}$$


$$N(H) = 93 \cdot 0,075 \cdot \frac{1\text{aatom}}{1} = 7 \text{ aatomit}$$

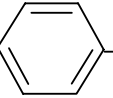


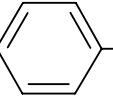
- iii) $C_6H_7N + N - 2H = C_6H_5N_2$ (**E**)

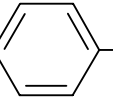
b) **A** -COOH, fenüülkarboksüülhape, bensoehape

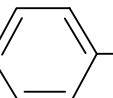
B  , benseen

C -NO₂, nitrobenseen

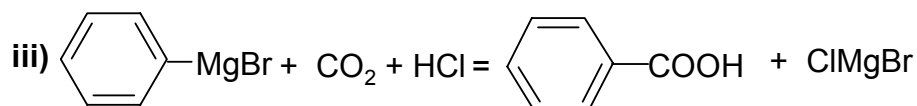
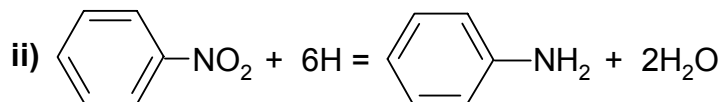
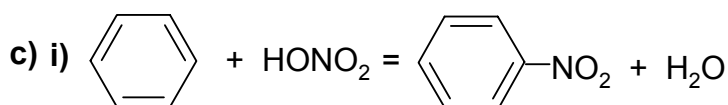
D -NH₂, aniliin

E -N⁺≡N, fenüülasooniumkatioon

F -Br, fenüülbromiid

G -MgBr, fenüülmagneesiumbromiid

H ClMgBr, magneesiumkloriidbromiid



6. a) $10^{-7} = 6,2 \cdot 10^{-8} \cdot 0,01 \text{ mol} \cdot \frac{174 \text{ g/mol}}{m(\text{K}_2\text{HPO}_4)}$

$$m(\text{K}_2\text{HPO}_4) = \frac{6,2 \cdot 10^{-10}}{10^{-7}} \cdot 174 \text{ g/mol} = 1,08 \text{ g} \approx \mathbf{1,1 \text{ g}}$$

b) $n(\text{hape}) = 0,010 \text{ mol} + 0,030 \text{ dm}^3 \cdot 0,1 \text{ mol/dm}^3 = 0,0130 \text{ mol}$

$n(\text{sool}) = 6,2 \cdot 10^{-3} - 0,030 \text{ dm}^3 \cdot 0,1 \text{ mol/dm}^3 = 0,0032 \text{ mol}$

$[\text{H}^+] = 6,2 \cdot 10^{-8} \cdot \frac{0,0130}{0,0032} = 2,5 \cdot 10^{-7} \quad \text{pH} = -\lg 2,5 \cdot 10^{-7} = 6,6$

$\Delta\text{pH} = 6,6 - 7,0 = -\mathbf{0,4}$ (pH väheneb)

c) $[\text{H}^+] = \frac{0,030 \text{ dm}^3 \cdot 0,1 \text{ mol/dm}^3}{1,030 \text{ dm}^3} = 0,0029 \text{ mol/dm}^3$

$\text{pH} = -\lg 0,0029 = 2,54 \approx 2,5 \quad \Delta\text{pH} = 2,5 - 7,0 = -\mathbf{4,5}$