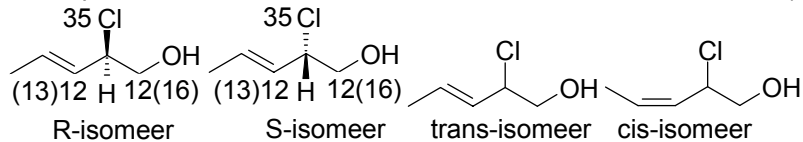


2006/2007 õ.a. keemiaolümpiaadi piirkonnavooru
 ülesannete lahendused
 12. klass

1. a) i) aminohapped ii) amiidid (2·0,5) 1
 b) Katoodil: $4\text{H}_2\text{O} + 4\text{e}^- = 2\text{H}_2\uparrow + 4\text{OH}^-$ (1)
 Anoodil: $2\text{H}_2\text{O} - 4\text{e}^- = \text{O}_2\uparrow + 4\text{H}^+$ (1) 2
 c) $V(\text{N}_2, \text{g}) = 1 \text{ dm}^3 \cdot \frac{0,81 \text{ g}}{1 \text{ cm}^3} \cdot \frac{1000 \text{ cm}^3}{1 \text{ dm}^3} \cdot \frac{1 \text{ mol}}{28 \text{ g}} \cdot \frac{22,4 \text{ dm}^3}{1 \text{ mol}} = 648 \text{ dm}^3 = 650 \text{ dm}^3$

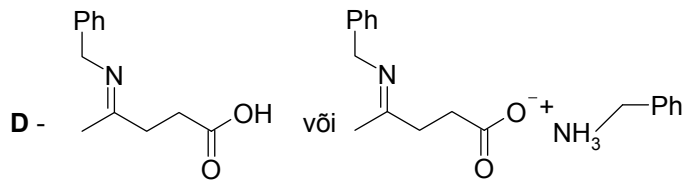
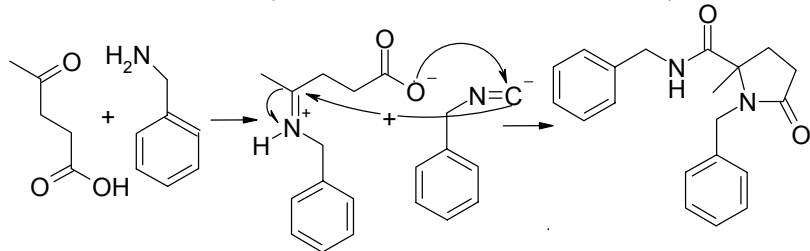
1,5
 d) $m(\text{tooraine } 0,25 \%) = 100 \text{ kg} \cdot (1 - 0,99) \frac{1}{1 - 0,9975} = 400 \text{ kg}$ 1

- e) 2-kloropent-3-een-1-ool (0,5)

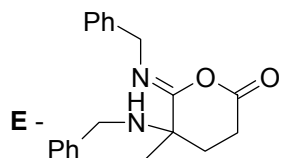


(4·0,5) 2,5
 8 p

2. a) A – 4-oksopentaanhape (1)
 B – aminometüülenseen (bensüülamiin) (1) 2
 b) Karboksüülne rühm. (1)
 c) (reaktsioonimehhanismi ei hinnata) 1

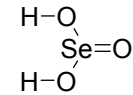


(2)



(2) 4
 7 p

3. a) i)

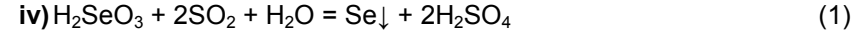
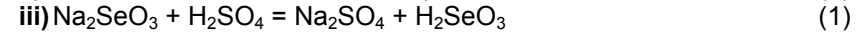
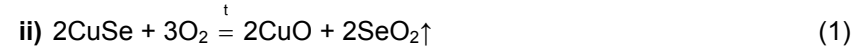
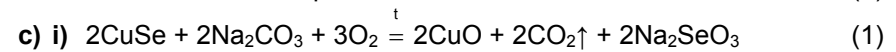


(0,5)

ii) $\frac{A_r(\text{A})}{2A_r(\text{H}) + A_r(\text{A}) + 3A_r(\text{O})} - \frac{A_r(\text{A})}{A_r(\text{Cu}) + A_r(\text{A})} = \frac{A_r(\text{A})}{50,0 + A_r(\text{A})} - \frac{A_r(\text{A})}{63,5 + A_r(\text{A})} = 0,058$
 $A_r(\text{A}) \frac{63,5 + A_r(\text{A}) - 50,0 - A_r(\text{A})}{3175 + 113,5 \cdot A_r(\text{A}) + A_r^2(\text{A})} = \frac{13,5A_r(\text{A})}{3175 + 113,5 \cdot A_r(\text{A}) + A_r^2(\text{A})} = 0,058$
 $0,058A_r^2(\text{A}) - 6,917A_r(\text{A}) + 184,15 = 0$ $A_r(\text{A}) - 79$

A – Se, Seleen (võrrandi koost. 1, lahend. 1, õige aine 0,5) 3

- b) B – CuO, vask(II)oksiid (õige aine 0,75, õige valem ja nimetus 1)
 C – CO₂, süsinikdioksiid (1)
 D – Na₂SeO₃, naatriumselenit (1)
 E – H₂SeO₃, seleenishape (1)
 F – SeO₂, seleendioksiid (1)
 G – H₂SeO₄, seleenhape (1) 6



4. a) A – K, kaalium 1A rühma metall, leek värvub violetseks (0,75)
 B₂ – I₂, jood $A_r(\text{B}) = \frac{39}{0,235} - 39 = 127$ B – I, jood (0,75)

C – Pb, plii Oksiidi valem: CO_n $\%(\text{C}) = \frac{A_r(\text{C})}{A_r(\text{C}) + 16 \cdot n} = 0,9283$
 $A_r(\text{C}) = \frac{0,9283 \cdot 16 \cdot n}{1 - 0,9283} = 207,2n$ $n = 1$ (0,75)

D₂ – N₂, lämmastik $A_r(\text{D}) = 29 \cdot 0,97 \cdot \frac{1}{2} = 14$ D – N, lämmastik (0,75)

E – Ti, titaan Oksiidi valem: EO_n $A_r(\text{E}) = \frac{0,5994 \cdot 16 \cdot n}{1 - 0,5994} = 23,95n$

$n = 2$ $A_r(\text{E}) = 47,90$ (0,75)

F – TiCl₃, titaan(III)kloriid Neljaaatomilise ühendi üldvalem E_nY_{4-n}
 $A_r(\text{Y}) = \frac{47,90 \cdot (1 - 0,31)}{0,31} \cdot \frac{1}{4 - n} = 106,6/(4 - n)$
 $n = 1$ $A_r(\text{Y}) = 35,5$ Y – Cl (0,75)

- G** – KI, kaaliumjodiid (0,25)
H – Pb(CH₃COO)₂, pliietanaat (0,25)
I – PbO, plii(II)oksiid (0,25)
J – CH₃COOH, etaanhape (0,25)
K – PbI₂, plii(II)jodiid (0,25)
L – Ni₃, lämmastiktrijodiid (jodonitriid või trijodoasaan) (0,25)
M – TiCl₄, titaan(IV)kloriid (0,25)
N – TiO₂, titaan(IV)oskiid (0,25)
O – HCl, vesinikkloriidhape (0,25)
P – H₂, vesinik (õige aine 0,15, õige valem ja nimetus 0,1, põhj. 0,5) (0,25) **7**
b) i) PbO + 2CH₃COOH = Pb(CH₃COO)₂ + H₂O (1)
ii) Pb(CH₃COO)₂ + 2KI = PbI₂↓ + 2CH₃COOK (1)
iii) 2NI₃ = N₂ + 3I₂ (1)
iv) TiCl₄ + 2H₂O = TiO₂ + 4HCl (1)
v) 2K + 2H₂O = 2KOH + H₂↑ (1)
vi) 2TiCl₄ + H₂ = 2TiCl₃ + 2HCl (1) **6**
13 p

- 6. a) i) Ei** (tasakaalulises segus suureneb lähteaine osakaal rõhu tõstmisel) (1)
ii) Ei (NH₃ lisamisel suureneb NH₄HS osakaal) (1) **2**
b) i) Δ_rH = [-20,4 – (45,9 + (-157,0))] kJ/mol = **90,7 kJ/mol**
 endotermiline reaktsioon (1)
ii) Temperatuuri tuleb langetada. (1) **2**
c) i) p(NH₃) = p(H₂S)
 $p = p(\text{NH}_3) + p(\text{H}_2\text{S}) = 2p(\text{NH}_3)$ (1)
 $K_p = p^2(\text{NH}_3) = p^2/4 \quad p = 2\sqrt{K_p}$ (1)
 $p = 2 \cdot \sqrt{6,2 \cdot 10^9} = 1,57 \cdot 10^5 \text{ Pa} \approx \mathbf{1,6 \cdot 10^5 \text{ Pa}}$ (1) **3**
ii) n(NH₄HS) = 50 g · $\frac{1 \text{ mol}}{51,11 \text{ g}} - \frac{1}{2} \cdot \frac{1,57 \cdot 10^5 \text{ Pa} \cdot 0,015 \text{ m}^3}{8,314 \text{ J}/(\text{mol} \cdot \text{K}) \cdot 313 \text{ K}}$ = 0,525 mol (2)
 $m(\text{NH}_4\text{HS}) = 0,525 \text{ mol} \cdot \frac{51,11 \text{ g}}{1 \text{ mol}} = 26,7 \text{ g} = \mathbf{27 \text{ g}}$ (1) **3**
10 p

