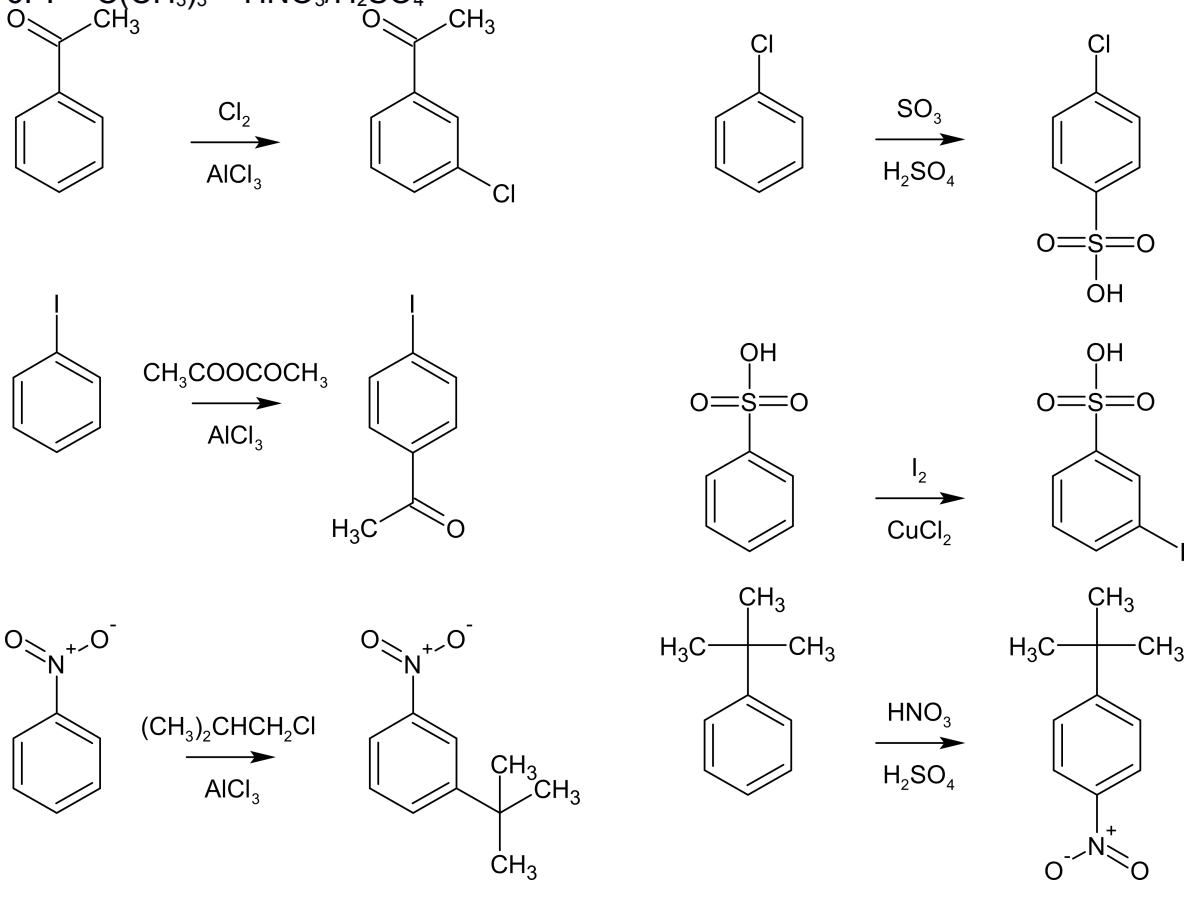
Lahendused

1. **a)** $Ba(NO_3)_2$, BaI_2, $BaCl_2$, KNO_3, K_2SO_4, KI, KCl, $Pb(NO_3)_2$, $Al(NO_3)_3$, $AlCl_3$, AlI_3, $Al_2(SO_4)_3$
Iga õige vastus annab 0,5 p. (0,5×12)
$PbCl_2$ on vähelahustuv. (0)
Iga vale vastuse eest −0,5 p.
Kuna $Pb(OH)_2$ ei lahustu vees, ainuke Pb^{2+} sool, mis vastab tingimustele on $Pb(NO_3)_2$.

b) $AlCl_3 + KOH \rightarrow Al(OH)_3\downarrow + 3KCl$ (0,5)
$Al(OH)_3 + KOH \rightarrow K[Al(OH)_4] + H_2O$ (0,5)
$Pb(NO_3)_2 + 2KOH \rightarrow Pb(OH)_2\downarrow + 2KNO_3$ (0,5)
$Pb(OH)_2 + 2KOH \rightarrow K_2[Pb(OH)_4] + 2H_2O$ (0,5)
$2KOH + H_2SO_4 \rightarrow K_2SO_4 + H_2O + Q$ (0,5)
$BaI_2 + H_2SO_4 \rightarrow BaSO_4\downarrow + 2HI$ (0,5)
$Pb(NO_3)_2 + H_2SO_4 \rightarrow PbSO_4\downarrow + 2HNO_3$ (0,5)
$Pb(NO_3)_2 + BaI_2 \rightarrow PbI_2\downarrow + Ba(NO_3)_2$ (0,5)
I – **KOH** (pH = 13) (0,5)
II – **BaI_2** (0,5)
III – **$AlCl_3$** (0,5)
IV – **$Pb(NO_3)_2$** (0, vt punkt **a)**)
V – **H_2SO_4** (pH < 1) (0,5)

12 p

2. 1. ? = $COCH_3 + Cl_2/AlCl_3$ (1+1)
2. ? = $I + CH_3COOCOCH_3/AlCl_3$ (1+1)
3. ? = $NO_2 + (CH_3)_2CHCH_2Cl/AlCl_3$ (1+1)
4. ? = $Cl + SO_3/H_2SO_4$ (1+1)
5. ? = $SO_3H + I_2/CuCl_2$ (1+1)
6. ? = $C(CH_3)_3 + HNO_3/H_2SO_4$ (1+1)



12 p

3. **a)** $m = 3{,}43\ \text{cm}^2 \cdot 30{,}0\ \mu\text{m} \cdot \frac{1\ \text{cm}}{10000\ \mu\text{m}} \cdot 10{,}5\ \text{g/cm}^3 \cdot \frac{1000\ \text{mg}}{1\ \text{g}} = \mathbf{108\ mg}$ (2)

b) $t = \frac{108\ \text{mg}}{108\ \text{g/mol}} \cdot \frac{1\ \text{g}}{1000\ \text{mg}} \cdot \frac{96485\ \text{A·s/mol}}{0{,}50\ \text{A}} = \mathbf{190\ s}$ (2)

c) $4[Ag(CN)_2]^- + 2H_2O = 4Ag + 8CN^- + 4H^+ + O_2$ (1)

d) $\Delta H = 150{,}6\ \text{kJ/mol}\cdot 8\ \text{mol} - (269{,}0\ \text{kJ/mol}\cdot 4\ \text{mol} + -285{,}8\ \text{kJ/mol}\cdot 2\ \text{mol}) = \mathbf{700\ kJ}$ (2)

e) $E = -\frac{1000\ \text{J}}{1\ \text{kJ}} \cdot \frac{700\ \text{kJ}}{96485\ \text{A·s/mol}\cdot 4\ \text{mol}} = \mathbf{-1{,}8\ V}$ (1)

Tuleb rakendada **+1,8 V**. (1)

9 p

4. **a)** $c(\text{kofeiin}) = \frac{11\ \text{mg}}{100\ \text{g}} \cdot \frac{1\ \text{g}}{1000\ \text{mg}} \cdot \frac{20 \cdot 2{,}0\ \text{g}}{194\ \text{g/mol}} \cdot \frac{1}{1\ \text{dm}^3} \cdot \frac{1000\ \text{mmol}}{1\ \text{mol}} = \mathbf{0{,}0226\ mmol/dm^3}$ (2)

b) $K = \frac{18{,}0\ \text{g}}{100\ \text{cm}^3} : \frac{1{,}8\ \text{g}}{100\ \text{cm}^3} = \mathbf{10}$ (1)

c) $m(\text{kofeiin}) = 0{,}0226\ \text{mmol/dm}^3 \cdot 1\ \text{dm}^3 \cdot \frac{1\ \text{mol}}{1000\ \text{mmol}} \cdot 194\ \text{g/mol} \cdot \frac{1000\ \text{mg}}{1\ \text{g}} = 4{,}4\ \text{mg}$

$K = 10 = \frac{x\ \text{g}}{300\ \text{cm}^3} : \frac{(4{,}4-x)\ \text{g}}{1000\ \text{cm}^3}$, kus x on kofeiini mass kloroformi faasis.

Lahendades saadud võrrandi saame x = **3,3 mg**. (2)

d) $K = 10 = \frac{x\ \text{g}}{100\ \text{cm}^3} : \frac{(4{,}4-x)\ \text{g}}{1000\ \text{cm}^3}$.

Lahendades saadud võrrandi saame x = **2,2 mg**.

Kofeiini mass jäänud vee faasi pärast esimest ekstraheerimist on 2,2 mg.

Märkame, et ekstraheerimisel täpselt pool kofeiini massist jäi vee faasi ja pool läks kloroformi faasi üle. Järelikult, saame arvutusi lihtsustada nii:

$m(\text{kofeiin kloroformis}) = 4{,}4 \cdot 0{,}5 + 4{,}4 \cdot 0{,}5^2 + 4{,}4 \cdot 0{,}5^3 \approx \mathbf{3{,}8\ mg}$ (2)

e) $m(\text{kofeiin ühes tassis}) = 4\ \text{g} \cdot \frac{6{,}0\ \text{mg}}{20 \cdot 2{,}0\ \text{g}} = 0{,}6\ \text{mg}$

$N(\text{tassid}) = \frac{400\ \text{mg}}{0{,}6\ \text{mg}} \approx \mathbf{667}$ (2)

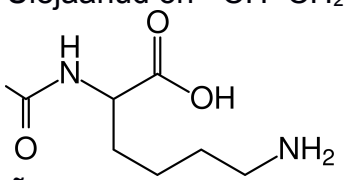
9 p

5. **a)** $M(\mathbf{Z}) = 2 \cdot (340{,}4 - 1{,}008)\ \text{g/mol} \cdot \frac{0{,}0855}{1-0{,}0855} \approx 63{,}5\ \text{g/mol}$ (1)

b) $M(\mathbf{R}) = 340{,}4 - (7\cdot 12{,}01 + 4\cdot 14{,}01 + 16{,}00 + 11\cdot 1{,}008) = 173{,}2\ \text{g/mol}$

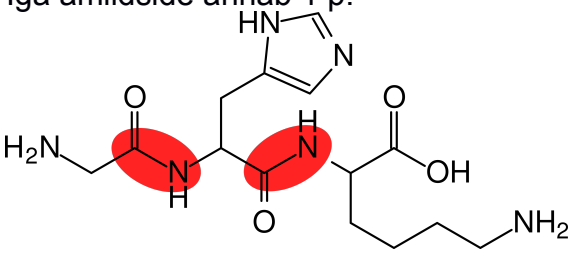
GHK on tripeptiid, seega **R** sisaldab −NH−CO− ning −COOH. (1)

Ülejäänud on $-CH(-CH_2-CH_2-CH_2-CH_2-NH_2)-$. (1)

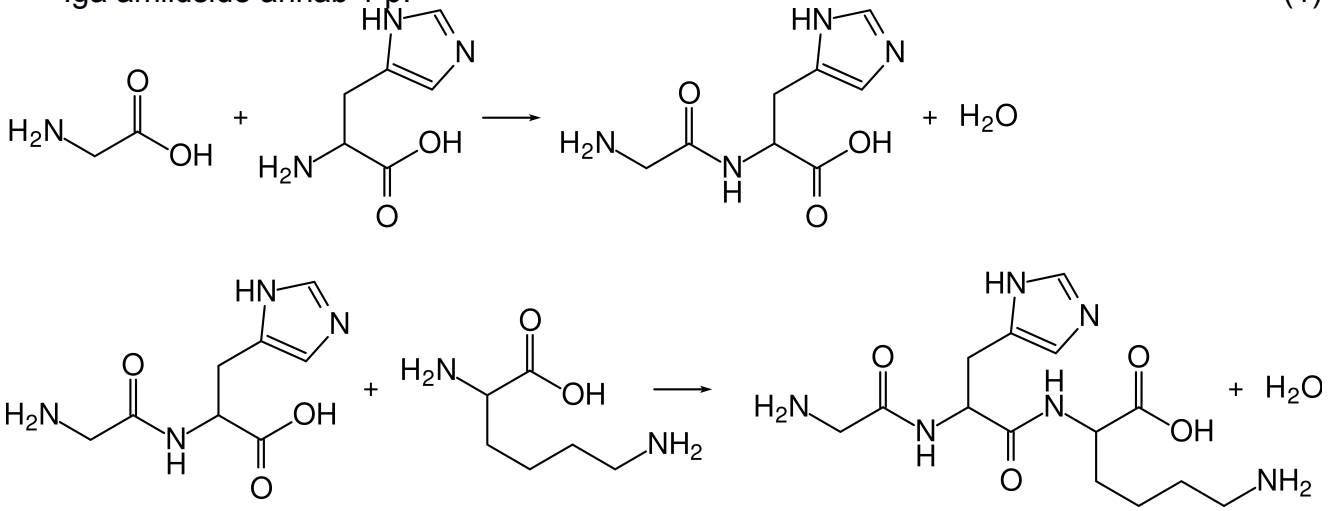


c) Õige struktuuri annab 1 p. (1)

Iga amiidside annab 1 p. (2)



d) His ja Lys aminihappete valik annab kokku 1 p. (1)
Iga amiidside annab 1 p. (1)



8 p