2002/2003 õa keemiaolümpiaadi piirkonnavooru
ülesannete lahendused
12. klass

1. a) i) Pb elektrood on (-), sest sellel on elektronide liig, PbO_2 elektrood on (+), sest sellel on elektronide defitsiit. **ii)** Aku tühjenemisel toimub (-) elektroodil anoodprotsess ja (+) elektroodil toimub katoodprotsess. **iii)** Aku laadimisel toimub (-) elektroodil katoodprotsess ja (+) elektroodil toimub anoodprotsess.

b) $4FeS_2 + 11O_2 = 2Fe_2O_3 + 8SO_2$

$2\cdot(-I)$ (-) $2\cdot IV$ | $S_2 - 10e^- \rightarrow 2S$ | II (-) III | $Fe - 1e^- \rightarrow Fe$ | $2\cdot 0$ (-) $2\cdot(-II)$ | $O_2 + 4e^- \rightarrow O$ | $-11e^-$ | $+4e^-$

c) $O_2 \Leftrightarrow 4e^-$

$n(e^-) = \frac{4}{1}\cdot 3\ \text{mol} = 12\ \text{mol}$ $\qquad$ $1F \Leftrightarrow 1\ \text{mol}(e^-) \Leftrightarrow 96500\ A\cdot s$

n(F) = 12

d) $2C_2H_5OH \xrightarrow{H_2SO_4} C_2H_5OC_2H_5 + H_2O$ või
$C_2H_5ONa + C_2H_5I = C_2H_5OC_2H_5 + NaI$

e) Al mass on suurem, sest väiksema tiheduse tõttu “tõrjutakse” rohkem õhku välja, mille arvelt Al "kaotab oma kaalus".

f) Saadusainete mass on endotermilise reaktsiooni korral ($\Delta H>0$) suurem, sest saadusained on energiarikkamad.

g) m(tooraine, 99% niiskust) = $\frac{75\ \text{kg}\cdot 0{,}02}{0{,}01}$ **= 150 kg**

2. a) i) **X** – Pd, pallaadium
Y – Pt, plaatina

ii) **A** – $HC{\equiv}CH$, etüün
B – H_2O, vesi
C – $H_2C{=}CH_2$, eteen
D – CuCl, vask(I)kloriid
E – H_2, vesinik

b) i) $HC{\equiv}CH + H_2O \xrightarrow{HgO} CH_3CHO$

ii) $H_2C{=}CH_2 + H_2O + PdCl_2 = CH_3CHO + Pd + 2HCl$

iii) $Pd + 2CuCl_2 = PdCl_2 + 2CuCl$

iv) $2CuCl + 2HCl + 0{,}5O_2 = 2CuCl_2 + H_2O$

v) $HC{\equiv}CH + H_2 \xrightarrow{Pt} H_2C{=}CH_2$

vi) $CO + PdCl_2 + H_2O = CO_2 + Pd + 2HCl$

c) N(neutronid, Pt) = 195 - 78 = **117**
N(neutronid, Pd) = 106 - 46 = **60**

$$\frac{117}{60} = 1{,}95$$

3. a) i) M(süsivesinik) = 28,0 g/mol · 2,00 = **56,0 g/mol**

$$N(C) = 56{,}0\ \text{g/mol} \cdot 0{,}856 \cdot \frac{1\ \text{mol}}{12\ \text{g}} = 4$$

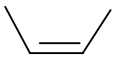
$$N(H) = 56{,}0\ \text{g/mol} \cdot 0{,}144 \cdot \frac{1\ \text{mol}}{1\ \text{g}} = 8$$

C_4H_8

b) $C_4H_8 + Br_2 = C_4H_8Br_2$

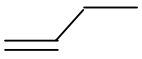
c)

2-metüül-1-propeen

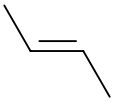


cis-2-buteen

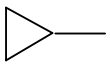
tsüklobutaan



1-buteen

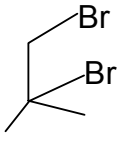


trans-2-buteen

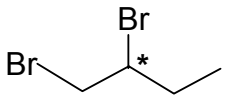


metüültsüklopropaan

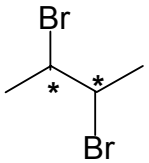
d)



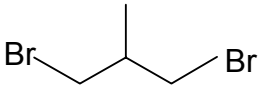
1,2-dibromo-2-metüülpropaan



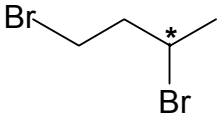
1,2-dibromobutaan



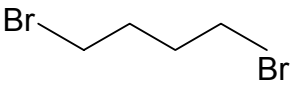
2,3-dibromobutaan



1,3-dibromo-2-metüülpropaan

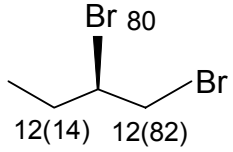


1,3-dibromobutaan

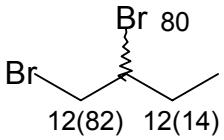


1,4-dibromobutaan

e)



R



S

4. a) A – K_2CrO_4, kaaliumkromaat
B – K_2WO_4, kaaliumvolframaat
C – CrO_3, kroom(VI)oksiid, kroomtrioksiid
D – WO_3, volfram(VI)oksiid, volframtrioksiid
E – $(NH_4)_2Cr_2O_7$, ammooniumdikromaat

b) i) $W + 3KNO_3 + 2KOH = K_2WO_4 + 3KNO_2 + H_2O$

ii) $W + 3KNO_3 + K_2CO_3 = K_2WO_4 + 3KNO_2 + CO_2$

iii) $W + 2KO_2 = K_2WO_4$

iv) $W + 3Ca(Cl)OCl + K_2CO_3 = K_2WO_4 + 3CaCl_2 + CO_2$
v) $W + 6KMnO_4 + 4K_2CO_3 = K_2WO_4 + 6K_2MnO_4 + 4CO_2$

vi) $2K_2CrO_4 + H_2SO_4 = K_2SO_4 + K_2Cr_2O_7 + H_2O$
$K_2Cr_2O_7 + H_2SO_4 = K_2SO_4 + 2CrO_3 + H_2O$

vii) $W + 3H_2O \overset{^0t^0t}{=} WO_3 + 3H_2\uparrow$

viii) $(NH_4)_2Cr_2O_7 = N_2\uparrow + Cr_2O_3 + 4H_2O\uparrow$

5. a) i) $C_3H_6O_3$, piimhape

ii) $C_4H_6O_4$, merivaikhape

iii) $C_2H_4O_2$, äädikhape

iv) $C_4H_8O_2$, butaanhape

v) $C_6H_8O_7$, sidrunhape

vi) $C_2H_2O_4$, oblikhape

b) II $3C_4H_6O_4 = 2C_4H_8O_2 + 4CO_2 + H_2$

III $2C_3H_6O_3 = C_4H_8O_2 + 2CO_2 + 2H_2$

IV $C_6H_8O_7 + 6[O] = 3C_2H_2O_4 + H_2O$

V $2C_6H_8O_7 = 2C_4H_8O_2 + 4CO_2 + O_2$

c) 0 0,5 0 0

$C_3H_6O_3 \rightarrow C_4H_6O_4 + C_2H_4O_2 + H_2$

3x+6-6=0 4x+6-8=0 2x+4-4=0

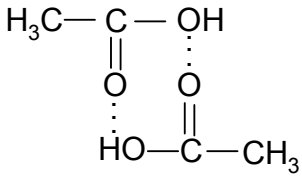
4·0,5 (-) 4·0

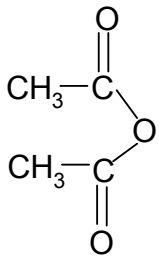
$C_4 + 2e^- = 4C$

2·0 (-) 2·I

$H_2 - 2e^- = 2H$

$2C_3H_6O_3 = C_4H_6O_4 + C_2H_4O_2 + H_2$

d) i) 

ii) 

6. a) $Pb(OCN)_2 + 2NH_3 + 2H_2O = 2NH_2CONH_2 + Pb(OH)_2$

b) $6HCHO \xrightarrow{Ca(OH)_2} CHOCHOHCHOHCHOHCHOHCHOHCHOH$ $(C_6H_{12}O_6)$

c) i) $H_2 + 2C \xrightarrow{\text{voltakaar}} HC{\equiv}CH$

ii) $CS_2 + 2H_2S + 8Cu = 4Cu_2S\downarrow + CH_4$

d)