

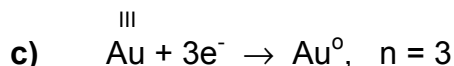
Keemia lahtine võistlus

Ülesannete lahendused

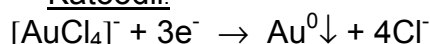
1. november 1997. a.

Tallinn, Tartu, Kuressaare, Narva, Ahtme
Vanem aste (11. ja 12. klass)

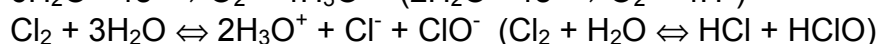
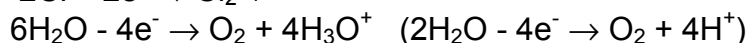
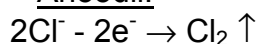
1. a) $1\text{ oz} \cdot \frac{25\text{ g}}{0,8818\text{ oz}} = 28,35\text{ g} \quad 1\text{ oz} \Leftrightarrow 28,35\text{ g}$



d) Katoodil:



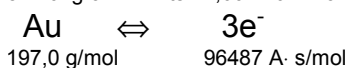
Anoodil:



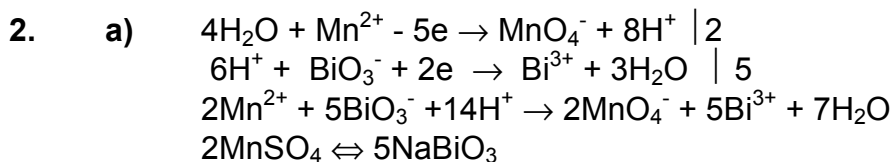
e) $m(\text{Au}) = 1,00 \text{ EEK} \cdot \frac{1 \text{ USD}}{14,00 \text{ EEK}} \cdot \frac{1 \text{ oz}}{300 \text{ USD}} \cdot \frac{28,35 \text{ g}}{1 \text{ oz}} = 6,75 \cdot 10^{-3} \text{ g}$

f)

$$6,75 \cdot 10^{-3} \text{ g/cm}^2 \quad \text{ts} \cdot 1,00 \cdot 10^{-2} \text{ A/cm}^2$$



$$t = \frac{3}{1} \cdot \frac{6,75 \cdot 10^{-3} \text{ g/cm}^2}{197,0 \text{ g/mol}} \cdot 96487 \text{ A} \cdot \text{s/mol} \cdot \frac{1}{1,00 \cdot 10^{-2} \text{ A/cm}^2} = 991,7 \text{ s} \sim 992 \text{ s} \sim 16 \text{ min} 32 \text{ s}$$



b) $n(\text{NaBiO}_3) = 0,200 \text{ l} \cdot 0,500 \text{ mol/l} = 0,100 \text{ mol}$

c)




$$m(\text{MnSO}_4) = \frac{2}{5} \cdot 0,100 \text{ mol} \cdot 151 \text{ g/mol} = 6,04 \text{ g}$$

$$m(\text{H}_2\text{O}) = 6,04 \text{ g}(\text{MnSO}_4) \cdot \frac{100 \text{ g}(\text{H}_2\text{O})}{64,5 \text{ g}(\text{MnSO}_4)} = 9,36 \text{ g}$$

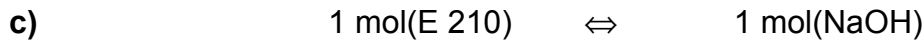
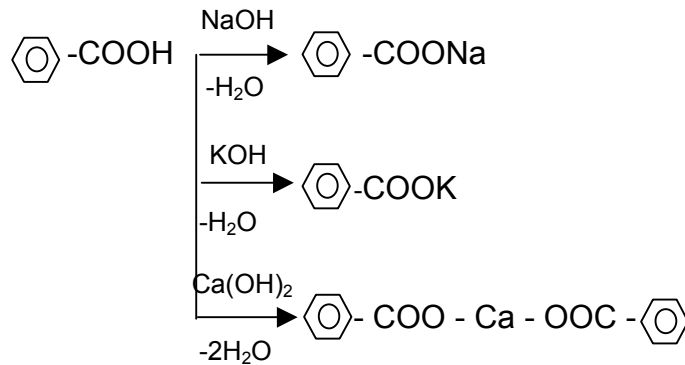
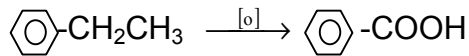
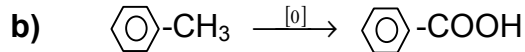
$$m(\text{lahus}) = 6,04 \text{ g} + 9,36 \text{ g} = 15,4 \text{ g}$$

d) $m(\text{MnSO}_4 \cdot 7\text{H}_2\text{O}) = 6,04 \text{ g}(\text{MnSO}_4) \cdot \frac{277 \text{ g}(\text{MnSO}_4 \cdot 7\text{H}_2\text{O})}{151 \text{ g}(\text{MnSO}_4)} = 11,08 \sim 11,1 \text{ g}$

$$m(\text{H}_2\text{O}) = 15,4 - 11,08 = 4,32 \text{ g} \sim 4,3 \text{ g}$$

3. a) E 210  -COOH benseenkarboksüülhape e. bensoehape
E 211  -COONa naatriumbenseenkarboksülaat e. naatriumbensoaat
E 212  -COOK kaaliumbenseenkarboksülaat e. kaaliumbensoaat

E 213 $(\text{C}_6\text{H}_5\text{-COO})_2\text{Ca}$ kaltsiumbenseenkarboksülaat e. kaltsiumbensoaat



Nende ainete vastavad hulgad on:

$$100 \text{ cm}^3 \cdot 0,100 \text{ mol/cm}^3 \Leftrightarrow V \text{ cm}^3 \cdot 1,046 \text{ g/cm}^3 \cdot 0,0400 \cdot \frac{1 \text{ mol}}{40 \text{ g}}$$

millest

$$V(\text{NaOH lahus}) = \frac{1}{1} \cdot 100 \text{ cm}^3 \cdot 0,100 \text{ mol/cm}^3 \cdot 40 \text{ g/mol} \cdot \frac{1}{4,00 \cdot 10^{-2}} \cdot \frac{1 \text{ cm}^3}{1,046 \text{ g}} = 9,56 \text{ cm}^3$$

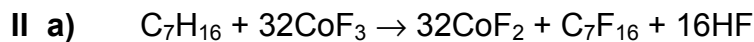
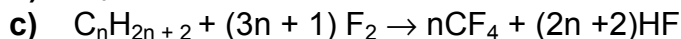
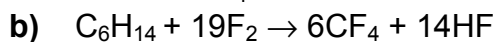
4. I a)

$$n(\text{C}) = 13,6 \text{ g} \cdot \frac{1 \text{ mol}}{12,0 \text{ g}} = 1,13 \text{ mol}$$

$$n(\text{F}) = 86,4 \text{ g} \cdot \frac{1 \text{ mol}}{19,0 \text{ g}} = 4,45 \text{ mol}$$

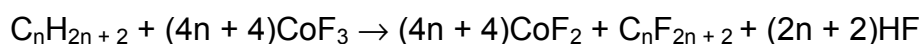
$$\frac{n(\text{F})}{n(\text{C})} = \frac{4,45}{1,13} = 4$$

Tekib CF_4 tetrafluormetaan

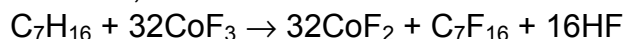


$$3m = 2m + 2 \cdot (2n+2)$$

$$m = 4n + 4$$



kui $n = 7$, siis



c) See on redoksreaktsioon kus Co redutseerub (on oksüdeerija) III \rightarrow II ja

süsinik oksüdeerub $-\frac{16}{7} \rightarrow +\frac{16}{7}$ (on redutseerija).

5. a) $E_k = \frac{9,00 \cdot 10^{-3} \text{ kg} \cdot 700^2 \text{ m}^2/\text{s}^2}{2} = 2205 \text{ kg m/sek}^2 \cdot \text{m} = 2,205 \text{ kJ} \approx 2,21 \text{ kJ}$

b) $M(\text{püssirohi}) = 2 \cdot 101 + 3 \cdot 12 + 32 = 270 \text{ g/mol}$

$$\text{c) } m(\text{püssirohi}) = \frac{10 \cdot 2,205 \text{ kJ}}{582,6 \text{ kJ/mol}} \cdot 270 \text{ g/mol} = 10,2 \text{ g}$$

$$\text{d) } 1 \text{ mol (püssirohi)} \Leftrightarrow 4 \text{ mol(gaase)}$$

$$p \cdot V = n \cdot R \cdot T$$

$$p = \frac{4}{1} \cdot \frac{1500 \text{ g}}{270 \text{ g/mol}} \cdot 0,0820 \frac{\text{atm} \cdot \text{dm}^3}{\text{mol} \cdot \text{K}} \cdot 2273 \text{ K} \cdot \frac{1}{1 \text{ dm}^3} = 4141,0 \text{ atm} \sim 4140 \text{ atm}$$

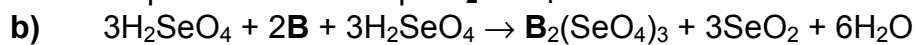
6. a) Et happel **A** peab olema väävelhappega sarnane kuju, siis on tema valem H_2XO_4

$$M(2(\text{H}) + 4(\text{O})) = 66,0 \text{ g/mol}$$

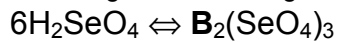
$$M(\text{X}) = 66,0 \text{ g/mol} \cdot \frac{1}{45,5\%} \cdot 54,5\% = 79 \text{ g/mol}$$

Element **X** on seleen **Se**.

Hape **A** on seleenhape **H₂SeO₄**



$$87,0 \text{ g} \qquad 82,3 \text{ g}$$



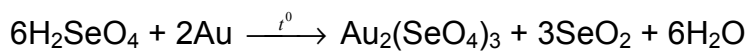
$$145 \text{ g/mol} \quad (429 + 2\text{B})\text{g/mol}$$

$$82,3 \text{ g} = \frac{1}{6} \cdot \frac{87,0 \text{ g}}{145 \text{ g/mol}} \cdot (429 + 2\text{B})\text{g/mol}$$

$$2\text{B g/mol} = 82,3 \text{ g} \cdot \frac{6}{1} \cdot \frac{145 \text{ g/mol}}{87 \text{ g}} - 429 \text{ g/mol}$$

$$M(\text{B}) = 197 \text{ g/mol}$$

Element **B** on kuld **Au**.



Sool **C** on $\text{Au}_2(\text{SeO}_4)_3$

Oksiid **D** on SeO_2

c) Hape **E** on $\text{H}[\text{AuCl}_4]$

