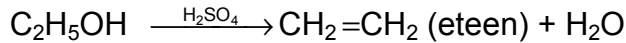
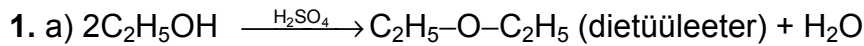


1996/97 õa keemiaolümpiaadi lõppvooru ülesannete lahendused
11. klass



b) $1,25 \text{ g/dm}^3 \cdot 22,4 \text{ dm}^3/\text{mol} = 28,0 \text{ g/mol}$ (eteen)

c) molaarruumala

$$V_M = 1 \text{ mol} \cdot 0,08206 \frac{\text{atm} \cdot \text{dm}^3}{\text{mol} \cdot \text{K}} \cdot 323 \text{ K} \cdot \frac{1}{1 \text{ atm}} = 26,5 \text{ dm}^3 / \text{mol}$$

$$M(\text{gaasid}) = 1,49 \text{ g/dm}^3 \cdot 26,5 \text{ dm}^3/\text{mol} = 39,49 \sim 39,5 \text{ g/mol}$$

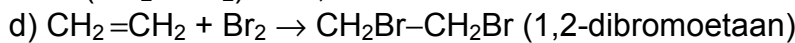
$$x \text{ mol } \underset{74,1 \text{ g/mol}}{\text{C}_2\text{H}_5\text{OC}_2\text{H}_5} + (1-x) \text{ mol } \underset{28,0 \text{ g/mol}}{\text{CH}_2=\text{CH}_2} = \underset{39,5 \text{ g/mol}}{1 \text{ mol gaase}}$$

$$74,1x + 28,0 - 28,0x = 39,5$$

$$x = 25,0 \%$$

$$\% (\text{C}_2\text{H}_5\text{OC}_2\text{H}_5) = 25,0$$

$$\% (\text{CH}_2=\text{CH}_2) = 75,0$$

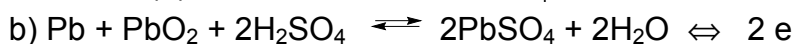
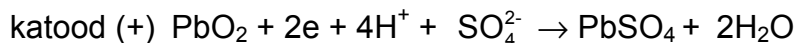
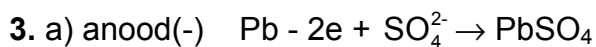
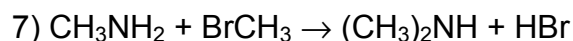
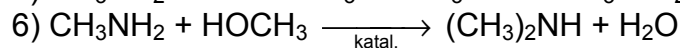
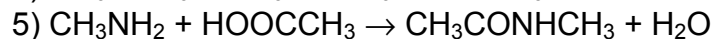
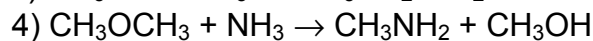
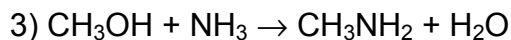


$$\underset{28 \text{ g/mol}}{\text{CH}_2=\text{CH}_2} \quad \quad \quad \underset{188 \text{ g/mol}}{\text{CH}_2\text{Br-CH}_2\text{Br}}$$

$$188 : 28 = 6,7$$



$$31,1 : 45,1 = 1 : 1,45$$



c) $n(\text{e}) = 250 \text{ A} \cdot 45 \text{ s} \cdot \frac{1 \text{ mol}}{96500 \text{ A} \cdot \text{s}} = 0,11658 \sim 0,117 \text{ mol}$

$$\Delta m(\text{anood}) = \frac{1}{2} \cdot 0,11658 \text{ mol} \cdot 96 \text{ g/mol} = 5,595 \sim 5,60 \text{ g}$$

$$\Delta m(\text{katood}) = -\frac{1}{2} \cdot 0,11658 \text{ mol} \cdot 32 \text{ g/mol} + 5,595 \text{ g} = 3,72 \text{ g}$$

d) $\Delta m(\text{H}_2\text{SO}_4) = 3,00 \text{ dm}^3 \cdot 1243 \text{ g/dm}^3 \cdot 0,33 - 3,00 \text{ dm}^3 \cdot 1194 \text{ g/dm}^3 \cdot 0,27 = 263 \text{ g}$

$$Q = \frac{2}{2} \cdot \frac{263 \text{ g}}{98,1 \text{ g/mol}} \cdot 96500 \frac{\text{A} \cdot \text{s}}{\text{mol}} \cdot \frac{1 \text{ tund}}{3600 \text{ s}} = 71,9 \text{ A} \cdot \text{tundi}$$

$$4. a) n(\text{H}_2\text{SO}_4) = \frac{10,0 \text{ cm}^3 \cdot 1,83 \text{ g / cm}^3 \cdot 0,95}{98,1 \text{ g / mol}} = 0,1772 \sim 0,117 \text{ mol}$$

$$n(\text{NaOH}) = 2 \cdot 0,1772 = 0,354 \text{ mol}$$

$$n(\text{H}_2\text{O}) = 10 \cdot 0,1772 = 1,772 \text{ mol}$$

$$n'(\text{H}_2\text{O}) = \frac{10,0 \text{ cm}^3 \cdot 1,83 \text{ g / cm}^3 \cdot 0,05}{18 \text{ g / mol}} = 0,0508 \text{ mol (H}_2\text{SO}_4)$$

$$n''(\text{H}_2\text{O}) = 0,354 \text{ mol (tekib reaktsiooni käigus)}$$

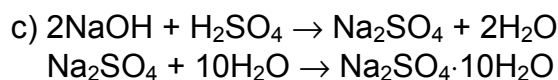
$$n''' \text{ lahuses (H}_2\text{O)} = 1,772 - 0,354 - 0,051 = 1,367 \text{ mol (NaOH lahuses)}$$

$$m(\text{NaOH lahus}) = 0,354 \text{ mol} \cdot 40 \text{ g/mol} + 1,367 \text{ mol} \cdot 18,0 \text{ g/mol} = 38,8 \text{ g}$$

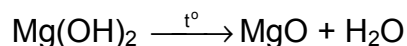
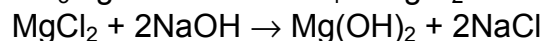
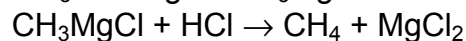
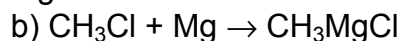
$$\%(\text{NaOH}) = \frac{0,354 \text{ mol} \cdot 40,0 \text{ g / mol}}{38,8 \text{ g}} = 36,5 \%$$

$$b) \%(\text{H}_2\text{O väävelhapest}) = \frac{0,0508}{1,772} \cdot 100 = 2,87$$

$$\%(\text{H}_2\text{O NaOH}) = \frac{1,367}{1,772} \cdot 100 = 77,1$$



5. a) A - CH₃Cl; B - Mg; C - CH₃MgCl; D - CH₄; E - MgCl₂; F - Mg(OH)₂; G - MgO



c) Ühend E saab olla kloriid, millest NaOH lisamisel tekib hüdroksiid F. Viimane laguneb termilisel töötlemisel oksiidiks G.

$$\frac{M(E)}{M(G)} \Rightarrow \frac{5,96}{2,52} = \frac{M(B) + 35,5x}{M(B) + x \cdot \frac{16}{2}}; M(B) = 12,15x. \text{ Kui } x=2, \text{ siis } M(B)=24,3$$

g/mol

B on Mg.

$$M(G) = M(\text{MgO}) = 24,3 + 16,0 = 40,3 \text{ g/mol}$$

$$M(D) = \frac{40,3}{2,52} = 16 \text{ g / mol};$$

Ühend D on metaan CH₄.

6. a) M(seguga) = 17,0 · 2,02 g/mol = 34,3 g/mol

$$\%(I) = \frac{120}{200} \cdot 100 = 60$$

$$\%(II) = \frac{200 - 120}{200} \cdot 100 = 40$$

b) Gaas(I) ei reageeri broomiveega, järelkult on ta alkaan (C_xH_{2x+2})

$$n(\text{II}) = 0,080 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} = 0,00357 \text{ mol}$$

$$n(\text{Br}_2) = 0,200 \text{ dm}^3 \cdot 0,100 \text{ mol/dm}^3 - 2,06 \text{ g} \cdot \frac{1 \text{ mol}}{160 \text{ g}} = 0,0200 - 0,0129 =$$

$$= 0,0071 \text{ mol}$$

Et broomi hulk on kaks korda suurem gaasi (II) hulgast [$n(\text{Br}_2) \sim 2n(\text{II})$].
siis gaas(II) peab olema kas dieen või alküün (C_yH_{2y-2}).

c) Gaasi(I) molaarmass on $(14x+2)$ ja gaasi(II) molaarmass on $(14y-2)$

$$0,6 \cdot (14x+2) + 0,4(14y-2) = 34,0, \text{ mis taandub kujule}$$

$$3x+2y = 12$$

Selle võrrandi täisarvuliseks lahendiks on $x=2$ ja $y=3$

Gaas(I) - C_2H_6

Gaas(II) - C_3H_4

d) Gaas(I) CH_3-CH_3 etaan

Gaas(II) $CH_2=C=CH_2$ propadieen

$CH\equiv C-CH_3$ propüün

e) $CH_2=C=CH_2 + 2Br_2 \rightarrow CH_2BrCBr_2CH_2Br$ 1,2,2,3-tetrabromopropaan

$CH\equiv C-CH_3 + 2Br_2 \rightarrow CHBr_2CBr_2CH_3$ 1,1,2,2-tetrabromopropaan