

Keemia lahtise võistluse ülesannete lahendused

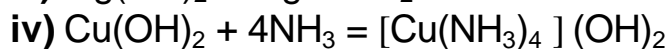
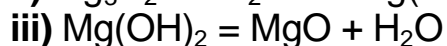
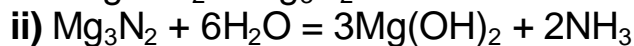
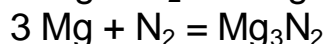
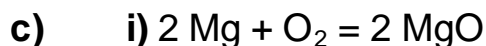
Noorem aste (9. ja 10. klass)

27. november 1999. a.

1. a) **A** on Mg, sest ta järjekorranumber on 12. Järjekorranumber on määratud prootonite arvuga. Sama palju on ka aatomis elektrone.

b) $M(\text{H}_2) = 2,0 \text{ g/mol}$

$$M(\text{E}) = 2,0 \text{ g/mol} \cdot 8,5 = 17 \text{ g/mol}$$

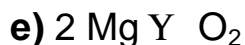


d) **B** - magneesiumoksiid, MgO.

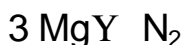
C - magneesiumnitriid; Mg_3N_2

D - magneesiumhüdroksiid, $\text{Mg}(\text{OH})_2$

E - ammoniaak, NH_3



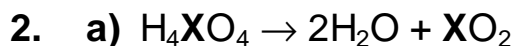
$$m(\text{Mg}) = \frac{2}{1} \cdot 5,00 \text{ dm}^3 \cdot 0,209 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} \cdot 24,3 \text{ g/mol} = 2,27 \text{ g}$$



$$m(\text{Mg}) = \frac{3}{1} \cdot 5,00 \text{ dm}^3 \cdot 0,78 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} \cdot 24,3 \text{ g/mol} = 12,7 \text{ g}$$

$m(\text{Mg})$

15,0 g



b) $m(\text{H}_2\text{O}) = 24,0 - 15,0 = 9,0 \text{ g}$

$$n(\text{H}_4\text{XO}_4) = \frac{1}{2} \cdot 9,0 \text{ g} \cdot \frac{1 \text{ mol}}{18 \text{ g}} = 0,25 \text{ mol}$$

$$n(\text{XO}_2) = 0,25 \text{ mol}$$

$$n(\text{H}_2\text{O}) = 0,50 \text{ mol}$$

c) $M(\text{H}_4\text{XO}_4) = \frac{24,0 \text{ g}}{0,25 \text{ mol}} = 96 \text{ g/mol}$

$$M(\text{XO}_2) = \frac{15,0 \text{ g}}{0,25 \text{ mol}} = 60 \text{ g/mol}$$

d) $A_r(\text{X}) = 96 - 4 - 64 = 28$

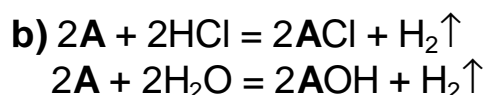
$$A_r(\mathbf{X}) = 60 - 32 = 28$$

Element \mathbf{X} on Si (räni).

e) ortoränihape

f) H_2SiO_3 - metaränihape

3. a) $m(\text{HCl}) = 49,03\text{g} \cdot 0,2978 = 14,60\text{ g}$
 $m(\text{H}_2\text{O}) = 49,03\text{g} \cdot 0,7022 = 34,43\text{ g}$



c) Võimalikeks aineteks saavad olla leelismetalli kloriid (\mathbf{ACl}), vastav hüdroksiid (\mathbf{AOH}) ja leelismetall (\mathbf{A}).

d) Kui leelismetallidest ainult üks rahuldab ülesande tingimusi, siis selleks saab olla ainult kõige väiksema aatommassiga leelismetall, sest tema hulk on kõige suurem. Selleks on **Li**.

e) $\text{HCl} \text{ Y } \text{LiCl}$

$$m(\text{LiCl}) = \frac{1}{1} \cdot 14,60\text{g} \cdot \frac{1\text{mol}}{36,47\text{g}} \cdot 42,40\text{g/mol} = 16,97\text{ g}$$

$\text{H}_2\text{O} \text{ Y } \text{LiOH}$

$$m(\text{LiOH}) = \frac{1}{1} \cdot 34,43\text{g} \cdot \frac{1\text{mol}}{18,02\text{g}} \cdot 23,95\text{g/mol} = 45,76\text{ g}$$

$\text{HCl} \text{ Y } \text{Li}$

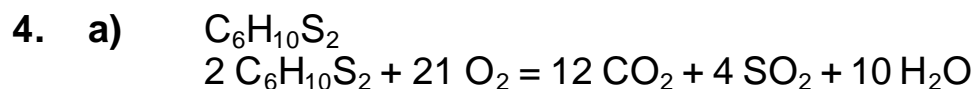
$$m(\text{Li}) = \frac{1}{1} \cdot 14,60\text{g} \cdot \frac{1\text{mol}}{36,47\text{g}} \cdot 6,940\text{g/mol} = 2,78\text{ g}$$

$\text{H}_2\text{O} \text{ Y } \text{Li}$

$$m(\text{Li}) = \frac{1}{1} \cdot 34,43\text{g} \cdot \frac{1\text{mol}}{18,02\text{g}} \cdot 6,940\text{g/mol} = 13,25\text{ g}$$

$$m(\text{Li}) = 52,20\text{ g} - 2,78\text{ g} - 13,25\text{ g} = 36,17\text{ g}$$

$$\Sigma m = 16,97\text{g} + 45,76\text{g} + 36,17\text{g} = \mathbf{98,90\text{ g}}$$



b) $1,0\text{ cm}^3 \cdot 1,040\text{ g/cm}^3$ $V \cdot 0,209$
 $2 \text{C}_6\text{H}_{10}\text{S}_2$ Y 21O_2
 146 g/mol $22,4\text{ dm}^3/\text{mol}$

$$V(\text{õhk}) = \frac{21}{2} \cdot 1,04 \text{ g} \cdot \frac{1 \text{ mol}}{146 \text{ g}} \cdot 22,4 \frac{\text{dm}^3}{\text{mol}} \cdot \frac{1}{0,209} = 8,02 \text{ dm}^3$$

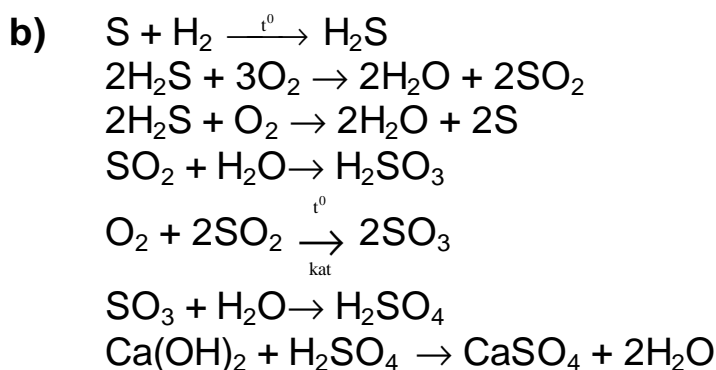
c) Reaktsioonivõrrandis selgub, et hapniku hulk suhtub moodustunud gaaside hulka nagu 21:(12+4). Seega moodustunud gaaside ruumala erineb hapniku ruumalast $16/21 = 0,76$ korda

d) d ja e - 1,2
 abc ja fgh - di (kaks sarnast radikaali)
 b ja g - 2 (radikaali süsiniku number, loendamist alustatakse põhiahelast (väävlis))
 abc ja fgh - prop (kolme süsinikuga ahel)
 ab ja fg - enüül (kaksiksides)
 de - disulfiid (põhiahel)

$$5. \quad \begin{array}{ccc} V \text{ km}^3 \cdot 2,65 \text{ g/dm}^3 \cdot 10^{12} \text{ dm}^3/\text{km}^3 & & 1,0 \cdot 10^{12} \text{ g} \\ \text{SO}_4^{2-} & \text{)} & \text{H}_2\text{SO}_4 \\ 96 \text{ g/mol} & & 98 \text{ g/mol} \end{array}$$

$$V = \frac{1}{1} \cdot \frac{10^{12} \text{ g}}{98 \text{ g/mol}} \cdot 96 \text{ g/mol} \cdot \frac{1 \text{ km}^3}{2,65 \cdot 10^{12} \text{ g}} = 0,37 \text{ km}^3$$

6. a) **X** on väävel (S), **B** on divesiniksulfiid (H_2S), **C** on vääveldioksiid (SO_2), **D** on vääveltrioksiid (SO_3), **E** on väävelhape (H_2SO_4), **F** on kaltsiumsulfaat (CaSO_4), **M** on väävlisshappe lahus (H_2SO_3).



c)

$$\begin{aligned} \%(\text{Ca}) &= \frac{40,1}{136,2} \cdot 100 = 29,4 & \%(\text{O}) &= \frac{64}{136,2} \cdot 100 = 47,0 \\ \%(\text{S}) &= \frac{32,1}{136,2} \cdot 100 = 23,6 & 29,4 + 47,0 + 23,6 &= 100 \end{aligned}$$