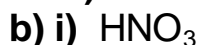
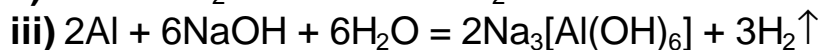
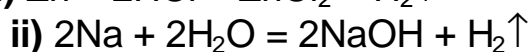
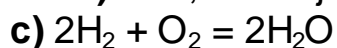


2005/2006 õa keemiaolümpiaadi lõppvooruu ülesannete lahendused  
9. klass



ii) sool, oksiid ja vesi



d) Vesinikku on  $\frac{2}{3} \cdot 300 \text{ cm}^3 = 200 \text{ cm}^3$

Hapnikku on  $\frac{1}{3} \cdot 300 \text{ cm}^3 = 100 \text{ cm}^3$

i)  $m(\text{O}_2) = 0,100 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} \cdot 32,0 \text{ g/mol} = 0,1429 \text{ g} \approx \mathbf{0,143 \text{ g}}$

ii)  $\begin{matrix} m & 0,200 \text{ dm}^3 \\ \text{Zn} \leftrightarrow & \text{H}_2 \\ 65,39 \text{ g/mol} & 22,4 \text{ dm}^3/\text{mol} \end{matrix}$

$m(\text{Zn}) = \frac{1}{1} \cdot 0,200 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} \cdot 65,39 \text{ g/mol} = 0,5838 \text{ g} \approx \mathbf{0,584 \text{ g}}$

2. a) i)  $M(\text{A}) = 29 \text{ g/mol} \cdot 2,45 = \mathbf{71 \text{ g/mol}}$

ii)  $M(\text{C}) = 16,0 \text{ g/mol} \times \frac{1}{0,305} = \mathbf{52,5 \text{ g/mol}}$

b) A –  $\text{Cl}_2$ , kloor

B –  $\text{HCl}$ , soolhape

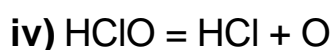
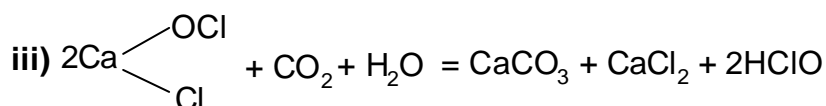
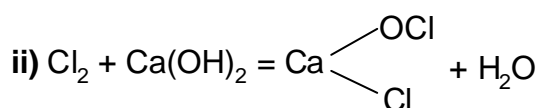
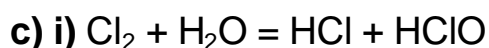
C –  $\text{HClO}$ , hüpokloorishape

D –  $\begin{matrix} \text{OCl} \\ \diagdown \\ \text{Ca} \\ \diagup \\ \text{Cl} \end{matrix}$ , kloorlubi

F –  $\text{CaCO}_3$ , kaltsiumkarbonaat

G –  $\text{CaCl}_2$ , kaltsiumkloriid

H – O, atomaarne hapnik



3. a) A – C, süsinik, grafiit

B - CaSO<sub>4</sub>·2H<sub>2</sub>O, kaltsiumsulfaat-vesi(1/2), kips

C – CaCO<sub>3</sub>, kaltsiumkarbonaat, kaltsiit

$$\%(\text{Ca}) = \frac{40,08 \text{ g/mol}}{136,14 \text{ g/mol}} \cdot 100 = 29,44$$

D – FeS<sub>2</sub>, püriit

E - Fe<sub>2</sub>O<sub>3</sub>, raud(III)oksiid, pruun rauamaak

b) X – CO<sub>2</sub>, süsinikdioksiid

Y – H<sub>2</sub>O, vesi

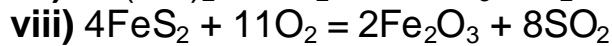
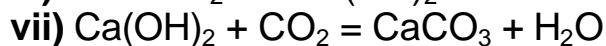
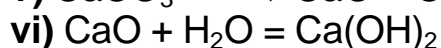
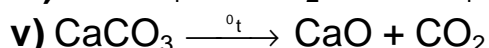
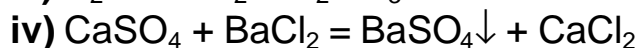
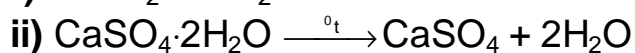
Z – H<sub>2</sub>CO<sub>3</sub>, süsihape

S – CaO, kaltsiumoksiid

T – Ca(OH)<sub>2</sub>, kaltsiumhüdrosiid

U – SO<sub>2</sub>, vääveldioksiid

c) i) C + O<sub>2</sub> = CO<sub>2</sub>



4. a) Ca(HCO<sub>3</sub>)<sub>2</sub> + Mg(HCO<sub>3</sub>)<sub>2</sub> = CaCO<sub>3</sub>↓ + MgCO<sub>3</sub>↓ + 2H<sub>2</sub>O + 2CO<sub>2</sub>↑

b) n(vesinikkarbonaadid) = n(karbonaadid)

$$n(\text{karbonaadid}) = 3,39 \text{ mmol/l} \cdot 3,6 \text{ l/päevas} \cdot 14 \text{ päeva} = 171 \text{ mmol} \approx \mathbf{0,17 \text{ mol}}$$

c) Ca<sup>2+</sup> moolprotsendiline sisaldus on 2 korda suurem kui Mg<sup>2+</sup> sisaldus, järelikult moodustab katlakivi karbonaatidest 2 moolosa CaCO<sub>3</sub> ja 1 moolosa MgCO<sub>3</sub>.

$$n(\text{CaCO}_3) = \frac{0,171}{2+1} \cdot 2 = 0,114 \text{ mol}$$

$$n(\text{MgCO}_3) = \frac{0,171}{2+1} \cdot 1 = 0,0570 \text{ mol}$$

$$m(\text{CaCO}_3) = n \cdot M = 0,114 \text{ mol} \cdot 100 \text{ g/mol} = 11,4 \text{ g}$$

$$m(\text{MgCO}_3) = n \cdot M = 0,0570 \text{ mol} \cdot 84,1 \text{ g/mol} = 4,79 \text{ g}$$

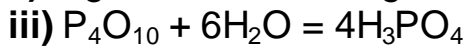
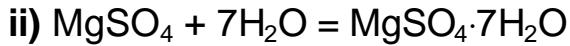
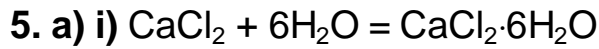
$$m(\text{karbonaadid}) = 11,4 \text{ g} + 4,79 \text{ g} = 16,19 \text{ g} \approx 16,2 \text{ g}$$

$$V(\text{karbonaadid}) = \frac{m}{\rho} = \frac{16,2 \text{ g}}{2,7 \text{ g/cm}^3} = 6,00 \text{ cm}^3 \approx 6,0 \text{ cm}^3$$

$$\text{Karbonaatide kihi paksus } l = \frac{V}{S} = \frac{6,0 \text{ cm}^3}{94,2 \text{ cm}^2} = 0,0637 \text{ cm} \approx \mathbf{0,64 \text{ mm}}$$

$$\text{d) } t = 14 \text{ päeva} \cdot \frac{0,5 \text{ mm}}{0,64 \text{ mm}} = 10,9 \text{ päeva} \approx \mathbf{11 \text{ päeva}}$$

e) i) happed



$$\begin{array}{ccc} 50,0 \text{ g} & & m \\ \text{b) i) } \text{CaCl}_2 & \Leftrightarrow & 6\text{H}_2\text{O} \\ 111 \text{ g/mol} & & 18,0 \text{ g/mol} \\ m(\text{H}_2\text{O}) = \frac{6}{1} \cdot 50,0 \text{ g} \cdot \frac{1 \text{ mol}}{111 \text{ g}} \cdot 18,0 \text{ g/mol} = \mathbf{48,6 \text{ g}} \end{array}$$

$$\begin{array}{ccc} 50,0 \text{ g} & & m \\ \text{ii) } \text{MgSO}_4 & \Leftrightarrow & 7\text{H}_2\text{O} \\ 120 \text{ g/mol} & & 18,0 \text{ g/mol} \\ m(\text{H}_2\text{O}) = \frac{7}{1} \cdot 50,0 \text{ g} \cdot \frac{1 \text{ mol}}{120 \text{ g}} \cdot 18,0 \text{ g/mol} = \mathbf{52,5 \text{ g}} \end{array}$$

$$\text{c) } m(\text{H}_2\text{O, õhus}) = 48,6 \text{ g} \cdot \frac{1}{0,75} = 64,8 \text{ g}$$

$$m(\text{õhk}) = 64,8 \text{ g} \cdot \frac{1}{0,001} = 64800 \text{ g}$$

$$V(\text{õhk}) = 64800 \text{ g} \cdot \frac{1 \text{ dm}^3}{1,29 \text{ g}} \cdot \frac{1 \text{ m}^3}{1000 \text{ dm}^3} = 50,23 \text{ m}^3 \approx \mathbf{50,2 \text{ m}^3}$$

$$\text{d) } \%(\text{H}_2\text{O peale kuivatamist}) = 0,1 \cdot 0,25 = \mathbf{0,025}$$

$$\text{e) } \%(\text{H}_2\text{SO}_4) = \frac{1,10 \text{ dm}^3 \cdot 1,820 \text{ kg/dm}^3 \cdot 0,9}{1,10 \text{ dm}^3 \cdot 1,820 \text{ kg/dm}^3 + 0,05 \text{ kg}} \cdot 100 = \mathbf{87,8}$$

$$\text{6. a) } m(\text{lahus}) = 1 \text{ dm}^3 \cdot 1,070 \text{ g/cm}^3 \cdot \frac{1000 \text{ cm}^3}{1 \text{ dm}^3} = 1070 \text{ g}$$

$$\text{i) } m(\text{H}_2\text{O}) = 1070 \text{ g} \cdot \frac{100 \text{ g}}{111,1 \text{ g}} = \mathbf{963,1 \text{ g}}$$

$$\text{ii) } m(\text{K}_2\text{Cr}_2\text{O}_7) = 1070 \text{ g} \cdot \frac{11,10 \text{ g}}{111,1 \text{ g}} = \mathbf{106,9 \text{ g}}$$

$$\text{b) } m(\text{lahus}) = 100,0 \text{ g} \cdot \frac{111,1 \text{ g}}{11,10 \text{ g}} = 1000,9 \text{ g} \approx \mathbf{1001 \text{ g}}$$

$$\text{c) } c(\text{K}_2\text{Cr}_2\text{O}_7) = 106,9 \text{ g} \cdot \frac{1 \text{ mol}}{294,2 \text{ g}} \cdot \frac{1}{\text{dm}^3} = \mathbf{0,3634 \text{ mol/dm}^3}$$