

Tallinna XI koolinoorte keemiaolümpiaadi koolivoor
2010/ 2011 õ.-a.

Ülesannete lahendused

9. klass

1.a)



$$\text{b) } P(\text{I}) = \frac{0,005\% \times 126,9 \frac{\text{g}}{\text{mol}}}{166,0 \frac{\text{g}}{\text{mol}}} \sim \mathbf{0,0038\%} \quad (1)$$

c)

$$m(\text{KI}) = \frac{10 \text{ g} \times 0,005\%}{100\%} = \mathbf{0,0005 \text{ g}} \quad (0,5)$$

$$m(\text{NaCl}) = \frac{10 \text{ g} \times 99,8\%}{100\%} = \mathbf{9,9800 \text{ g}} \quad (0,5)$$

$$m(\text{AgNO}_3) = \frac{m(\text{KI}) \times M(\text{AgNO}_3)}{M(\text{KI})} + \frac{m(\text{NaCl}) \times M(\text{AgNO}_3)}{M(\text{NaCl})} =$$

$$\frac{0,0005 \text{ g} \times 169,9 \frac{\text{g}}{\text{mol}}}{166,0 \frac{\text{g}}{\text{mol}}} + \frac{9,98 \text{ g} \times 169,9 \frac{\text{g}}{\text{mol}}}{58,5 \frac{\text{g}}{\text{mol}}} \sim \mathbf{28,985 \text{ g}} \quad (2)$$

d)



$$m(\text{Pb}(\text{NO}_3)_2) = \frac{0,0005 \text{ g} \times 331,2 \frac{\text{g}}{\text{mol}}}{2 \times 166,0 \frac{\text{g}}{\text{mol}}} \sim \mathbf{0,0005 \text{ g}} \quad (1,5)$$

e)

$$m(\text{I}) = \frac{0,00005 \text{ g} \times 1 \cdot 10^6 \times 126,9 \frac{\text{g}}{\text{mol}}}{166 \frac{\text{g}}{\text{mol}}} \sim \mathbf{38,223 \text{ g}} \quad (2)$$

$$\text{f) } m(\text{SiO}_2) = \frac{10000 \text{ g} \times 0,195\%}{100\%} = \mathbf{19,5 \text{ g}} \quad (1)$$

10p

2. a) A - Ca, kaltsium, кальций (0,5)

B - O₂, hapnik, кислород (0,5)

C - Ca(OH)₂, kaltsiumhüdroksiid, гидроксид кальция (0,5)

D - SO₂, vääveldioksiid, диоксид серы (0,5)

E - CaCl₂, kaltsiumkloriid, хлорид кальция (0,5)

F - CO₂, süsinikdioksiid, диоксид углерода (0,5)

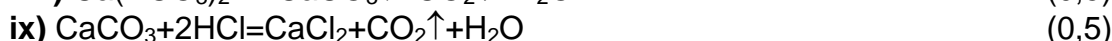
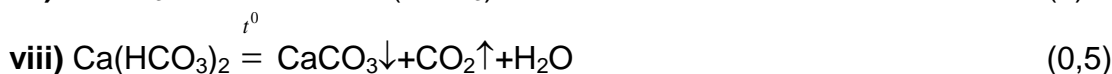
b) i) 2Ca + O₂ = 2CaO (0,5)

ii) CaO + H₂O = Ca(OH)₂ (0,5)

iii) Ca(OH)₂ + SO₂ = CaSO₃↓ + H₂O (0,5)

i) H₂SO₃ = SO₂↑ + H₂O (0,5)

ii) Ca + 2H₂O = Ca(OH)₂ + H₂↑ (0,5)



c) C - alus, основание (0,5)

D - happeline oksiid, кислотный оксид (0,5)

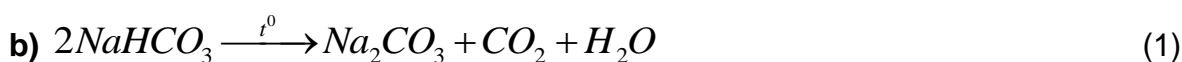
E - sool, соль (0,5)

F - happeline oksiid, кислотный оксид (0,5)

10p

3.

a) $n(\text{K}_2\text{CO}_3) = \frac{111\text{g} \times 20\text{g}}{211\text{g} \times 138,2\text{g/mol}} \sim 0,076\text{mol}$ (2)



$V(\text{CO}_2) = \frac{20\text{g} \times 22,4\text{dm}^3/\text{mol}}{84\text{g/mol} \times 2} \sim 2,67\text{dm}^3$ (2)



$n(\text{C}_2\text{H}_5\text{OH}) = \frac{20\text{g}}{46\text{g/mol}} \sim 0,435\text{mol}$ (1)

$n(\text{O}_2) = \frac{20\text{dm}^3}{22,4\text{dm}^3/\text{mol}} \sim 0,893\text{mol}$ (1)

$n(\text{C}_2\text{H}_5\text{OH}) > 3n(\text{O}_2)$ (etanooli on reaktsioonis liiaga, избыточное количество спирта в реакции) (1)

$V(\text{gaasi ruumala peale reaktsiooni, газа после реакции}) = \frac{20\text{dm}^3 \times 2}{3} \sim 13,3\text{dm}^3$ (1)

10p

4.

a)

$m(100\% \text{H}_2\text{SO}_4) = 567\text{cm}^3 \times 1,28\text{g/cm}^3 \times 0,365 \sim 265\text{g}$

$m(96\% \text{H}_2\text{SO}_4) = 265\text{g}/0,96 = 276\text{g}$

i) $V(96\% \text{H}_2\text{SO}_4) = 276\text{g}/1,84\text{g/cm}^3 \sim 150\text{cm}^3$ (2)

$m(36,5\% \text{-line lahus}) = 567\text{cm}^3 \times 1,28\text{g/cm}^3 \sim 726\text{g}$

$m(\text{vesi}) = 726\text{g} - 276\text{g} = 450\text{g}$

ii) $V(\text{vesi}) = 450\text{g}/1\text{g/cm}^3 = 450\text{cm}^3$ (1,5)

iii) Ei piisanud (0,5)

b)

Aine masside summa segatavates lahustes võrdub aine massiga lõpplahuses:

iv) $V(28\%) = \frac{726\text{g} \times 0,365 - 253\text{cm}^3 \times 1,357\text{g/cm}^3 \times 0,46}{1,202\text{g/cm}^3 \times 0,28} \sim 318\text{cm}^3$ (2,5)

v) $V(36,5\% \text{H}_2\text{SO}_4) = 726\text{g}/1,28\text{g/cm}^3 = 567\text{cm}^3$ (0,5)

c)

$m(\text{HNO}_3) = 100\text{cm}^3 \times 1,40\text{g/cm}^3 \times 0,65 = 91\text{g}$

$$m(\text{HCl}) = 300\text{cm}^3 \times 1,18\text{g/cm}^3 \times 0,36 \sim \mathbf{127,4\text{g}}$$

$$m(\text{hapete segu}) = 567\text{cm}^3 \times 1,28\text{g/cm}^3 + 100\text{cm}^3 \times 1,4\text{g/cm}^3 + 300\text{cm}^3 \times 1,18\text{g/cm}^3 \sim \mathbf{1220\text{g}}$$

$$P(\text{H}_2\text{SO}_4) = \frac{265\text{g}}{1220\text{g}} \times 100\% \sim \mathbf{21,7\%} \quad (1)$$

$$P(\text{HNO}_3) = \frac{91\text{g}}{1220\text{g}} \times 100\% \sim \mathbf{7,5\%} \quad (1)$$

$$P(\text{HCl}) = \frac{127,4\text{g}}{1220\text{g}} \times 100\% \sim \mathbf{10,4\%} \quad (1)$$

10p