Tallinna XII koolinoorte keemiaolümpiaadi koolivoor
2011/ 2012 õ.-a.

Ülesannete lahendused
9. klass
1.(10)

a. $n[K]^+ = n[Cl]^- \frac{47g \times 0,08 \times 1mol}{74,5g} = 0,05mol$ (1)

$n[Ag]^+ = n[NO_3]^- = \frac{149g \times 0,08 \times 1mol}{170g} = 0,07mol$ (1)

$K^+ + Cl^- + Ag^+ + NO_3^- \rightarrow \overset{0,05mol}{AgCl_\downarrow} + K^+ + Ag^+ + NO_3^-$

$n[K]^+$ = **0,05mol** (0,5)

$n[Ag]^+ = 0,07mol - 0,05mol$ = **0,02mol** (0,5)

$n[NO_3]^-$ = **0,07mol** (0,5)

$n[Cl]^- = 0,00mol$ (0,5)

b.

$Ag^+ + \overset{0,02mol}{Br^-} \rightarrow AgBr_\downarrow$, $m(KBr) = 0,02mol \times 119\frac{g}{mol}$ = **2,38g** (1)

c.

$Ag^+ + Cl^- \rightarrow AgCl_\downarrow, Ag^+ + Br^- \rightarrow AgBr_\downarrow$ (2)

$KCl + AgNO_3 = AgCl + KNO_3$
$KBr + AgNO_3 = AgBr + KNO_3$ (1)

d. $m(lah.) = 47g + 149g + 2,38g - 0,05mol \times 143,5\frac{g}{mol} - 0,02mol \times 188\frac{g}{mol} = 187,4$ **~187g**

(2)
10p

2. (10)

i.

A-Ca; **B-**Ca_3P_2; **C-**PH_3; **D-**$Ca(OH)_2$; **E-**P_4O_{10}; **F-**H_2O; **G-** H_3PO_4 (3,5)

ii.

1. $3Ca+2P=Ca_3P_2$
2. Ca_3P_2**+** $6H_2O$ **=** $2PH_3$**+** $3Ca(OH)_2$
3. $4PH_3+8O_2= P_4O_{10}+ 6H_2O$
4. $P_4O_{10}+ 6H_2O= 4H_3PO_4$
5. Fe_2O_3**+** $2H_3PO_4=2FePO_4+3H_2O$ (5)

iii.

n(H_3PO_4)= $\frac{1,96g}{98\,g/mol} = 0,02$mol

$$\overset{0,01mol}{Fe_2O_3 \cdot xH_2O} + \overset{0,02mol}{2H_3PO_4} = 2FePO_4 + 3H_2O + \overset{0,0Xmol}{xH_2O}$$ (1)

$$X = \frac{1,96g - 0,01mol \times 160\,g/mol}{0,01mol \times 18\,g/mol}$$

X=2 (0,5)
10p

3.(10)

a. 2,07mol-0,52mol=1,55mol. (1)

b. $MgCl_2$ – magneesiumkloriid (1)

$MgSO_4$ – magneesiumsulfaat (1)

c. $Ca(HCO_3)_2 \rightarrow CaCO_3 + H_2O + CO_2$ (1)

d. $m(CaCO_3) = \frac{1}{1} \times 3,5m^3 \times 1,55\,{}^{mol}/_{m^3} \times 0,9 \times 100\,{}^{g}/_{mol} = 488,3g \approx 490g$ (3)

e. Karedust põhjustavate katioonide ja fosfaatioonide moolsuhe reaktsioonis on 3:2.

$3\ Ca^{2+} + 2\ PO_4^{3-} \rightarrow Ca_3(PO_4)_2$

$3\ Mg^{2+} + 2\ PO_4^{3-} \rightarrow Mg_3(PO_4)_2$

$$m(Na_3PO_4 lahus) = \frac{3,5m^3 \times 2mol \times 0,52mol \times 164g}{1mol \times 1m^3 \times 3mol \times 0,23} = 865,2g \approx 870g$$

(3)

10p

4.(10)

a. 5L = 5000cm^3 , m(vesi) = 5000cm^3 × 1g/cm^3 = 5000g

m(keedusool) = $\frac{5000g \times 0,06}{0,94}$ = **319g** (2)

b. $2000\text{cm}^3 \times 1,042\text{g/cm}^3 \times 0,06 = \left(2000\text{cm}^3 \times 1,042\text{g/cm}^3 + \text{m(vesi)}\right) \times 0,04$

$m(vesi) = 1042g$

$V(vesi) = \frac{1042g}{1\,{}^{g}/_{cm^3}}$ = **1042cm^3** (2)

c. $p = \frac{35,8g}{135,8g} \times 100\%$ = **26,4%** (1)

d. m(100% äädikhape) = $3000\text{cm}^3 \times 1,004\,{}^{g}/_{cm^3} \times 0,04$ =120,5g

m(30% äädikhape) = $\frac{120,5}{0,3} = 401,7$g

V(30% äädikhape) = $\frac{401,7\text{g}}{1,038\,{}^{g}/_{cm^3}}$ = **387cm^3**

m(lahus) = $3000\text{cm}^3 \times 1,004\,{}^{g}/_{cm^3}$ = 3012g

m(vesi) = $3012\text{g} - 387\text{g} = 2625\text{g}$

V(vesi) = $\frac{2625\text{g}}{1\,{}^{g}/_{cm^3}}$ = **2625cm^3** (2)

e. Kastruli pinda kaitsev oksiidikiht hakkab happe lahuses lahustuma.

$Al_2O_3 + 6CH_3COOH \rightarrow 2(CH_3COO)_3Al + 3H_2O$

$2Al + 6CH_3COOH \rightarrow 2(CH_3COO)_3Al + 3H_2\uparrow$ (2)

f. Alumiiniumiühendid võivad inimorganismis põhjustada närvisüsteemi häireid. (1)

10p