

1997/98 õa keemiaolümpiaadi piirkondliku vooru ülesannete lahendused
8. klass

- 1) 1) keeduklaas 1) химический стакан
2) lehter 2) воронка
3) mensuur 3) мензурка
4) tiiglitangid 4) щипцы
5) Kippi aparaat 5) аппарат Киппа
6) gaasipõleti 6) газовая горелка
7) seisukolb 7) плоскодонная колба
8) ümarkolb 8) круглодонная колба
9) kooniline kolb 9) коническая колба
10) mõõtkolb 10) мерная колба

2. a) $4\text{Al} + 3\text{O}_2 = 2\text{Al}_2\text{O}_3$
b) $2\text{SO}_2 + \text{O}_2 = 2\text{SO}_3$
c) $2\text{Al}(\text{OH})_3 + 3\text{H}_2\text{SO}_4 = \text{Al}_2(\text{SO}_4)_3 + 6\text{H}_2\text{O}$
d) $3\text{Fe} + 4\text{H}_2\text{O} = \text{Fe}_3\text{O}_4 + 4\text{H}_2$
e) $4\text{H}_3\text{BO}_3 + 2\text{NaOH} = \text{Na}_2\text{B}_4\text{O}_7 + 7\text{H}_2\text{O}$

3. a) $\text{C}_8\text{H}_{10} \rightarrow 8\text{CO}_2 + 5\text{H}_2\text{O}$
b) $\text{Mr}(\text{CO}_2) = 44 \quad m(\text{CO}_2) = 44 \frac{\text{amü}}{\text{molekul}}$
 $\text{Mr}(\text{H}_2\text{O}) = 18 \quad m(\text{H}_2\text{O}) = 18 \frac{\text{amü}}{\text{molekul}}$
c) $m(\text{CO}_2) = 8 \text{ molekuli} \cdot \frac{44 \text{ amü}}{\text{molekul}} = 352 \text{ amü}$
 $m(\text{H}_2\text{O}) = 5 \text{ molekuli} \cdot \frac{18 \text{ amü}}{\text{molekul}} = 90 \text{ amü}$
d) $\frac{352 \text{ amü}}{90 \text{ amü}} = 3,91 \text{ korda} \sim \mathbf{3,9 \text{ korda}}$
e) $2\text{C}_8\text{H}_{10} + 21\text{O}_2 = 16\text{CO}_2 + 10\text{H}_2\text{O}$

4. a): 1) CuO 2) NaOH 3) H₂SO₄ 4) HNO₃ 5) Fe₂O₃
b): 1) tsinkkloriid 2) kaltsiumkarbonaat 3) raud(III)kloriid
4) fosforhape 5) diboortrioksiid

5. a) $\text{CaO} + 2\text{HNO}_3 = \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O}$
b) $M(\text{CaO}) = 56 \text{ g/mol}; \quad M[\text{Ca}(\text{NO}_3)_2] = 164 \text{ g/mol}$
 $M(\text{HNO}_3) = 63 \text{ g/mol}; \quad M(\text{H}_2\text{O}) = 18 \text{ g/mol}$
c) $n(\text{CaO}) = 11,2 \text{ g} \cdot \frac{1 \text{ mol}}{56 \text{ g}} = \mathbf{0,20 \text{ mol}}$
 $n(\text{HNO}_3) = 25,2 \text{ g} \cdot \frac{1 \text{ mol}}{63 \text{ g}} = \mathbf{0,40 \text{ mol}}$

d) Lähteained on ekvivalentsetes vahekorras. Saadusainete massi võib leida nii esimese kui teise lähteaine järgi.



$$n(\text{Ca}(\text{NO}_3)_2) = n(\text{CaO}) \cdot \frac{1 \text{ Ca}(\text{NO}_3)_2}{1 \text{ CaO}}$$

$$m(\text{Ca}(\text{NO}_3)_2) = \frac{1}{1} \cdot 0,20 \text{ mol} \cdot 164 \text{ g/mol} = 32,8 \text{ g} \sim \mathbf{33 \text{ g}}$$

$$m(\text{H}_2\text{O}) = \frac{1}{2} n(\text{HNO}_3) \cdot 18 \text{ g/mol} = \frac{1}{2} \cdot 0,40 \text{ mol} \cdot 18 \text{ g/mol} = \mathbf{3,6 \text{ g}}$$

Märkus: Vastus $m[\text{Ca}(\text{NO}_3)_2] = 32,8 \text{ g}$ lugeda õigeks.

6. a) $n(\text{C}_2\text{H}_5\text{OH}) = 60,3 \text{ g} \cdot \frac{1 \text{ mol}}{46,0 \text{ g}} = \mathbf{1,31 \text{ mol}}$

b) 250 cm^3 (lahus) \Leftrightarrow $1,31 \text{ mol}$ (piiritus)

$$n(\text{C}_2\text{H}_5\text{OH}) = 1,00 \text{ liitrit} \cdot \frac{1000 \text{ cm}^3}{1 \text{ liiter}} \cdot \frac{1,31 \text{ mol}}{250 \text{ cm}^3} = \mathbf{5,24 \text{ mol}}$$

c) $m(\text{lahus}) = 341,5 \text{ g} - 100,5 \text{ g} = 241,0 \text{ g}$

$$\rho(\text{lahus}) = \frac{241,0 \text{ g}}{250,0 \text{ cm}^3} = \mathbf{0,9640 \text{ g/cm}^3}$$

d) massiprotsent % (piiritus) = $\frac{60,3 \text{ g}}{241 \text{ g}} \cdot 100 = \mathbf{25,0}$

e) I variant:

$$m(\text{H}_2\text{O}) = 241,0 \text{ g} - 60,3 \text{ g} = 180,7 \text{ g}$$

$250,0 \text{ cm}^3$ (lahus) \Leftrightarrow $60,3 \text{ g}$ (piiritus)

$$m(\text{C}_2\text{H}_5\text{OH}) = 850 \text{ cm}^3 \text{ (lahus)} \cdot \frac{60,3 \text{ g (piiritus)}}{250,0 \text{ cm}^3 \text{ lahus}} = \mathbf{205 \text{ g}}$$

$250,0 \text{ cm}^3$ (lahus) \Leftrightarrow $180,7 \text{ g}$ (H_2O)

$$m(\text{H}_2\text{O}) = 850 \text{ cm}^3 \text{ (lahus)} \cdot \frac{180,7 \text{ g}(\text{H}_2\text{O})}{250,0 \text{ cm}^3(\text{lahus})} = 614,38 \text{ g} \sim \mathbf{614 \text{ g}}$$

II variant:

$$m(\text{lahus}) = 850 \text{ cm}^3 \cdot 0,9640 \text{ g/cm}^3 = 819,4 \sim \mathbf{819 \text{ g}}$$

$$m(\text{C}_2\text{H}_5\text{OH}) = 819 \text{ g} \cdot 0,250 = 204,75 \text{ g} \sim \mathbf{205 \text{ g}}$$

$$m(\text{H}_2\text{O}) = 819 \text{ g} \cdot 0,750 = 614,25 \text{ g} \sim \mathbf{614 \text{ g}}$$