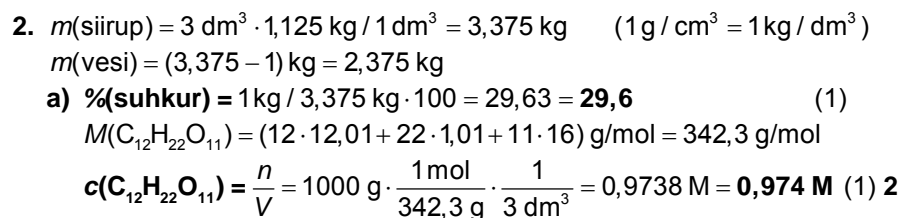
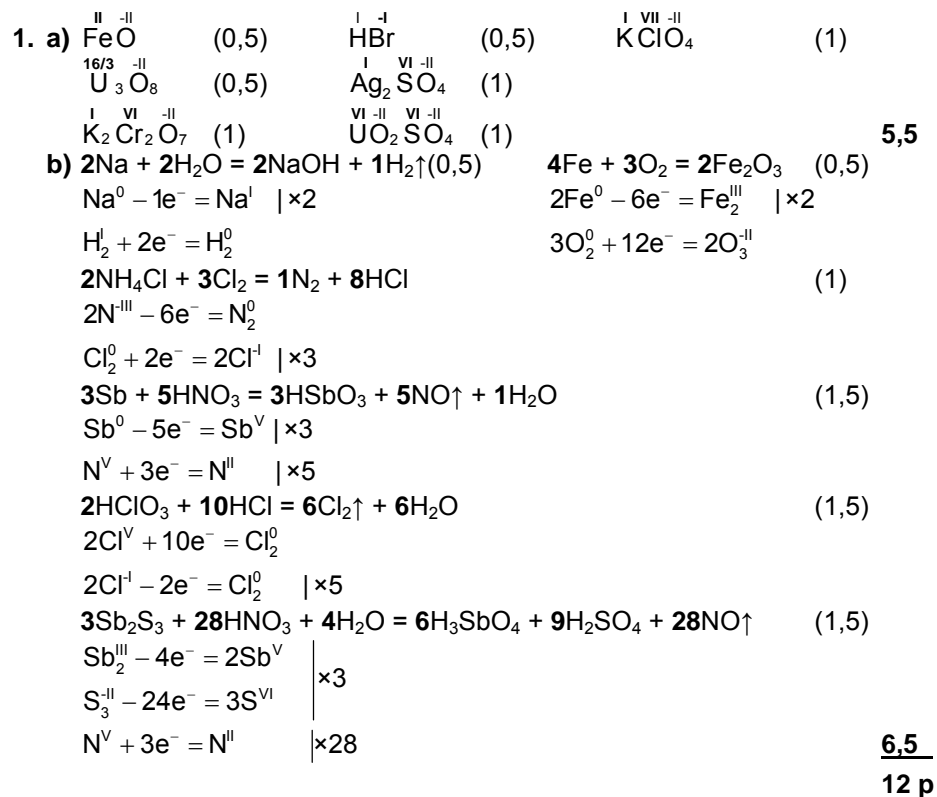


VIIIE KOOLI

(Nõo RG, Tartu HTG, Tartu MHG, Tartu Tamme G, Viljandi CRJG)

KOHTUMISE KEEMIAÜLESANNETE LAHENDUSED

Carl Robert Jakobsoni nimeline G., 8.–9. jaanuar 2009



v1 $V(\text{vesi}) = 2,375 \text{ kg} \cdot 1 \text{ dm}^3 / 0,998 \text{ kg} = \mathbf{2,38 \text{ dm}^3}$ **1**

v2 $m(65\% \text{ siirup}) = 1 \text{ kg} \cdot 100 / 65 = 1,538 \text{ kg}$

$V(65\% \text{ siirup}) = 1,538 \text{ kg} \cdot 1 \text{ dm}^3 / 1,32 \text{ kg} = \mathbf{1,17 \text{ dm}^3}$ (1)

$V(\text{vesi}) = (3,375 - 1,538) \text{ kg} \cdot 1 \text{ dm}^3 / 0,998 \text{ kg} = \mathbf{1,84 \text{ dm}^3}$ (1) **2**

v3 $m(10\% \text{ siirup}) = 1 \text{ kg} \cdot 100 / 10 = 10 \text{ kg}$

$V(10\% \text{ siirup}) = 10 \text{ kg} \cdot 1 \text{ dm}^3 / 1,04 \text{ kg} = \mathbf{9,62 \text{ dm}^3}$ (1)

$V(\text{vesi}) = (10 - 3,375) \cdot 1 \text{ dm}^3 / 0,998 \text{ kg} = \mathbf{6,64 \text{ dm}^3}$ (0,5) **1,5**

v4

$$\begin{cases} V_{10\%} \cdot \frac{1,04 \text{ kg}}{1 \text{ dm}^3} + V_{65\%} \cdot \frac{1,32 \text{ kg}}{1 \text{ dm}^3} = 3,375 \text{ kg} \Rightarrow V_{10\%} = 3,245 \text{ dm}^3 - 1,269V_{65\%} \\ V_{10\%} \cdot \frac{1,04 \text{ kg}}{1 \text{ dm}^3} \cdot 0,1 + V_{65\%} \cdot \frac{1,32 \text{ kg}}{1 \text{ dm}^3} \cdot 0,65 = 1 \text{ kg} \Rightarrow 0,104V_{10\%} + 0,858V_{65\%} = 1 \text{ dm}^3 \end{cases}$$

$(3,245 \text{ dm}^3 - 1,269V_{65\%}) \cdot 0,104 + 0,858V_{65\%} = 1 \text{ dm}^3$

$0,3375 \text{ dm}^3 - 0,132V_{65\%} + 0,858V_{65\%} = 1 \text{ dm}^3$

$0,726V_{65\%} = 0,6625 \text{ dm}^3$ $V_{65\%} = V(65\% \text{ siirup}) = \mathbf{0,91 \text{ dm}^3}$

$V_{10\%} = V(10\% \text{ siirup}) = 3,245 \text{ dm}^3 - 1,269 \cdot 0,913 \text{ dm}^3 = \mathbf{2,09 \text{ dm}^3}$ **3,5**

v5 Lisada 10,0 % siirupile suhkrut. (0,5)

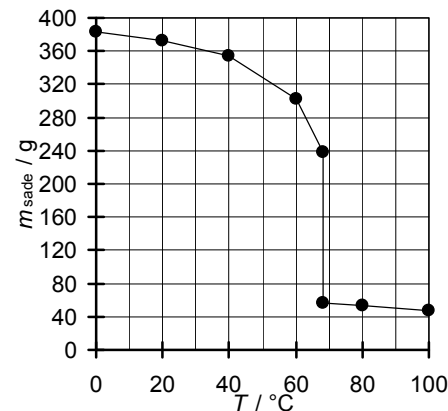
$m(10\% \text{ siirup}) = \frac{2,375 \text{ kg}}{100 - 10} \cdot 100 = 2,639 \text{ kg}$

$V(10\% \text{ siirup}) = 2,639 \text{ kg} \cdot 1 \text{ dm}^3 / 1,04 \text{ kg} = \mathbf{2,54 \text{ dm}^3}$ (1)

$m(\text{lisatav suhkur}) = (3,375 - 2,639) \text{ kg} = \mathbf{0,74 \text{ kg}}$ (0,5) **2**

12 p

3. a)



- b) $0 \leq T < 68,2^\circ\text{C}$ $\text{NaI} \cdot x\text{H}_2\text{O}$
 $68,2 < T \leq 100^\circ\text{C}$ NaI **1**
- c) $m(\text{NaI lahuses, } 68,21^\circ\text{C}) = 350 \text{ g} - 56,6 \text{ g} = 293,4 \text{ g}$
Lahustuvus(NaI, 68,21°C) = 293,4 g / 100 g H₂O **1**
- d) $m(\text{lahus, } 68,19^\circ\text{C}) = 350 \text{ g} + 100 \text{ g} - 238,2 \text{ g} = 211,8 \text{ g}$ (0,5)
 $Lahustuvus(\text{NaI, } 68,19^\circ\text{C}) = 293,4 \text{ g} = \frac{x}{211,8 \text{ g} - x} \cdot 100 \text{ g}$
 $m(\text{NaI lahuses, } 68,19^\circ\text{C}) = x = 158,0 \text{ g}$ (1,5)
 $m(\text{NaI sademes, } 68,19^\circ\text{C}) = 350 \text{ g} - 158 \text{ g} = 192,0 \text{ g}$ (0,5)
 $m(\text{vesi sademes, } 68,19^\circ\text{C}) = 238,2 \text{ g} - 192 \text{ g} = 46,2 \text{ g}$ (0,5) **3**
- e) $n(\text{NaI sademes, } 68,19^\circ\text{C}) = 192 \text{ g} \cdot \frac{1 \text{ mol}}{149,9 \text{ g}} = 1,281 \text{ mol}$
 $n(\text{vesi sademes, } 68,19^\circ\text{C}) = 46,2 \text{ g} \cdot \frac{1 \text{ mol}}{18,02 \text{ g}} = 2,564 \text{ mol}$
 $x = \frac{2,564 \text{ mol}}{1,281 \text{ mol}} = 2$ **NaI · 2H₂O** **2**
9 p

4. a) Rõhu tõstmine **ei nihuta** tasakaalu saaduste suunas, sest gaasilise ainete hulk ($\Delta n_g = 0$) reaktsiooni käigus ei muutu. **1**
- b) **Lähteainete suunas** **0,5**
- c) **Aeglustab** **0,5**
- d) Uuritav reaktsioon on endotermiline, seega temperatuuri tõstmisel nihkub tasakaal **saaduste s.o. endotermilise protsessi suunas** ($\Delta H > 0$). **1**
- e) **Kasvab** **0,5**
- f) **Väheneb** **0,5**
- g) **c(C₂H₆) ei muutu** **1**
- h) $K = \frac{[\text{C}_4\text{H}_{10}][\text{H}_2]}{[\text{C}_2\text{H}_6]^2}$ **1**
- i) $n(\text{C}_2\text{H}_6) = (1 - 0,221) \cdot 2,5 \text{ mol} = 1,948 \text{ mol} \approx 1,95 \text{ mol}$ (1)
 $n(\text{C}_4\text{H}_{10}) = n(\text{H}_2) = \frac{1}{2} \cdot 0,221 \cdot 2,5 \text{ mol} = 0,2673 \text{ mol} \approx 0,276 \text{ mol}$ (1)
 $K = \frac{(0,2763 \text{ mol})^2}{(1,948 \text{ mol})^2} = 0,0201$ (1) **3**
9 p

5. a) Ühend **X** on orgaanilise aine molekul, mis võib koosneda süsinikust, vesinikust ja hapnikust. **X – C_aH_bO_c**

$$n(\text{C}) = n(\text{CO}_2) = 19,5 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} = 0,871 \text{ mol} \quad (0,5)$$

$$n(\text{H}) = 2n(\text{H}_2\text{O}) = 2 \cdot 19,6 \text{ g} \cdot \frac{1 \text{ mol}}{18,02 \text{ g}} = 2,18 \text{ mol} \quad (0,5)$$

$$m(\text{O}) = 16,2 \text{ g} - 0,871 \text{ mol} \cdot \frac{12,01 \text{ g}}{1 \text{ mol}} - 2,18 \text{ mol} \cdot \frac{1,008 \text{ g}}{1 \text{ mol}} = 3,462 \text{ g}$$

$$n(\text{O}) = 3,462 \cdot \frac{1 \text{ mol}}{16 \text{ g}} = 0,216 \text{ mol} \quad (1)$$

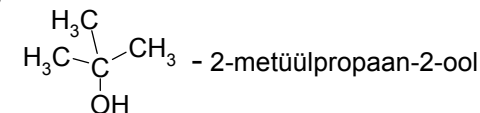
$$N(\text{C}) : N(\text{H}) : N(\text{O}) \quad 0,871 : 2,18 : 0,216 \quad 4 : 10 : 1$$

Aine **X** empiiriline valem on **C₄H₁₀O**. (0,5)

Kuna aine **X** reageerimisel naatriumiga eraldus vesinik, siis sisaldus molekulis üks või mitu –OH rühma. (0,5)

* Ühele –OH rühmale vastab kolm –CH₃ rühma. (0,5)

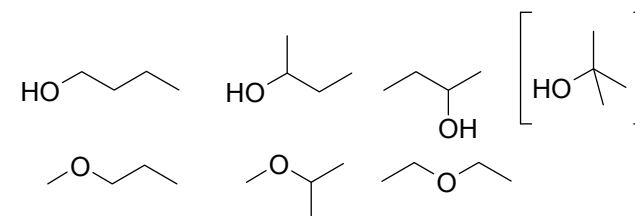
Nendele tingimustele vastab tert-butüülalkohol.



X – C₄H₁₀O (3·0,5) **5**

** Empiirilise valemiga täisarv kordsed (C₄H₁₀O)₂, (C₄H₁₀O)₃ jne ei sobi lahendiks.

b)



(6·0,5) **3**
8 p