

2001/2002 õa keemiaolümpiaadi lõppvooru ülesannete lahendused
9. klass

1. a) $M(\text{CuSO}_4 \cdot 5\text{H}_2\text{O}) = 250 \text{ g/mol}$
 $m(\text{CuSO}_4) = 5,0 \text{ kg} \cdot 0,040 = 0,20 \text{ kg}$
 $m(\text{CuSO}_4 \cdot 5\text{H}_2\text{O}) = 0,20 \text{ kg} (\text{CuSO}_4) \cdot \frac{250 (\text{CuSO}_4 \cdot 5\text{H}_2\text{O})}{160 (\text{CuSO}_4)} = 0,312 \text{ kg} \approx$
» 0,31 kg

$m(\text{H}_2\text{O}) = 5,0 \text{ kg} - 0,31 \text{ kg} = 4,69 \text{ kg} \approx \mathbf{4,7 \text{ kg}}$

b) $M(\text{FeSO}_4 \cdot 7\text{H}_2\text{O}) = 278 \text{ g/mol}$

Olgu $m(\text{FeSO}_4 \cdot 7\text{H}_2\text{O}) = x$

$$0,050 = \frac{9,0 \text{ kg} \cdot 0,030 + x \cdot \frac{152}{278}}{9,00 \text{ kg} + x}$$

$$0,45 \text{ kg} + 0,05 x = 0,27 \text{ kg} + x \cdot 0,547$$

$$0,18 \text{ kg} = 0,497x$$

$$x = 0,362 \text{ kg} \approx 0,36 \text{ kg}$$

$m(\text{FeSO}_4 \cdot 7\text{H}_2\text{O}) = \mathbf{0,36 \text{ kg}}$

2. a) i) **X** – Al, alumiinium

ii) Alumiinium on kaetud oksiidiga Al_2O_3 tiheda kihiga.

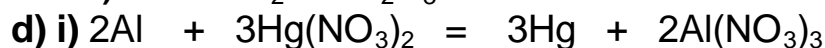
b) i) **Y** – Hg, elavhõbe

ii) Al_2O_3 kaitsekiht eemaldati

iii) Lusika pinnale moodustus alumiiniummalm (alumiiniumi lahus elavhõbedas).

iv) Tilgakesed **C** on metalliline elavhõbe.

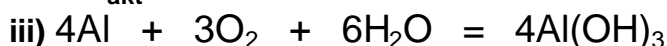
c) i) Alumiinium kattub tiheda Al_2O_3 kaitsekihiga.



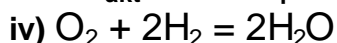
X **A** – elavhõbe(II)nitraat



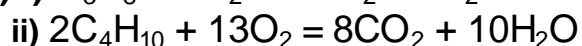
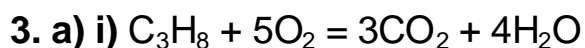
X_{akt} **D** – vesi **B** – alumiiniumhüdroksoid **F** – vesinik



X_{akt} **E** – hapnik **D** **B**



E **F** **D**



b) i) $n(\text{C}_3\text{H}_8) = 21,0 \cdot 10^3 \text{ g} \cdot \frac{1 \text{ mol}}{44,1 \text{ g}} = 4,76 \cdot 10^2 \text{ mol}$

$$\text{DH}(\text{C}_3\text{H}_8) = 4,76 \cdot 10^2 \text{ mol} \cdot (-2221 \text{ kJ/mol}) = -1,06 \cdot 10^6 \text{ kJ} = -1,06 \cdot 10^3 \text{ MJ} = \mathbf{-1,06 \text{ GJ}}$$

ii) $n(\text{C}_4\text{H}_{10}) = 21,0 \cdot 10^3 \text{ g} \cdot \frac{1 \text{ mol}}{58,1 \text{ g}} = 3,61 \cdot 10^2 \text{ mol}$

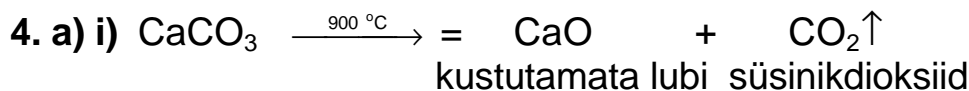
$$DH(C_4H_{10}) = 3,61 \cdot 10^2 \text{ mol} \cdot (-2,889 \cdot 10^3 \text{ kJ/mol}) = -1,04 \cdot 10^6 \text{ kJ} = -1,04 \cdot 10^3 \text{ MJ} = \mathbf{-1,04 \text{ GJ}}$$

c) Sama raha eest saadud energia hulk on antud juhul energiaühiku hinnaga pöördvõrdelises seoses.

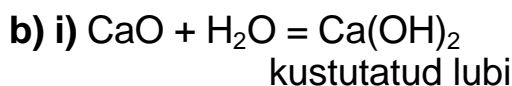
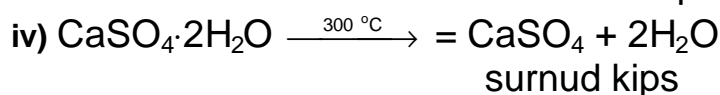
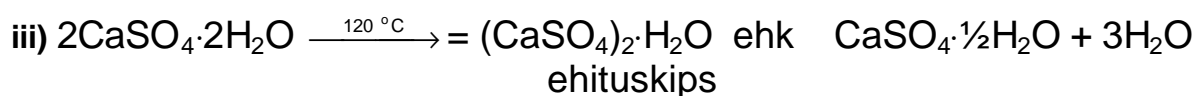
i) Propaani põletamisel saame sama energia väiksema raha eest. Propaan on odavam.

ii) Ühe ballonitäie ükskõik kumma gaasi põletamisel saame keskmiselt 1,05 GJ energiat (tarbija seisukohalt märk +).

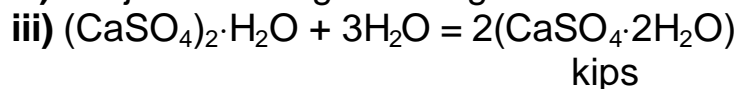
$$\text{Hind} = \frac{250 \text{ krooni}}{1,05 \text{ GJ}} = \mathbf{238 \text{ krooni/GJ}}$$



ii) 300 °C juures lubjakivi ei lagune.

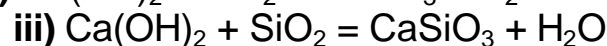
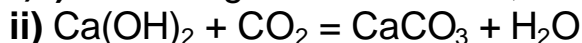


ii) Lubjakivi ei reageeri veega.

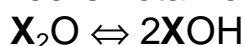


iv) Surnud kips ei reageeri veega.

c) i) Krohvisegu saadakse liiva, kustutatud lubja ja vee segamisel.



5. a) Leelismetalli oksidi **D** valem on X_2O .



D **B**

$$n(\text{XOH}) = \frac{2}{1} \cdot 0,100 \text{ mol} = 0,200 \text{ mol}$$

$$M(\text{XOH}) = \frac{8,00 \text{ g}}{0,200 \text{ mol}} = 40,0 \text{ g/mol}$$

$$M_r(\text{X}) = 40,0 - 16,0 - 1,0 = 23$$

X – Na, naatrium

B – NaOH, naatriumhüdroksoid

b) Gaas **C** saab olla CO_2 , sest see on kolmeatomiline, värvitu ja lõhnatu. CO_2 reageerimisel süsihappe normaalsoolaga **A** moodustub vesiniksool **E**. Vesiniksool **E** laguneb vee keemistemperatuurist madalamal temperatuuril normaalsoolaks **A**. CO_2 (**C**) juhtimisel NaOH (**B**) vesilahusesse moodustub alguses normaalsool **A** ja seejärel vesiniksool **E**.

c) i) $\overset{\text{A}}{\text{Na}_2\text{CO}_3} + \overset{\text{B}}{\text{H}_2\text{O}} = 2\overset{\text{B}}{\text{NaOH}} + \overset{\text{C}}{\text{CO}_2}$

