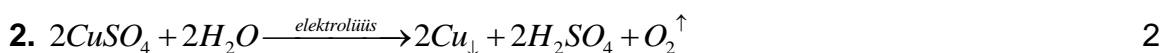
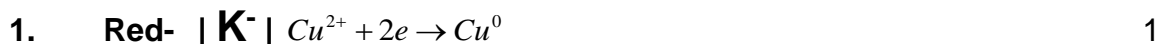


Ülesannete lahendused*

10. klass

Tallinna XIX koolinoorte keemiaolümpiaadi koolivoor 2018/ 2019 õ. a

1. (10)



3. $t = \frac{4 \times 96485 \text{ C/mol} \times 0,3000 \text{ g}}{2 \times 15,999 \text{ g/mol} \times 0,5 \text{ A} \times 3600 \text{ s}} \sim 2 \text{ tundi}$ 3

4. $2n(H_2SO_4) = n(O_2) = 2 \times \frac{0,3000 \text{ g}}{2 \times 15,999 \text{ g/mol}} \sim 0,019 \text{ mol}$ 1

5. $m(Cu) = \frac{63,546 \text{ g/mol} \times 0,5 \text{ A} \times 7200 \text{ s}}{2 \times 96485 \text{ C/mol}} \sim 1,2 \text{ g}$

2
10p

2. (10)

a. $P(N_2) = 1 \text{ atm} \times \frac{78\%}{100\%} = 0,78 \text{ atm}$ 0,5

$P(Ar) = 1 \text{ atm} \times \frac{1\%}{100\%} = 0,01 \text{ atm}$ 0,5

b. $P(N_2) = 300 \text{ atm} \times \frac{52\%}{52\% + 40\%} = 170 \text{ atm}$ 1

$P(Ar) = 300 \text{ atm} \times \frac{40\%}{52\% + 40\%} = 130 \text{ atm}$ 1

c. $V_{(ruum)} = V_{\text{õhk}} + V_{\text{INERGEN}}$ ja $V_{(ruum)} 0,125 = V_{\text{õhk}} \times 0,21$ 1

$V_{\text{õhk}} = V_{(ruum)} \times \frac{12,5\%}{21\%} = 0,595 \times V_{(ruum)}$ 1

$V = V_{\text{INERGEN}} = V_{(ruum)} \times \left(1 - \frac{12,5\%}{21\%}\right) = 0,405 \times V_{(ruum)}$ 1

$P(N_2) = 1 \text{ atm} \times \frac{78\% \times V_{\text{õhk}} + 52\% \times V}{100\% \times V_{(ruum)}} = 1 \text{ atm} \times (0,595 \times 0,78 + 0,405 \times 0,52) = 0,67 \text{ atm}$ 1

$P(Ar) = 1 \text{ atm} \times \frac{1\% \times V_{\text{õhk}} + 40\% \times V}{100\% \times V_{(ruum)}} = 1 \text{ atm} \times (0,595 \times 0,01 + 0,405 \times 0,40) = 0,17 \text{ atm}$ 1

$$d. V = 10 \times \frac{100\% \times 50 \text{ dm}^3}{52\% + 40\%} \times \frac{1 \text{ m}^3}{1000 \text{ dm}^3} \times \frac{300 \text{ atm}}{1 \text{ atm}} \sim 163 \text{ m}^3 \quad 1$$

$$S = \frac{163 \text{ m}^3}{0,405 \times 3 \text{ m}} \sim 134 \text{ m}^2$$

$\frac{1}{10p}$

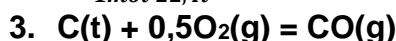
3. (10)

1. eksotermiline (0,5), reaktsiooni entalpia(muut) on negatiivse väärtusega

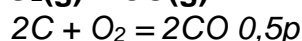
0,5

$$2. \frac{-127,9 \text{ kJ} \cdot 1 \text{ mol} \cdot 1 \text{ l}}{1 \text{ mol} \cdot 22,4 \text{ l}} = -5,71 \text{ kJ}$$

1



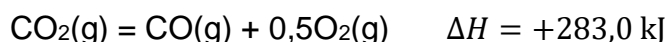
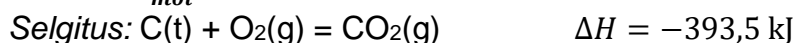
1



$$4. \Delta H = -393,5 \frac{\text{kJ}}{\text{mol}} \cdot 1 \text{ mol} + 283,0 \frac{\text{kJ}}{\text{mol}} \cdot 1 \text{ mol} = -110,5 \text{ kJ}$$

$$\Delta H_f[\text{CO}] = -110,5 \frac{\text{kJ}}{\text{mol}}$$

1

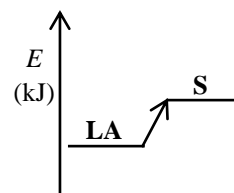


$$5. \text{i) } \Delta H = \left[(-110,5) \frac{\text{kJ}}{\text{mol}} \cdot 1 \text{ mol} + (-59,8) \frac{\text{kJ}}{\text{mol}} \cdot 1 \text{ mol} \right] - \left[(-635,1) \frac{\text{kJ}}{\text{mol}} \cdot 1 \text{ mol} \right] = 464,8 \text{ kJ}$$

1

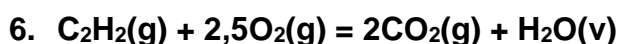
ii) endotermiline

0,5

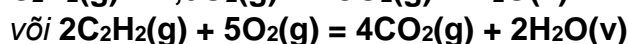


iii) energiadiagramm, milles saaduste energianivoo on kõrgem kui lähteainetel

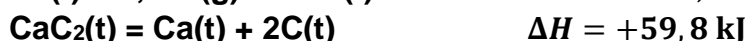
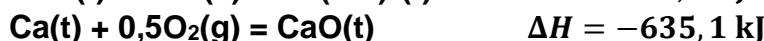
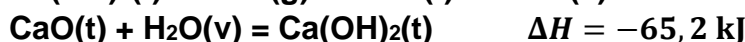
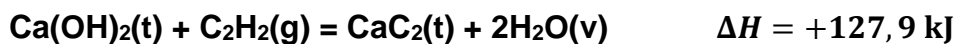
0,5



1



7.



$$\Delta H = 127,9 \text{ kJ} + (-65,2) \text{ kJ} + (-635,1) \text{ kJ} + 59,8 \text{ kJ} + 2 \cdot (-393,5) \text{ kJ} = -1299,6 \text{ kJ}$$

$$\Delta H_c[\text{C}_2\text{H}_2] = -1299,6 \frac{\text{kJ}}{\text{mol}}$$

$\frac{3}{10p}$

Täielikult õige lahendus annab 3p.

Kui vastus on esitatud 2 mol etüüni põlemise kohta (-2599,2 kJ/mol), siis max 2p.

Kui arvestamata on jäänud ühte ainet või kordajat iseloomustav suurus, siis max 2p.

Kui arvestamata on jäänud kahte ainet või ühte ainet ja kordajat iseloomustav suurus, siis max 1p. Kui ΔH väärtus on positiivne, siis 0p.

4. (10)

1. i) $\text{Al}_2\text{O}_3 + 2\text{NaOH} + 3\text{H}_2\text{O} \rightarrow 2\text{Na}[\text{Al}(\text{OH})_4]$ 1
ii) $\text{SiO}_2 + 2\text{NaOH} + 2\text{H}_2\text{O} \rightarrow \text{Na}_2[\text{Si}(\text{OH})_6]$
või $\text{SiO}_2 + 2\text{NaOH} = \text{Na}_2\text{SiO}_3 + \text{H}_2\text{O}$ 0,5
iii) $\text{Na}[\text{Al}(\text{OH})_4] \rightarrow \text{Al}(\text{OH})_3\downarrow + \text{NaOH}$ 0,5
iv) $2\text{Al}(\text{OH})_3 \rightarrow \text{Al}_2\text{O}_3 + 3\text{H}_2\text{O}$ 0,5
2. Fe_2O_3 ja TiO_2 ei reageeri, eraldatakse filtreerimisega 0,5
3. Kõrge rõhk on vajalik selleks, et hoida vesilahust vedelas olekus
140 - 240 °C juures 0,5
4. Krüoliit - Na_3AlF_6 . 0,5
naatriumheksafluoroaluminaat 0,5
5. katoodprotsess: $2\text{Al}^{3+} + 6e \rightarrow 2\text{Al}$, alumiinium redutseerub katoodil 0,5
anoodprotsess: $3\text{O}^{2-} - 6e \rightarrow 3/2 \text{O}_2$ 0,5
üldkujul : $2\text{Al}_2\text{O}_3 \rightarrow 4\text{Al} + 3\text{O}_2$
6. Anoodil eralduv hapnik reageerib süsinikelektroodiga tekitades CO ja CO_2 .
 $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$, $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ 0,5
7. Suur elektrikulu ja vajadus uute anoodide järele. 1
8. $m(\text{boksiit}) = \frac{1000\text{kg}}{0,48 \times 0,87} \sim 2395 \text{ kg} \sim 2,4 \text{ tonni}$ 1
9. $\text{Al}_2\text{O}_3 \rightarrow 2\text{Al}$
 $m(\text{Al}_2\text{O}_3) = \frac{1\text{Mg} \times 102 \frac{\text{Mg}}{\text{Mmol}}}{27 \frac{\text{Mg}}{\text{Mmol}} \times 2 \times 0,9} \sim 2,10\text{Mg}(\text{tonni})$ 1
10. $m(\text{boksiit}) = 2,39 \times 2,10 \sim 5 \text{ tonni}$

(1)
10p

* Keemiaolümpiaadi koolivooru komisjon võib iseseisvalt hinnata võimalikke alternatiivseid lahendusvariante.