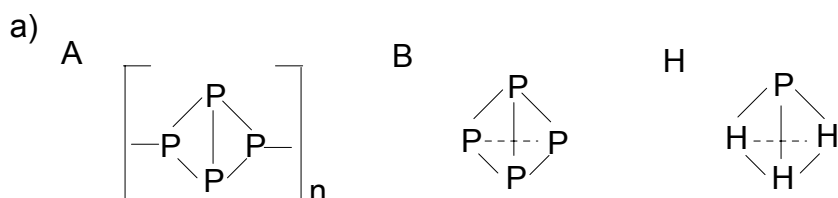


1997/98. õa 10. klassi vabariikliku vooru ülesannete lahendused

1. a) A - Cr_2O_3 (kroom(III)oksiid); B - $\text{Na}_2\text{Cr}_2\text{O}_7$ (naatriumdikromaat) C - Na_2SO_4 (naatriumsulfaat); D - NaOH (naatriumhüdrosiid); E - NaCrO_2 (naatriumkromit); F - $\text{Cr}(\text{OH})_3$ (kroom(III)hüdrosiid); K = $\text{Na}_3[\text{Cr}(\text{OH})_6]$ (naatriumheksahüdrosükromaat(III)); G - $\text{CrO}(\text{OH})$ (kroom(III)hüdrosüksoiid); H - Cr (kroom); I - Na_2CrO_4 (naatriumkromaat).

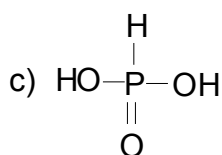
- b) 1) $\text{Na}_2\text{Cr}_2\text{O}_7 + \text{S} \rightarrow \text{Cr}_2\text{O}_3 + \text{Na}_2\text{SO}_4$
 2) $\text{Cr}_2\text{O}_3 + 2\text{NaOH} \rightarrow 2\text{NaCrO}_2 + \text{H}_2\text{O}$
 3) $\text{NaCrO}_2 + 2\text{H}_2\text{O} + 2\text{NaOH} \rightarrow \text{Na}_3[\text{Cr}(\text{OH})_6]$
 4) $\text{Na}_3[\text{Cr}(\text{OH})_6] + 3\text{H}^+ \rightarrow 3\text{Na}^+ + \text{Cr}(\text{OH})_3 \downarrow + 3\text{H}_2\text{O}$
 5) $\text{Cr}(\text{OH})_3 \rightarrow \text{CrO}(\text{OH}) + \text{H}_2\text{O}$
 6) $2\text{CrO}(\text{OH}) \xrightarrow{150^\circ\text{C}} \text{Cr}_2\text{O}_3 + \text{H}_2\text{O}$
 7) $\text{Cr}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Cr}$
 8) $2\text{Cr} + 2\text{Na}_2\text{CO}_3 + 3\text{O}_2 \rightarrow 2\text{Na}_2\text{CrO}_4 + 2\text{CO}_2$

2.



- b) aine C: $M(\text{P}_4\text{O}_{10}) = 284 \text{ g/mol}$; aine F: $M(\text{P}_4\text{O}_6) = 220 \text{ g/mol}$

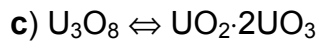
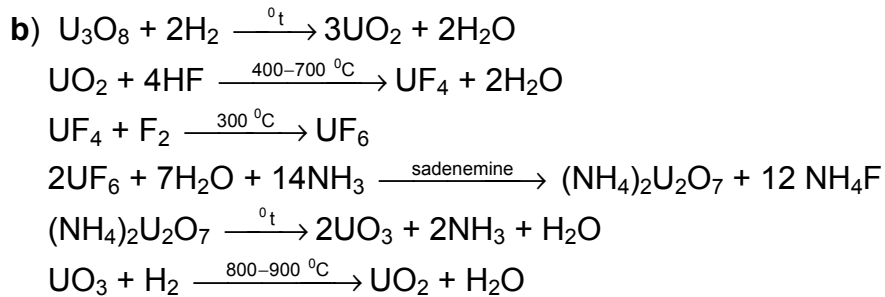
$$\frac{284}{220} = 1,29$$



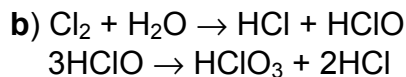
- d) 1) $4\text{P} + 5\text{O}_2 \rightarrow \text{P}_4\text{O}_{10}$
 2) $\text{P}_4\text{O}_{10} + 2\text{H}_2\text{O} \rightarrow 4\text{HPO}_3$
 3) $\text{P}_4\text{O}_{10} + 6\text{H}_2\text{O} \rightarrow 4\text{H}_3\text{PO}_4$
 4) $\text{P}_4 + 3\text{O}_2 \rightarrow \text{P}_4\text{O}_6$
 5) $\text{P}_4\text{O}_6 + 6\text{H}_2\text{O} \xrightarrow{\text{madal } ^\circ\text{t}} 4\text{H}_3\text{PO}_3$
 6) $\text{P}_4\text{O}_6 + 6\text{H}_2\text{O} \xrightarrow{\text{korge } ^\circ\text{t}} 3\text{H}_3\text{PO}_4 + \text{PH}_3$

- e) A - P (punane fosfor); B - P_4 ehk P (valge fosfor); C - P_4O_{10} (tetrafosfordekaoksiid); D - HPO_3 (metafosforhape); E - H_3PO_4 (ortofosforhape); F - P_4O_6 (tetrafosforheksaoksiid); G - H_3PO_3 (fosforishape); H - PH_3 (fosfiin ehk fosfaan).

3. a) $^{16/3}U_3O_8$ (triuraanoktaoksiid); $^{IV}UO_2$ (uraandioksiid); $^{IV}UF_4$ (uraan(IV)fluoriid);
 $^{VI}UF_6$ (uraan(VI)fluoriid); $^{VI}(NH_4)_2U_2O_7$ (ammooniumdiuranaat(VI); $^{VI}UO_3$ (uraantrioksiid).



4. a) katoodil $2H_2O + 2e \rightarrow H_2\uparrow + 2OH^-$
 anoodil $2Cl^- - 2e \rightarrow Cl_2$



$$m(KClO_3) = \frac{1}{3} \cdot \frac{1}{2} \cdot \frac{0,35\text{ A} \cdot 3600\text{ s}}{96500\text{ A} \cdot \text{s}} \cdot 123\text{ g/mol} = 0,27\text{ g}$$

5. a) $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$
 $3Ni + 8HNO_3 \rightarrow 3Ni(NO_3)_2 + 2NO + 4H_2O$
 $8Al + 30HNO_3 \rightarrow 8Al(NO_3)_3 + 3NH_4NO_3 + H_2O$
 $Cu(NO_3)_2 + 2NaOH \rightarrow Cu(OH)_2\downarrow + 2NaNO_3$
 $Ni(NO_3)_2 + 2NaOH \rightarrow Ni(OH)_2\downarrow + 2NaNO_3$
 $Al(NO_3)_3 + 6NaOH \rightarrow Na_3[Al(OH)_6] + 3NaNO_3$ või
 $Al(NO_3)_3 + 4NaOH \rightarrow Na[Al(OH)_4] + 3NaNO_3$
 $2Ni(NO_3)_2 + Br_2 + 6NaOH \rightarrow 2Ni(OH)_3\downarrow + 2NaBr + 4NaNO_3$

b) $m[Cu(OH)_2] + m[Ni(OH)_2] = 21,310\text{ g}$
 $m[Cu(OH)_2] + m[Ni(OH)_3] = 21,395\text{ g}$

$$n(Ni) = \Delta n(OH^-) = (21,395 - 21,310)\text{ g} \cdot \frac{1\text{ mol}}{17\text{ g}} = 0,0050\text{ mol}$$

$$\text{c) } m(\text{Ni}) = 0,0050 \text{ mol} \cdot \frac{2,92}{14,60} \cdot 58,7 \text{ g/mol} = 0,0587 \text{ g} \approx 0,059 \text{ g}$$

$$m[\text{Ni}(\text{OH})_2] = 0,0050 \text{ mol} \cdot 92,7 \text{ g/mol} = 0,4635 \text{ g}$$

$$m[\text{Cu}(\text{OH})_2] = 21,310 - 0,4635 = 20,846 \text{ g}$$

$$m(\text{Cu}) = \frac{1}{1} \cdot 20,846 \text{ g} \cdot \frac{63,54}{97,55} \cdot \frac{2,92}{14,60} = 2,716 \text{ g} \approx 2,72 \text{ g}$$

$$m(\text{Al}) = 2,92 \text{ g} - 0,059 \text{ g} - 2,716 \text{ g} = 0,145 \text{ g}$$

$$\text{d) } \%(\text{Ni}) = \frac{0,059}{2,92} \cdot 100 = \approx 2$$

$$\%(\text{Cu}) = \frac{2,72}{2,92} \cdot 100 = \approx 93$$

$$\%(\text{Al}) = \frac{0,145}{2,92} \cdot 100 = \approx 5$$

$$\text{6. a) } n(\text{CH}_4) = 3,60 \text{ MJ} \cdot \frac{1}{0,300} \cdot \frac{1 \text{ mol}}{802 \text{ kJ}} \cdot \frac{1000 \text{ kJ}}{1 \text{ MJ}} \approx 15,0 \text{ mol}$$

Märkus: Elektri tootmine tarbib energiat, mistõttu märk on +.

$$\text{b) } m(\text{CO}_2) = \frac{1}{1} \cdot 15,0 \text{ mol} \cdot 44,0 \text{ g/mol} = 658 \text{ g} = 0,658 \text{ kg}$$

$$\text{c) } n(\text{maagaas}) = 14,96 \text{ mol} \cdot \frac{100}{99} = 15,11 \text{ mol}$$

$$V(\text{maagaas suvel}) = 15,11 \text{ mol} \cdot 22,4 \text{ dm}^3 / \text{mol} \cdot \frac{293}{273} = 363,2 \text{ dm}^3 \approx \approx 0,363 \text{ m}^3$$

$$V(\text{maagaas talvel}) = 15,11 \text{ mol} \cdot 22,4 \text{ dm}^3 / \text{mol} \cdot \frac{253}{273} = 313,7 \text{ dm}^3 \approx \approx 0,314 \text{ m}^3$$