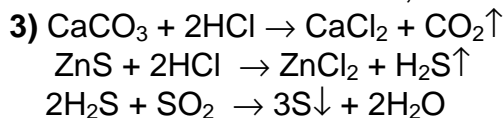


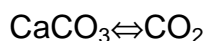
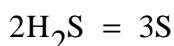
1996/97 õa keemiaolümpiaadi piirkondliku vooru ülesannete lahendused

10. klass

1. 1) Aine **A** on ZnS, tsinksulfiid; aine **B** on S, väävel.
 2) HCl-l ja CaCO₃ vahelisel reaktsioonil tekib SO₂, kuid happelise oksiidina ta ei saa reageerida teise happelise oksiidi - SO₂-ga. S on SO₂ suhtes redutseerunud olekus. Järelikult peab tekkima veel teine gaas, mis on SO₂ suhtes redutseerijaks. Selleks on H₂S, sest ZnS on valge, vees lahustumatu Zn ühend, millest tugev hape HCl nõrga happe (H₂S) välja tõrjub.



4) $\text{ZnS} \Leftrightarrow \text{H}_2\text{S} \quad m(\text{ZnS}) = \frac{1}{1} \cdot \frac{2}{3} \cdot \frac{19,2 \text{ g}}{32 \text{ g/mol}} \cdot 97,4 \text{ g/mol} = \mathbf{39,0 \text{ g}}$



$n(\text{CO}_2) = 13,44 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} - \frac{2}{3} \cdot 19,2 \text{ g} \cdot \frac{1 \text{ mol}}{32 \text{ g}} = 0,6 \text{ mol} - 0,4 \text{ mol} = \mathbf{0,2 \text{ mol}}$

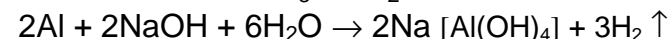
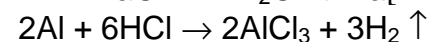
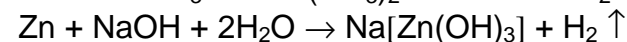
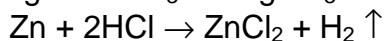
$m(\text{CaCO}_3) = 0,2 \text{ mol} \cdot 100 \text{ g/mol} = \mathbf{20 \text{ g}}$

5) $\%(\text{ZnS}) = \frac{39,0}{80,0} \cdot 100 = 48,75 \approx \mathbf{48,8\%}$

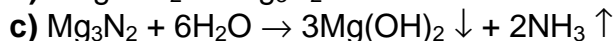
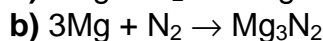
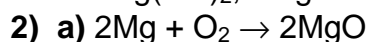
$\%(\text{CaCO}_3) = \frac{20,0}{80,0} \cdot 100 = \mathbf{25,0\%}$

$\%(\text{NaCl}) = 100 - 48,8 - 25,0 = \mathbf{26,2\%}$

2. 1) I on hõbe (Ag), II on tsink (Zn) ja III on alumiinium (Al)



3. 1) **A** - MgO, magneesiumoksiid; **B** - Mg₃N₂, magneesiumnitriid;
C - Mg(OH)₂, magneesiumhüdroksiid; **D** - NH₃, ammoniaak.



3) xg

$\text{Mg} \Leftrightarrow \text{MgO} \quad m(\text{MgO}) = \frac{1}{1} xg \cdot \frac{1 \text{ mol}}{24,31g} \cdot 40,31g/\text{mol} = 1,658 \cdot x \text{ g}$

1,00 - xg

$3\text{Mg} \Leftrightarrow \text{Mg}_3\text{N}_2 \quad m(\text{Mg}_3\text{N}_2) = \frac{1}{3} (1-x)g \cdot \frac{1 \text{ mol}}{24,31g} \cdot 100,94 \text{ g/mol} = (1-x) \cdot 1,384 \text{ g}$

4) $1,658 x + 1,384 - 1,384 x = 1,555$

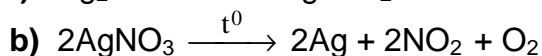
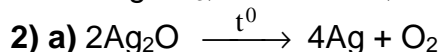
$x = 0,6241 \text{ g}$

$m(\text{MgO}) = 1,658 \cdot 0,6241 \text{ g} = 1,034 \text{ g}$

$m(\text{Mg}_3\text{N}_2) = 1,384 \cdot (1 - 0,6241)g = 0,5202 \text{ g}$

Märkus: Tähistades $m(\text{MgO}) = x$ ja $m(\text{Mg}_3\text{N}_2) = 1,555-x$ võime koostada võrrandi
 $x/40,31 + 3(1,555-x)/100 \cdot 94 = 1,000/24,31$

4. 1) **X** - Ag, hõbe, **A** - AgCl - hõbekloriid, **B** - Ag₂O, hõbeoksiid, **C** - O₂, hapnik,
D - AgNO₃, hõbenitraat, **E** - NO₂, lämmastikdioksiid



3) a) $144 : 4 = 36$ $36 \cdot 3 = 108$ AgCl

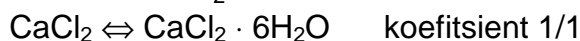
b) $232 : 29 = 8$ $8 \cdot 2 = 16$
 $8 \cdot 27 = 216$ Ag₂O
 $216 : 2 = 108$

5. 1) $2\text{HCl} + \text{CaCO}_3 \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$

2) $n(\text{HCl}) = \frac{V \text{cm}^3 \cdot 1,05 \text{g/cm}^3 \cdot 0,100}{36,5 \text{g/mol}} = 0,0288 \text{ mol}$

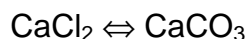
$n(\text{CaCO}_3) = \frac{\text{mg}}{100 \text{g/mol}} = 0,0100 \text{ mol}$.

$n(\text{CaCl}_2 \cdot 6\text{H}_2\text{O}) = \frac{100 \text{g}}{219 \text{g/mol}} = 0,457 \text{ mol}$.



$V(\text{HCl lahus}) \cdot 1,05 \text{g/cm}^3 \cdot 0,100 = \frac{2}{1} \cdot \frac{1}{1} \cdot 0,457 \text{ mol} \cdot 36,5 \text{g/mol}$

$V(\text{HCl lahus}) = 33,36 \text{ g} \cdot \frac{1 \text{cm}^3}{1,05 \text{ g}} \cdot \frac{1}{0,100} = \sim 318 \text{ cm}^3$



$m(\text{CaCO}_3) = \frac{1}{1} \cdot \frac{1}{1} \cdot 0,457 \text{ mol} \cdot 100 \text{ g/mol} = 45,7 \text{ g}$.

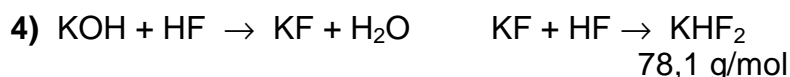
Märkus: Loeb õige vastus. Lahenduskäik pole oluline.

6. 1) HF reageerib klaasis oleva räni(dioksiidi)ga

2) Kahealuselise happe H₂F₂ vesiniksool KHF₂.

3) a) $n(\text{KOH}) = 100 \text{ cm}^3 \cdot 1,18 \text{ g/cm}^3 \cdot 0,205 \cdot 1 \text{ mol}/56,1 \text{ g} = 0,431 \text{ mol}$

b) $\text{KOH} \Leftrightarrow \text{HCl}$ $n(\text{KOH}) = \frac{1}{1} \cdot 0,431 = 0,431 \text{ mol}$.



$\text{KF} \Leftrightarrow \text{KHF}_2$ koef 1/1 $m(\text{KHF}_2) = \frac{1}{1} \cdot \frac{1}{1} \cdot 0,431 \text{ mol} \cdot 78,1 \text{ g/mol} = \mathbf{33,7 \text{ g}}$