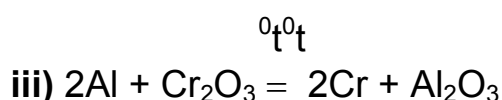
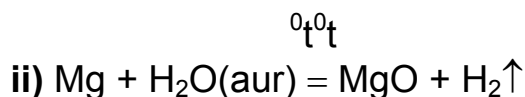
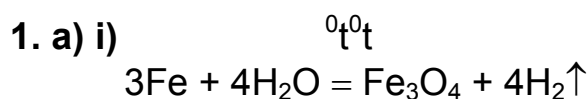
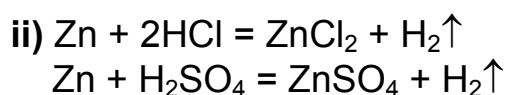


**2002/2003 õa keemiaolümpiaadi piirkonnavooru  
ülesannete lahendused  
9. klass**



b) i) Lämmastikhappega reageerimisel ei moodustu vesinik.



c) **Au**, kuld

d) 
$$\text{proov}(\text{Ag}) = \frac{100}{125} \cdot 1000 \text{‰} = \mathbf{800\text{‰}}$$

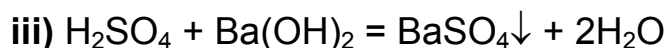
e) Üks mool ( $6,02 \cdot 10^{23}$  tk) a.m.ü.-sid moodustavad massi 1 gramm.  
 $6,02 \cdot 10^{23} \text{ a.m.ü.} \cdot 1,66 \cdot 10^{-24} \text{ g/a.m.ü.} = 0,999 \text{ g} \approx 1,00 \text{ g}$

f) 
$$V_m(\text{Fe}) = 56 \text{ g/mol} \cdot \frac{1 \text{ cm}^3}{7,9 \text{ g}} = 7,088 \text{ cm}^3/\text{mol} \approx \mathbf{7,1 \text{ cm}^3/\text{mol}}$$

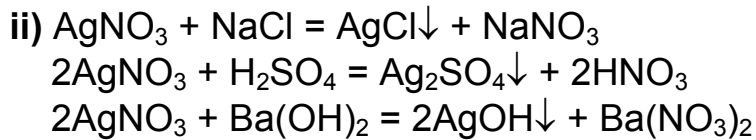
g) Temperatuuri tõustes gaasi molaarruumala **suureneb**, sest gaas paisub.

2. a) i) Happelahus muudab indikaatorpaberi punaseks, leeliselahus siniseks

ii) **A** – **H<sub>2</sub>SO<sub>4</sub>** lahus  
**B** – **Ba(OH)<sub>2</sub>** lahus



b) i) **AgNO<sub>3</sub>**, hõbenitraat



c) **NaCl**

d) **KNO<sub>3</sub>**

3. a)  $D_{\text{õhk}}(\text{NH}_3) = \frac{17 \text{ g/mol}}{29 \text{ g/mol}} = 0,586 \approx \mathbf{0,59}$

b)  $V(\text{NH}_3) = 550 \text{ cm}^3 \cdot 0,682 \text{ g/cm}^3 \cdot \frac{1 \text{ mol}}{17 \text{ g}} \cdot 24 \text{ dm}^3 / \text{mol} = 529 \text{ dm}^3 \approx \mathbf{530 \text{ dm}^3}$

c)  $V(\text{labor}) = 6,0 \text{ m} \times 4,0 \text{ m} \times 3,0 \text{ m} = 72 \text{ m}^3$   
 $m(\text{NH}_3) = 550 \text{ cm}^3 \cdot 0,682 \text{ g/cm}^3 = 375,1 \text{ g}$   
 $m(\text{NH}_3/\text{m}^3) = \frac{375,1 \text{ g}}{72 \text{ m}^3} \cdot \frac{1000 \text{ mg}}{\text{g}} \approx 5200 \text{ mg/m}^3$

$\frac{5200 \text{ mg/m}^3}{36 \text{ mg/m}^3} = 144 \approx \mathbf{140 \text{ korda}}$

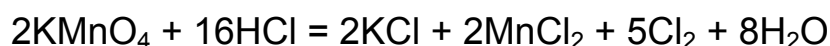
d)  $V(\text{H}_2\text{O}) = 375,1 \text{ g} \cdot \frac{1}{5,0 \%} \cdot 95 \% \cdot \frac{1 \text{ liiter}}{1000 \text{ g}} = 7,13 \text{ l} \approx \mathbf{7,1 \text{ l}}$

4. a)  $\%(\text{karbamiid}) = \frac{108}{108 + 100} \cdot 100 = \mathbf{51,9}$

b)  $0,0050 = \frac{m(\text{lahus}) \cdot 0,519}{m(\text{lahus}) + 1000 \text{ g}}$   
 $0,005m(\text{lahus}) + 5,0 \text{ g} = 0,519 m(\text{lahus})$   
 $m(\text{lahus}) = \frac{5,0 \text{ g}}{0,514} = 9,73 \text{ g} \approx \mathbf{9,7 \text{ g}}$

c)  $\%(\text{karbamiid}) = \frac{1,0 \text{ l} \cdot 1,40 \text{ kg/l} \cdot 0,519}{1,0 \text{ l} \cdot 1,40 \text{ kg/l} + 15 \text{ l} \cdot 1,00 \text{ kg/l}} \cdot 100 = 4,43 \approx \mathbf{4,4}$

5. a) Vesiniku aatomid on lähteainetes ainult vesinikkloriidis ja hapniku aatomid on lähteainetes ainult kaaliumpermanganaadis. Nii tuleb HCl ette koefitsient 16 ja KMnO<sub>4</sub> ette koefitsient 2. Puuduolevad koefitsiendid saadusainete ees leitakse lähteainete koefitsientide järgi.



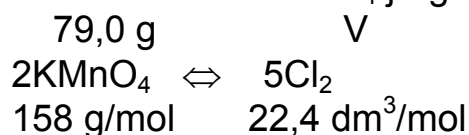
b) i)  $n(\text{KMnO}_4) = 79,0 \text{ g} \cdot \frac{1 \text{ mol}}{158 \text{ g}} = \mathbf{0,500 \text{ mol}}$

ii)  $n(\text{HCl}) = 1000 \text{ g} \cdot 0,365 \cdot \frac{1 \text{ mol}}{36,5 \text{ g}} = \mathbf{10,0 \text{ mol}}$



$n(\text{KMnO}_4 \text{ kulub}) = \frac{2}{16} \cdot 10,0 \text{ mol} = \mathbf{1,25 \text{ mol}}$

d)  $\text{KMnO}_4$  on vähem, kui kogu  $\text{HCl}$  jaoks kulub. Seega  $\text{HCl}$  on liias. Arvutada tuleb  $\text{KMnO}_4$  järgi.



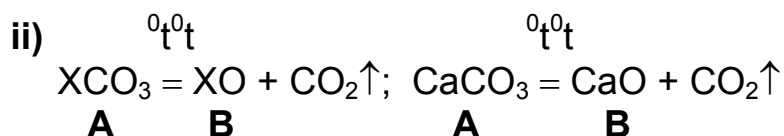
$V(\text{Cl}_2) = \frac{5}{2} \cdot 79,0 \text{ g} \cdot \frac{1 \text{ mol}}{158 \text{ g}} \cdot 22,4 \text{ dm}^3 / \text{mol} = \mathbf{28,0 \text{ dm}^3}$

Kloori ruumala saame leida ka varem arvutatud  $\text{KMnO}_4$  hulga järgi.

$V(\text{Cl}_2) = \frac{5}{2} \cdot 0,500 \text{ mol} \cdot 22,4 \text{ dm}^3 / \text{mol} = \mathbf{28,0 \text{ dm}^3}$

6. a) Liitainete lahustamisel annavad leelise lahuse leelismetallide ja leelismuldmetallide hüdroksiidid ja oksiidid.

b) Leelismuldmetallide karbonaadid on vees lahustumatud.



d) i)  $m(\text{CO}_2) = 1,190 \text{ g} - 0,667 \text{ g} = 0,523 \text{ g}$

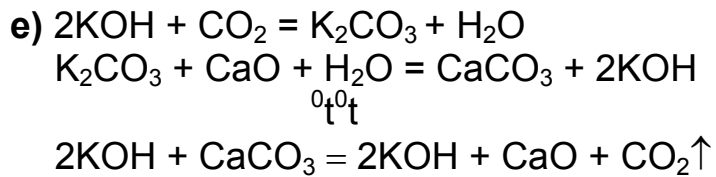
Reaktsioonis c) ii) on osalevate ainete moolide suhe 1 : 1 : 1

$M(\text{B}) = 44 \text{ g/mol} \cdot \frac{1}{0,523 \text{ g}} \cdot 0,667 \text{ g} = 56,1 \text{ g/mol}$

$M(\text{CaO}) = \mathbf{56,1 \text{ g/mol}}$ . Sama molaarmass peab olema ka teisel lahustatud ainel

ii) Aine **B** – **CaO**, kaltsiumoksiid on esimene lahustatud aine, sest esimene lahustatav aine saadi teistkordselt moodustunud  $\text{CaCO}_3$  kuumutamisel.

iii)  $\text{CaO}$  lisamisel filtraadile **F** moodustus  $\text{CaCO}_3$ . Filtraat **F** peab sisaldama ekvivalentse koguse karbonaatioone, mis said tekkida leelismetalli hüdroksiidi lahuses ekvivalentse koguse  $\text{CO}_2$  neeldumisel. teine lahustatud aine on **KOH**.  $M(\text{KOH}) = 56,1 \text{ g/mol}$ .



f)  $2\text{KOH} \Leftrightarrow \text{CaO}$   
Et molaarmassid on võrdsed, siis

$$m(\text{KOH}) = \frac{2}{1} \cdot 0,667 \approx 1,33 \text{ g}$$