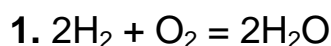


**2000/2001 õa keemiaolümpiaadi piirkondliku vooru
ülesannete lahendused
12. klass**



Temperatuuril 120 °C on nii lähte- kui saadusaine(d) gaasid. Reaktsiooni käigus toimunud ruumala muutus vastab reageerinud hapniku ruumalale

$$\Delta V = 2V(\text{H}_2\text{O}) - V(\text{O}_2) - 2V(\text{H}_2) = -V(\text{O}_2)$$

$$\Delta V = 800 \text{ cm}^3 - 1000 \text{ cm}^3 = -200 \text{ cm}^3$$

Kolm võimalikku varianti on:

- a) mõlemat lähteainet on ekvivalentne kogus,
- b) kogu hapnik reageerib ära ja vesinikku on liias,
- c) kogu vesinik reageerib ära ja hapnikku on liias.

a) $V(\text{H}_2) = 1000 \text{ cm}^3 \cdot \frac{2}{3} = 666,7 \text{ cm}^3$

$$V(\text{O}_2) = 1000 \text{ cm}^3 \cdot \frac{1}{3} = 333,3 \text{ cm}^3$$

Ekvivalentsete hulkade korral kogu vesinik ja kogu hapnik reageerivad täielikult.

$\Delta V = -V(\text{O}_2) = -333,3 \text{ cm}^3$, mis pole ülesande tingimustega ($\Delta V = -200 \text{ cm}^3$) kooskõlas.

b) $\Delta V = -V(\text{O}_2) = -200 \text{ cm}^3$ $V(\text{O}_2) = 200 \text{ cm}^3$

$$V(\text{H}_2) = 1000 \text{ cm}^3 - 200 \text{ cm}^3 = 800 \text{ cm}^3$$

$$\% \text{vol}(\text{O}_2) = 200 \cdot \frac{100}{1000} = 20,0$$

$$\% \text{vol}(\text{H}_2) = 100 - 20,0 = 80,0$$

c) $V(\text{H}_2) = 2(-\Delta V) = 2 \cdot [-(-200 \text{ cm}^3)] = 400 \text{ cm}^3$

$$V(\text{O}_2) = 1000 \text{ cm}^3 - 400 \text{ cm}^3 = 600 \text{ cm}^3$$

$$\% \text{vol}(\text{H}_2) = 400 \cdot \frac{100}{1000} = 40,0$$

$$\% \text{vol}(\text{O}_2) = 100 - 40,0 = 60,0$$

Lähteandmeid rahuldab kaks erinevat lähteainete koostist: **b)** ja **c)**

_____.
9 p

2. a) $m(\text{kuum lahus}) = 118,8 \text{ g} + 25,7 \text{ g} = 144,5 \text{ g}$

$$m(\text{A, kuum lahus}) = 144,5 \text{ g} \cdot 0,422 = 61,0 \text{ g}$$

$$m(\text{jahe lahus}) = 144,5 \text{ g} - 100,0 \text{ g} = 44,5 \text{ g}$$

$$m(\text{A, jahe lahus}) = 44,5 \text{ g} \cdot 0,215 = 9,568 \text{ g} \approx \mathbf{9,6 \text{ g}}$$

4

b) $m(\text{A, 100 g-s aines B}) = 61,0 \text{ g} - 9,6 \text{ g} = 51,4 \text{ g}$

$$m(\text{H}_2\text{O, 100 g-s aines B}) = 100,0 - 51,4 \text{ g} = 48,6 \text{ g}$$

$$m(\Sigma \text{H}_2\text{O, aines B}) = 1 \text{ mol} \cdot \frac{48,6 \text{ g}}{0,150 \text{ mol}} = 324 \text{ g}$$

$$n(\text{H}_2\text{O, moolis B}) = 324 \text{ g} \cdot \frac{1 \text{ mol}}{18 \text{ g}} = \mathbf{18 \text{ mol}}$$

$$N(\text{H}_2\text{O, molekulis B}) = \mathbf{18 \text{ molekuli}}$$

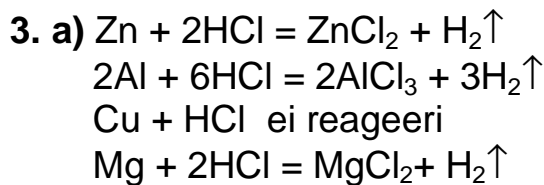
4

$$\text{c) } m(\mathbf{A}) = \frac{51,4 \text{ g}}{0,150 \text{ mol}} = 342,7 \text{ g/mol} \approx \mathbf{343 \text{ g/mol}}$$

$$m(\mathbf{B}) = \frac{100,0 \text{ g}}{0,150 \text{ mol}} = 666,7 \text{ g/mol} \approx \mathbf{667 \text{ g/mol}}$$

$\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$ – alumiiniumsulfaat-vesi (1/18)

3
11 p



2

$$\text{b) } \frac{2}{5}\text{Zn} \Leftrightarrow V(\text{H}_2) = \frac{1}{1} \cdot 7,00 \text{ g} \cdot \frac{2}{5} \cdot \frac{1 \text{ mol}}{65,3 \text{ g}} \cdot 22,4 \text{ dm}^3 / \text{mol} = 0,960 \text{ dm}^3$$

$$\frac{3}{5}\text{Al} \Leftrightarrow V(\text{H}_2) = \frac{3}{2} \cdot 7,00 \text{ g} \cdot \frac{3}{5} \cdot \frac{1 \text{ mol}}{27,0 \text{ g}} \cdot 22,4 \text{ dm}^3 / \text{mol} = 5,23 \text{ dm}^3$$

$$\frac{3}{5}\text{Mg} \Leftrightarrow V(\text{H}_2) = \frac{1}{1} \cdot 7,00 \text{ g} \cdot \frac{3}{5} \cdot \frac{1 \text{ mol}}{24,3 \text{ g}} \cdot 22,4 \text{ dm}^3 / \text{mol} = 3,87 \text{ dm}^3$$

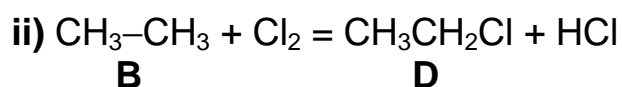
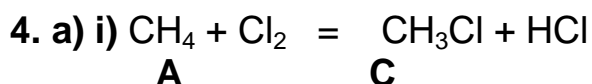
Sulam Zn-Al ei sobi, kuna juba alumiinium tõrjub välja rohkem vesinikku;

Cu-Zn ei sobi, sest isegi 7 g tsingi tõrjub välja vähem vesinikku;

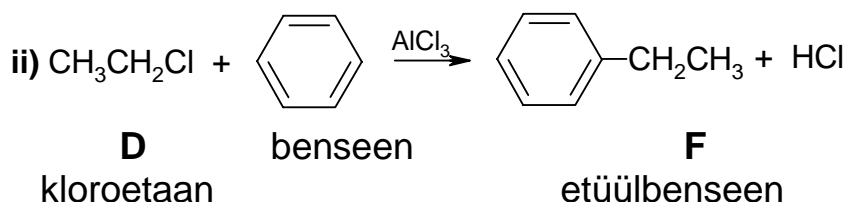
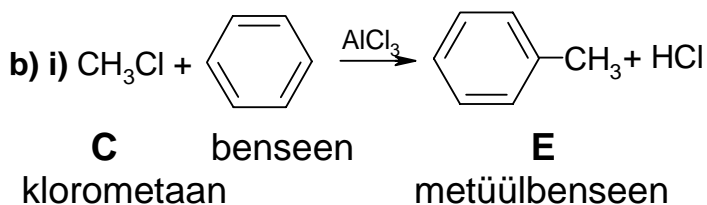
$\text{Zn-Mg } V(\text{H}_2) = 0,96 \text{ l} + 3,87 \text{ l} = \mathbf{4,83 \text{ l}}$ sobib;

Mg-Al ei sobi, sest juba alumiinium tõrjub välja rohkem vesinikku.

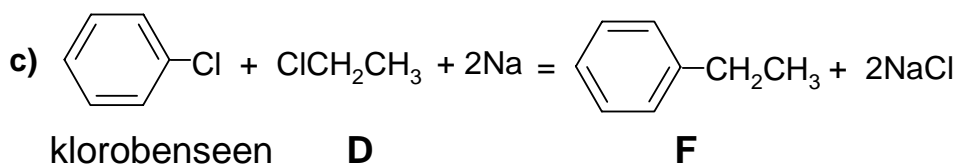
9
11 p



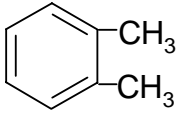
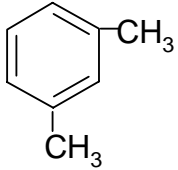
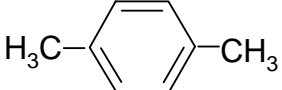
1



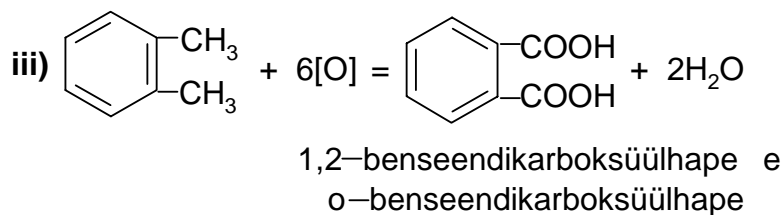
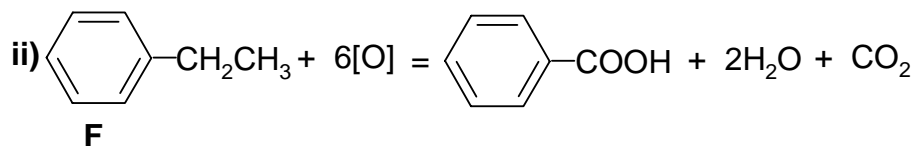
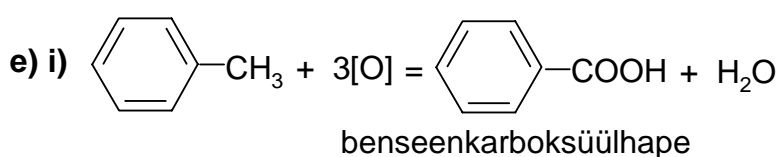
2



1,5

- d) i)  **G** 1,2-dimetüülbenseen
o-ksüleen e ortodimetüülbenseen
- ii)  **H** 1,3-dimetüülbenseen
m-ksüleen e metadimetüülbenseen
- iii)  **I** 1,4-dimetüülbenseen
p-ksüleen e paradimetüülbenseen

1,5

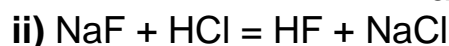


(1+1+2) 4
10 p



A kaaliummetasilikaat

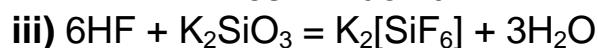
1,5



B

vesinikfluoriid

0,5



C kaaliumheksafluorosilikaat

2



D kaaliumfluoriid

B

E ortoränihape

2

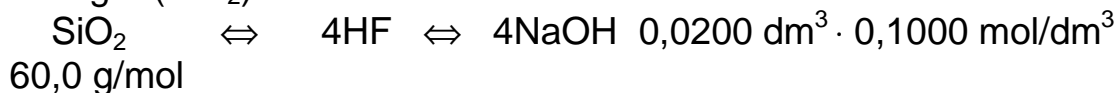


0,5

b) KCl vähendab vähelahustuva kompleksühendi **C** lahustumist.

1

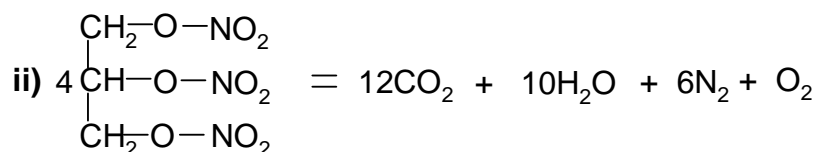
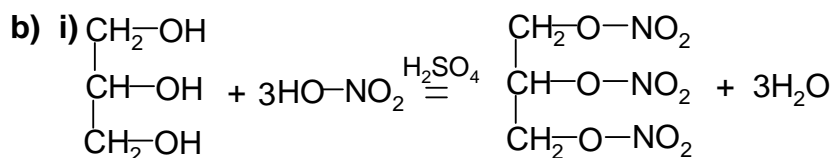
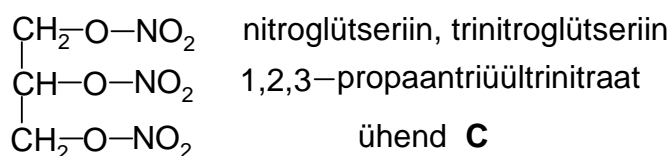
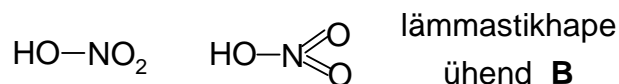
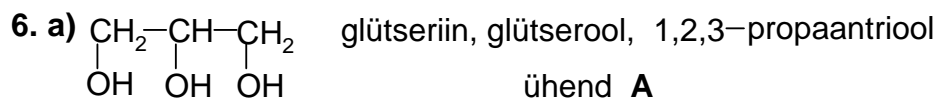
c) $0,0600 \text{ g} \cdot \%(\text{SiO}_2)/100$



$$\%(\text{SiO}_2) = \frac{1}{4} \cdot 0,0200 \text{ dm}^3 \cdot 0,1000 \text{ mol/dm}^3 \cdot 60,0 \text{ g/mol} \cdot 100 \cdot \frac{1}{0,0600 \text{ g}} = \mathbf{50,0}$$

2,5

10 p



c) Ühe mooli ühendi **C** oksüdeerimisel tekib 1,5 mooli lämmastikku ja 0,25 mooli hapnikku.

a) (2+1+2) 5
b) (1+1,5) 2,5
c) (1+ 0,5) 1,5
9 p