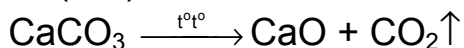
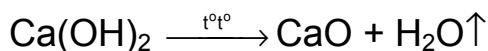
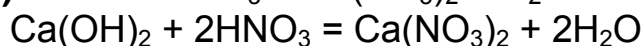


**2000/2001 õa keemiaolümpiaadi piirkondliku vooru
ülesannete lahendused
10. klass**

1. a) i) CaO kuumutamisel ei muutu



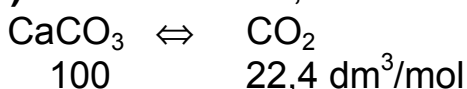
ii) $\text{CaO} + 2\text{HNO}_3 = \text{Ca(NO}_3)_2 + \text{H}_2\text{O}$



5

b) $\Delta m[\text{Ca(OH)}_2 + \text{CaCO}_3] = 7,1 \text{ g}$

i) ja ii) $m \quad 2,24 \text{ dm}^3$



$$n(\text{CaCO}_3) = n(\text{CO}_2) = 2,24 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} = \mathbf{0,100 \text{ mol}}$$

$$m(\text{CaCO}_3) = 0,100 \text{ mol} \cdot \frac{100 \text{ g}}{1 \text{ mol}} = \mathbf{10,0 \text{ g}}$$

$$m(\text{CO}_2) = 0,100 \text{ mol} \cdot 44,0 \text{ g/mol} = 4,40 \text{ g}$$

$$m(\text{H}_2\text{O, kaltsiumhüdroksiidist}) = 7,1 \text{ g} - 4,40 \text{ g} = 2,7 \text{ g}$$

$$n[\text{Ca(OH)}_2] = n(\text{H}_2\text{O}) = 2,7 \text{ g} \cdot \frac{1 \text{ mol}}{18,0 \text{ g}} = \mathbf{0,15 \text{ mol}}$$

$$m[\text{Ca(OH)}_2] = 0,15 \text{ mol} \cdot 74,1 \text{ g/mol} = 11,1 \text{ g} \approx \mathbf{11 \text{ g}}$$

$$m(\text{CaO}) = 23,9 \text{ g} - 10,0 \text{ g} - 11,1 \text{ g} = \mathbf{2,8 \text{ g}}$$

$$n(\text{CaO}) = 2,8 \text{ g} \cdot \frac{1 \text{ mol}}{56,1 \text{ g}} \approx \mathbf{0,050 \text{ mol}}$$

iii) $\text{CaO} : \text{Ca(OH)}_2 : \text{CaCO}_3 = 0,050 : 0,15 : 0,100 \Rightarrow \mathbf{1 : 3 : 2}$

6.
11 p

2. a) **A** – FeSO_4 , raud(II)sulfaat;

B – Fe(OH)_2 , raud(II)hüdroksiid;

C – Na_2SO_4 , naatriumsulfaat;

D – BaCl_2 , baariumkloriid;

E – BaSO_4 , baariumsulfaat;

F – Fe_3O_4 , raud(II)diraud(III)oksiid;

G – FeCl_2 , raud(II)kloriid;

H – FeCl_3 , raud(III)kloriid.

4

b) i) $\text{FeSO}_4 + 2\text{NaOH} = \text{Fe(OH)}_2\downarrow + \text{Na}_2\text{SO}_4$

A

B

C

ii) $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 = \text{BaSO}_4\downarrow + 2\text{NaCl}$

C

D

E

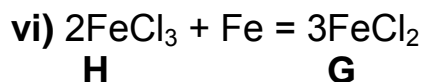
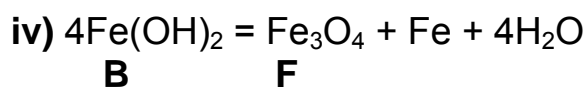
iii) $\text{FeSO}_4 + \text{BaCl}_2 = \text{BaSO}_4\downarrow + \text{FeCl}_2$

A

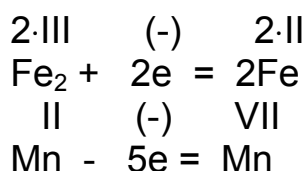
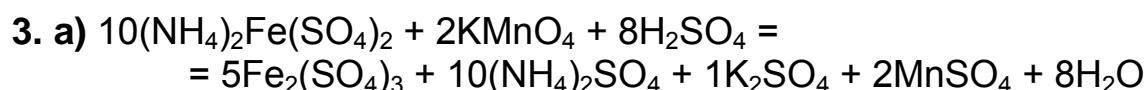
D

E

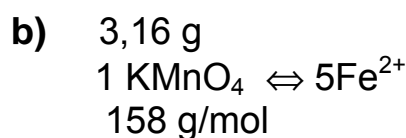
G



6.
10 p



4



$$n(\text{Fe}^{2+}) = \frac{5}{1} \cdot 3,16 \text{ g} \cdot \frac{1 \text{ mol}}{158 \text{ g}} = \mathbf{0,100 \text{ mol}}$$

2

c) $M[(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2] = 392 \text{ g/mol} - 6 \cdot 18,0 \text{ g/mol} = 284 \text{ g/mol}$
 $m[(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2] = 0,100 \text{ mol} \cdot 284 \text{ g/mol} = \mathbf{28,4 \text{ g}}$

2

d) $m(\text{Mohri sool}) = 0,100 \text{ mol} \cdot 392 \text{ g/mol} = 39,2 \text{ g}$
 $m(\text{H}_2\text{O, Mohri soola lahustamiseks}) = 958 \text{ g} - 39,2 \text{ g} \approx \mathbf{919 \text{ g}}$

2.
10 p

4. a) i) $\%(\text{HCl, A}) = \frac{1,00 \text{ mol} \cdot 36,5 \text{ g/mol}}{36,5 \text{ g} + 100 \text{ g}} \cdot 100 = \mathbf{26,7}$

ii) $\%(\text{HCl, B}) = \frac{36,08 \text{ cm}^3 \cdot 1,133 \text{ g/cm}^3 \cdot 0,267}{200,0 \text{ cm}^3 \cdot 1,036 \text{ g/cm}^3} \cdot 100 = \mathbf{5,27}$

4

b) i) $m(\text{H}_2\text{O}) = 200,0 \text{ cm}^3 \cdot 1,036 \text{ g/cm}^3 - 36,08 \text{ cm}^3 \cdot 1,133 \text{ g/cm}^3 =$
 $= 207,2 \text{ g} - 40,88 \text{ g} = \mathbf{166,3 \text{ g}}$

ii) $\Sigma V = 166,3 \text{ g} \cdot 1 \text{ cm}^3 / 0,9962 \text{ g} + 36,08 \text{ cm}^3 = 203,0 \text{ cm}^3$
 $\Delta V = 200,0 \text{ cm}^3 - 203,0 \text{ cm}^3 = \mathbf{-3,0 \text{ cm}^3}$

4.
8 p

5. a) i) Väga väikene tihedus ($0,0900 \text{ g/dm}^3$) saab olla ainult gaasilisel ainel

$$M(\text{aine B}) = 0,0900 \text{ g/dm}^3 \cdot 22,4 \text{ dm}^3/\text{mol} \approx \mathbf{2,02 \text{ g/mol}}$$

ii) Aine B on vesinik (H_2)

2

b) i) Aine C molekulis on kaks liitiumi aatomit, mis moodustab molekulmassist (molaarmassist) 13,62%.

$$M(\text{aine C}) = 2 \cdot 6,94 \text{ g} \cdot \frac{100}{13,62} \cdot \frac{1}{\text{mol}} = 101,9 \text{ g/mol} \approx \mathbf{102 \text{ g/mol}}$$

ii) Aines A, võrreldes ainega B, puuduvad liitiumi aatomid. Nende asemel on vesiniku aatomid.

$$M(\text{aine A}) = (101,9 \text{ g} - 2 \cdot 6,94 \text{ g} + 2,02 \text{ g}) \cdot \frac{1}{\text{mol}} \approx \mathbf{90,0 \text{ g/mol}}$$

3

c)

$$\text{CO}_2 \Leftrightarrow \text{C}$$
$$n(\text{C}) = \frac{1}{1} \cdot \frac{90,0}{9,0} \cdot 4,48 \text{ dm}^3 \cdot \frac{1 \text{ mol}}{22,4 \text{ dm}^3} = 2,0 \text{ mol}$$

$$\text{H}_2\text{O} \Leftrightarrow 2\text{H}$$
$$n(\text{H}) = \frac{2}{1} \cdot \frac{90,0}{9,0} \cdot 1,8 \text{ g} \cdot \frac{1 \text{ mol}}{18 \text{ g}} = 2,0 \text{ mol}$$

$$\text{CO}_2 \Leftrightarrow 2\text{O} \quad \text{H}_2\text{O} \Leftrightarrow \text{O} \quad \text{O}_2 \Leftrightarrow 2\text{O}$$
$$n(\text{O}) = \frac{2}{1} \cdot 2,0 \text{ mol} + \frac{1}{1} \cdot 1,0 \text{ mol} - \frac{2}{1} \cdot 0,50 \text{ mol} = 4,0 \text{ mol}$$

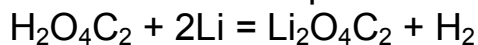
lisatud hapnik

i) $\text{H}_2\text{O}_4\text{C}_2$

4

d) i) Et liitium tõrjub ainst A vesiniku välja ja moodustub sool, siis on tegemist happega.

See on etaandihape ehk oblikhape (COOH)₂.



2
11 p

6. a) i) $\text{Ca}^{2+} + \text{SO}_4^{2-} = \text{CaSO}_4$ (ei reageeri hapetega)

ii) Kollane leegi värvus viitab naatriumi olemasolule.

Na_2SO_4 (kolm elementi)

$M(\text{Na}_2\text{SO}_4) = 142 \text{ g/mol}$

4

b) i) $m(\text{B}) \cdot 0,441 \Leftrightarrow m(\text{A})$

$$M(\text{aine B}) = 142 \text{ g/mol} \cdot \frac{100}{44,1} = \mathbf{322 \text{ g/mol}}$$

ii) $m(\text{B}) \cdot (1 - 0,559) \Leftrightarrow m(\text{A})$

$$M(\text{aine B}) = 142 \text{ g/mol} \cdot \frac{100}{100 - 55,9} = 322 \text{ g/mol}$$

3

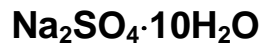
Märkus: 100% on tervik. Arv 100 on lõpmatult täpne.

c) i) Aine **B** on kristallhüdraat.

Vees sisalduv vesinik on veevaba soolaga võrreldes neljandaks elemendiks.

$$m(\text{H}_2\text{O}) = 322 \text{ g} \cdot 0,559 = 180 \text{ g}$$

$$n(\text{H}_2\text{O}) = 180 \text{ g} \cdot \frac{1 \text{ mol}}{18 \text{ g}} = 10 \text{ mol}$$



ii) Naatriumsulfaat-vesi(1/10).

Десятиводный кристаллогидрат сульфата натрия.

3
10 p