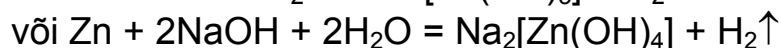
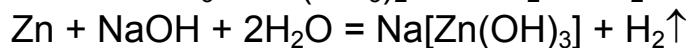
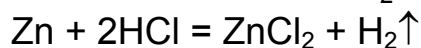
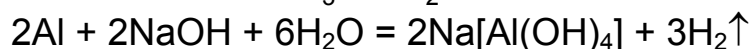
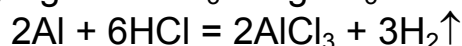


2004/2005 õa keemiaolümpiaadi lõppvooru ülesannete lahendused  
10. klass

1. a) I – Ag, hõbe; II – Al, alumiinium, III – Zn, tsink



c) Hõbe on passiivne metall. Al ja Zn on kaetud oksiidide tiheda kaitsekihiga, vastavalt  $\text{Al}_2\text{O}_3$  ja  $\text{ZnO}$ .

2. a) i) Aine D saab olla elemendi A oksiid.

$$M_r(\text{A}) = 16 \cdot \frac{47}{53} = 14,1$$

Pole tõenäoline, et ainukesteks saadusaineteks on NO ja  $\text{NH}_3$ .

$$M_r(\text{A}) = 32 \cdot \frac{47}{53} = 28,3 \quad \text{A} - \text{Si, räni}$$

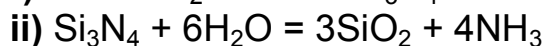
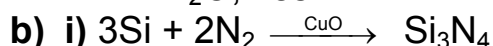
D –  $\text{SiO}_2$ , ränidioksiid (liiv)

ii) A – Si, räni

B –  $\text{N}_2$ , lämmastik

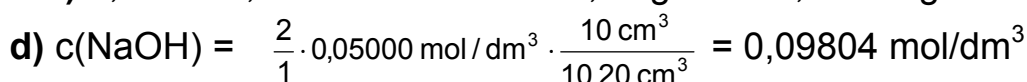
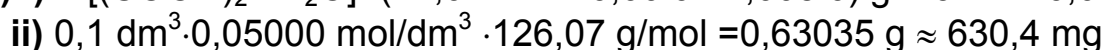
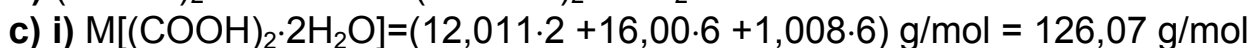
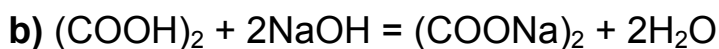
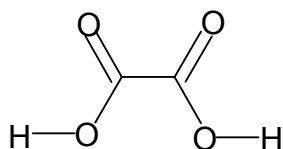
C –  $\text{Si}_3\text{N}_4$ , räninitriid

E –  $\text{H}_2\text{O}$ , vesi



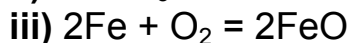
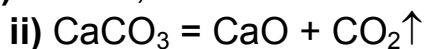
c) Räni saamise protsess on väga kulukas.

3. a)



$$e) \%(\text{NaOH}) = \frac{0,09804 \text{ mol/dm}^3 \cdot 1 \text{ dm}^3 \cdot 40,0 \text{ g/mol}}{5,2 \text{ cm}^3 \cdot 1,54 \text{ g/cm}^3} \cdot 100 \approx 49$$

4. a) i) **A** – Fe, raud



b) i) **R** – Fe sool; **M** – Ca sool

ii)  $M(\mathbf{X}) = 55,8 \cdot \frac{36,5}{63,5} = 32,1$

iii)  $M(\mathbf{X}) = 40,1 \cdot \frac{44,4}{55,6} = 32,0$

c) **Y** – P, fosfor

**Q** – C, süsinik

**Z** – Si, räni

**X** – S, väävel

**R** – FeS, raud(II)sulfiid

**B** – FeO, raud(II)oksiid

**D** –  $\text{P}_4\text{O}_{10}$ , tetrafosfordekaoksiid

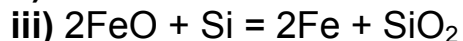
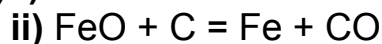
**E** – CO, süsinikmonooksiid

**G** –  $\text{SiO}_2$ , ränidioksiid

**J** – CaO, kaltsiumoksiid

**L** –  $\text{CO}_2$ , süsinikdioksiid

**M** – CaS, kaltsiumsulfiid



ii) **Y** – Cl, kloor

**Q** –  $\text{AgNO}_3$ , hõbenitraat

**Z** – AgCl, hõbekloriid

b) 100 g kristallhüdraadis on  $n(\text{O}) = 100 \text{ g} \cdot 0,36 \cdot \frac{1 \text{ mol}}{16 \text{ g}} = 2,25 \text{ mol}$

$$n(\text{H}) = 100 \text{ g} \cdot 0,045 \cdot \frac{1 \text{ mol}}{1,0 \text{ g}} = 4,5 \text{ mol}$$

c) Kuna ülesandes on öeldud, et vesinik kuulub ainult veemolekulide koostisse, saame  $n(\text{H}_2\text{O}) = \frac{1}{2} n(\text{H}) = 2,25 \text{ mol}$ . Saadud vee hulk on võrdne hapniku hulgaga. Kuna  $n(\text{H}_2\text{O}) = n(\text{O})$ , siis sellest järeldub, et hapnik kuulub samuti ainult neutraalsete veemolekulide koostisse ja aniooni koostises hapnikku pole. Seega moodustub anioon ainult elemendist **Y** ( $\text{Cl}^-$ ).

Kuna metall **X** on kolmelaenguline, siis kristallhüdraadi brutovalem peab olema  $\text{XCl}_3 \cdot n\text{H}_2\text{O}$ . Siit

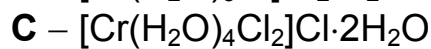
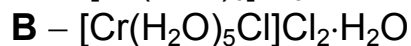
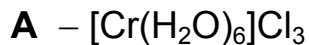
$$n(\mathbf{X}) = \frac{n(\text{Cl})}{3} = 100 \text{ g} \cdot 0,40 \cdot \frac{1 \text{ mol}}{35,5} \cdot \frac{1}{3} = 0,3756 \text{ mol}$$

$$M(\mathbf{X}) = 100 \text{ g} \cdot 0,195 \cdot \frac{1}{0,3756} = 51,9$$

**X** – Cr, kroom

Kristallhüdraadi brutovalem on:  $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$

d) Metalli koordinatsiooniarv on kuus. Hõbedaioonidega astuvad reaktsiooni ainult välissfääri ioonid. Seega peavad isomeeride valemid olema järgmised:



6. a) **A** –  $\text{H}_2\text{O}$ , vesi, divesinikmonooksiid

**B** –  $\text{CO}_2$ , süsinikdioksiid

**Z** –  $\text{O}_2$ , hapnik

**C** –  $\text{HCl}$ , vesinikkloriid

**D** –  $\text{H}_2$ , vesinik

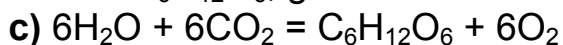
**E** –  $\text{Cl}_2$ , kloor

b)  $n(\text{C}) = 180 \text{ g} \cdot 0,4 \cdot \frac{1 \text{ mol}}{12 \text{ g}} = 6 \text{ mol}$

$$n(\text{H}) = 180 \text{ g} \cdot 0,067 \cdot \frac{1 \text{ mol}}{1 \text{ g}} = 12 \text{ mol}$$

$$n(\text{O}) = 180 \text{ g} \cdot 0,533 \cdot \frac{1 \text{ mol}}{16 \text{ g}} = 6 \text{ mol}$$

**Q** –  $\text{C}_6\text{H}_{12}\text{O}_6$ , glükoos



d)  $m(\text{H}_2\text{O}) = 1,00 \cdot 10^{25} \cdot \frac{1 \text{ mol}}{6,02 \cdot 10^{23}} \cdot 18 \text{ g/mol} = 299 \text{ g}$

$$V(\text{lahus}) = V(\text{H}_2\text{O}) = 299 \text{ g} \cdot \frac{1 \text{ dm}^3}{1000 \text{ g}} = 0,299 \text{ dm}^3$$

$$n(\text{HCl}) = 1,5 \cdot 10^{21} \cdot \frac{1 \text{ mol}}{6,02 \cdot 10^{23}} = 0,00249 \text{ mol}$$

$$c(\text{HCl}) = \frac{0,00249 \text{ mol}}{0,299 \text{ dm}^3} = 0,0083 \text{ mol/dm}^3 \text{ (kaks tüvenumbrit)}$$