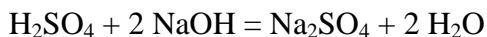


**Prirodno-matematički fakultet**  
**Društvo matematičara i fizičara Crne Gore**

**OLIMPIJADA ZNANJA 2017.**

**Rješenja zadataka iz HEMIJE**  
**za II razred srednje škole**

1.  $n(\text{H}_2\text{SO}_4) = c(\text{H}_2\text{SO}_4) \cdot V_1 = 3,6 \cdot 10^{-3} \text{ mol}$   
 $n(\text{NaOH}) = c(\text{NaOH}) \cdot V_2 = 1,2 \cdot 10^{-2} \text{ mol}$



$$\begin{aligned} n_p(\text{NaOH}) &= 2 n_p(\text{H}_2\text{SO}_4) = 2 n(\text{H}_2\text{SO}_4) = 7,2 \cdot 10^{-3} \text{ mol} \\ n_1(\text{NaOH}) &= n(\text{NaOH}) - n_p(\text{NaOH}) = 5,2 \cdot 10^{-3} \text{ mol} \\ c_1(\text{NaOH}) &= n_1(\text{NaOH}) / V = n_1(\text{NaOH}) / (V_1 + V_2) = 0,074 \text{ mol/dm}^3 \\ \text{NaOH} &\rightarrow \text{Na}^+ + \text{OH}^- \\ [\text{OH}^-] &= z \cdot c_1(\text{NaOH}) = 0,074 \text{ mol/dm}^3 \\ \text{pOH} &= -\log [\text{OH}^-]_1 = 1,13 \\ \text{pH} &= 14 - 1,13 = \mathbf{12,87} \end{aligned}$$

2.  $\text{HA} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{A}^-$   
 $K_a = \alpha_1^2 \cdot c_1(\text{HA}) = \alpha_2^2 \cdot c_2(\text{HA})$   
 $\alpha_2 = 2 \alpha_1$   
 $c_2(\text{HA}) = c_1(\text{HA}) / 4 = 0,050 \text{ mol/dm}^3$   
 $n_2(\text{HA}) = n_1(\text{HA}) = c_1(\text{HA}) \cdot V_1 = 1,0 \cdot 10^{-2} \text{ mol}$   
 $V_2 = n_2(\text{HA}) / c_2(\text{HA}) = 0,20 \text{ dm}^3$   
 $V(\text{H}_2\text{O}) = V_2 - V_1 = \mathbf{0,15 \text{ dm}^3}.$

3.  $m(\text{HCl}) = 9,572 \text{ g}$   
 $n(\text{HCl}) = 0,263 \text{ mol}$   
 $0,263 / 3 = 0,0875 \text{ mol za NaOH i}$   
 $2 \times 0,0875 = 0,175 \text{ mol HCl za Ca(OH)}_2 \text{ što odgovara } 0,0875 \text{ mol Ca(OH)}_2.$   
 $m(\text{Ca(OH)}_2) = 0,0875 \cdot 74 = \mathbf{6,478 \text{ g}}$   
 $m(\text{NaOH}) = 0,0875 \cdot 40 = \mathbf{3,5 \text{ g}}$

4. A) Broj nesparenih elektrona :  $\text{Fe}^{2+}$  ili  $\text{Fe}^{3+}$   
B) Jonski radijus:  $\text{Al}^{3+}$  ili  $\text{Na}^+$   
C) Oksidacijsko djelovanje:  $\text{Cl}_2$  ili  $\text{Br}_2$   
D) pH vodenog rastvora.  $\text{Na}_2\text{CO}_3$  ili  $\text{NH}_4\text{Cl}$ ?



$$n(\text{KMnO}_4) = c \cdot V = 2,2 \cdot 10^{-3} \text{ mol}$$

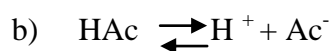
$$n(\text{Fe}^{2+}) / n(\text{MnO}_4^-) = 5/1$$

$$n(\text{Fe}^{2+}) = 0,011 \text{ mol}$$

$$m(\text{Fe}) = n \cdot M = 0,614 \text{ g}$$

$$w(\text{Fe}) = m(\text{Fe}) / m(\text{legure}) = \mathbf{0.307 \text{ (30,7\%)}}$$

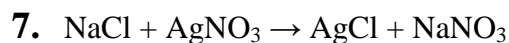
6. a)  $[\text{H}_3\text{O}^+] = [\text{HCl}] = 10^{-4} \text{ mol/dm}^3$



$$K_a = [\text{H}_3\text{O}^+] \cdot [\text{Ac}^-] / [\text{HAc}] = [\text{H}_3\text{O}^+]^2 / [\text{HAc}] - [\text{H}_3\text{O}^+]$$

$$[\text{HAc}] = \mathbf{6,56 \cdot 10^{-4} \text{ mol/dm}^3}$$

c) U smješi su koncentracije  $[\text{HCl}] = 5 \cdot 10^{-5} \text{ mol/dm}^3$  i  $[\text{NaOH}] = 5 \cdot 10^{-5} \text{ mol/dm}^3$ ,  
tako da je rastvor neutralan. **pH = 7**



$$n(\text{NaCl}) = n(\text{AgCl}) = c \cdot V = 3,88 \cdot 10^{-3} \text{ mol}$$

$$m(\text{NaCl}) = 0,2269 \text{ g}$$

$$m(\text{nečistoća}) = 0,0010 \text{ g}$$

$$w(\text{nečistoća}) = 0,438\%$$

8.  $n(\text{HCl}) = 4,28 \cdot 10^{-4} \text{ mol}$

$$n(\text{Ca}^{2+}) = n(\text{CaO}) = 2,14 \cdot 10^{-4} \text{ mol}$$

$$m(\text{CaO}) = 0,012 \text{ g u } 100 \text{ cm}^3 \text{ vode}$$

$$^0\text{N} = \mathbf{12}$$



Od 2 mola  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$  dobije se **2,4 mola NO**

10. c)

11.  $[\text{B}] = [\text{C}] / K_c [\text{A}] = 1 / 0,877 = \mathbf{1,14}$