Državna matura Kemija

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Ispitna knjižica 1

Zadatak	Točan odgovor	Zadatak	Točan odgovor
1	A	26	C
2	C	27	D
3	C	28	C
4	B	29	C
5	B	30	D
6	D	31	D
7	B	32	A
8	D	33	D
9	C	34	C
10	A	35	A
11	C	36	A
12	D	37	A
13	D	38	C
14	D	39	B
15	D	40	C
16	C	41	B
17	A	42	A
18	C	43	C
19	D	44	D
20	D	45	C
21	B		
22	C		
23	A		
24	A		
25	C		

1.1. Magnezijev sulfit

1.2. CH₃COOCH₃

2.1.

K1 $+ \ H_2O \rightleftharpoons$ **B1**   **B2** $+ \ H_3O^+$ **K2**

2.2. pH = 4,9

pH = – log ([H⁺] / mol dm⁻³);   pH = – log (1,14 x 10⁻⁵ / mol dm⁻³) = 4,9
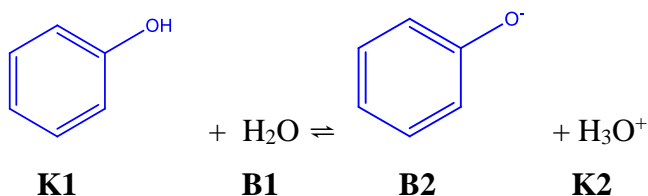
3.1. ρ = 1,02 g cm⁻³

V = 2 dL = 200 mL = 200 cm³

m = 0,204 kg = 204 g

$\rho = \dfrac{m}{V} = \dfrac{204 \ g}{200 \ cm^3}$ = 1,02 g cm⁻³

3.2. C₆H₇N

w(N, X) = 0,15 $0{,}15 = \dfrac{x \cdot 14 \ g/mol}{93{,}07 \ g/mol}$ $x = 1$

w(C, X) = 0,774 $0{,}774 = \dfrac{y \cdot 12 \ g/mol}{93{,}07 \ g/mol}$ $y = 6$

w(H, X) = 0,076 $0{,}076 = \dfrac{z \cdot 1{,}01 \ g/mol}{93{,}07 \ g/mol}$ $z = 7$

$x{:}y{:}z = 1 : 6 : 7$ **C₆H₇N**

4.1. $CH_4(g) \xrightarrow{\ \Delta\ } C(s) + 2 \ H_2(g)$

4.2. $CH_4 + Cl_2 \xrightarrow{\ h\nu\ } CH_3Cl + HCl$
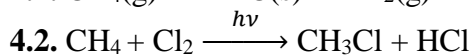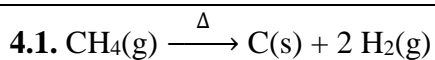
4.3. supstitucija, radikalska supstitucija

4.4. 1,2-diklorpropan

5.1.
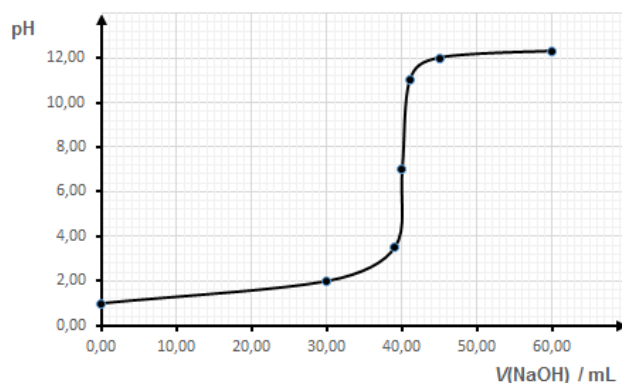
5.2. pH = 7

5.3. c(HCl) = 0,2 mol dm^{-3}

c(NaOH) = 0,1 mol dm^{-3}; V(NaOH) = 40 mL

V(HCl) = 20 mL

n(HCl) = n(NaOH)

c(HCl) V(HCl) = c(NaOH) V(NaOH) c(HCl) = c(NaOH) V(NaOH)/ V(HCl)

c(HCl) = 0,1 mol dm^{-3} × 40 mL/20 mL = 0,2 mol dm^{-3}

5.4. Koristiti **zaštitne naočale** i **zaštitne rukavice**

6.1. Al(s) │ Al^{3+}(aq) ‖ Cu^{2+}(aq) │ Cu(s)

6.2 $\Delta E = E_K - E_A$

ΔE = 0,342 V − (− 1,662 V) = **2,004 V**

6.3. na elektrodi načinjenoj od bakra, na katodi

7.1. m = 1,77 g

$$n(\text{NaHCO}_3) = \frac{m(\text{NaHCO}_3)}{M(\text{NaHCO}_3)} = \frac{2,80\,\text{g}}{84,01\,\text{g mol}^{-1}} = 3,33 \times 10^{-2}\,\text{mol}$$

$$n(\text{Na}_2\text{CO}_3) = \frac{1}{2}n(\text{NaHCO}_3) = \frac{3,33 \times 10^{-2}\,\text{mol}}{2} = 1,67 \times 10^{-2}\,\text{mol}$$

$$m(\text{Na}_2\text{CO}_3) = n(\text{Na}_2\text{CO}_3) \cdot M(\text{Na}_2\text{CO}_3) = 1,67 \times 10^{-2}\,\text{mol} \cdot 106\,\text{g mol}^{-1} = 1,77\,\text{g}$$

7.2. 91,5 %

$$\eta = \frac{m(\text{Na}_2\text{CO}_3)_{\text{eksp.}}}{m(\text{Na}_2\text{CO}_3)_{\text{teor.}}} \cdot 100\% = \frac{1,62\,\text{g}}{1,77\,\text{g}} \cdot 100\% = 91,5\,\%$$

7.3. linearne

8.1.

$2 NH_4Cl(s) + CaO(s) \rightarrow 2 NH_3(g) + CaCl_2(s) + H_2O(\ell)$

8.2. Gustoća amonijaka je manja od gustoće zraka. ($\rho(NH_3) < \rho(\text{zrak})$)

8.3. Amonijak se otapa u vodi, nastaje amonijeva lužina koja u vodi ionizira i mijenja boju otopine u ljubičastu.

9.1. sumporna kiselina

$V(H_2SO_4) = 100 mL = 0,1 \ dm^3$

$c(H_2SO_4) = 1 \ mol \ dm^{-3}$
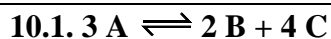
$m(Fe) = 50 \ g$

$n(H_2SO_4) = c \ V = 1 \ mol \ dm^{-3} \times 0,10 \ dm^{-3} = 0,1 \ mol$

$n(Fe) = n(H_2SO_4)$

$n(Fe) = \dfrac{m}{M} = \dfrac{50 \ g}{55,8 \ g/mol} = 0,896 \ mol$

9.2. $Fe^{3+} + 3 \ OH^- \rightarrow Fe(OH)_3$

10.1. 3 A $\rightleftharpoons$ 2 B + 4 C

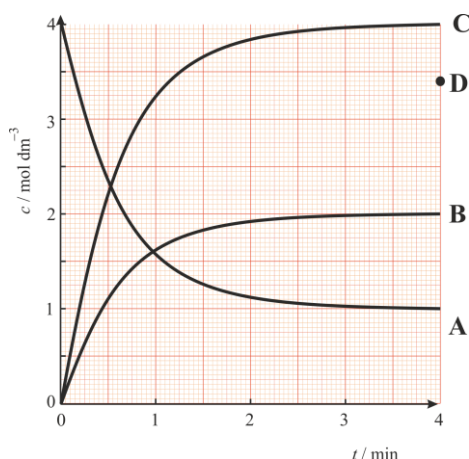**10.2.** Brzina reakcije će se **povećati**.

10. 3. 4,8 puta (priznati 5,0 ±0,5)

$v(\text{A u 1. min}) = -\dfrac{c1(A)-c0(A)}{t1-t0} = -\dfrac{1,6 \ mol/dm^3 \ -4 mol/dm^3}{1 \ min-0 \ min} = 2,4 \ mol \ dm^{-3} \ min^{-1}$

$v(\text{A u 2. min}) = -\dfrac{c2(A)-c1(A)}{t2-t1} = -\dfrac{1,1 \ mol/dm^3 \ -1,6 \ mol/dm^3}{2 \ min-1 \ min} = 0,5 \ mol \ dm^{-3} \ min^{-1}$

$v(\text{A u 1. min})/ v(\text{A u 2. min}) = 2,4/0,5 = 4,8$

10.4.

11.1.

ili
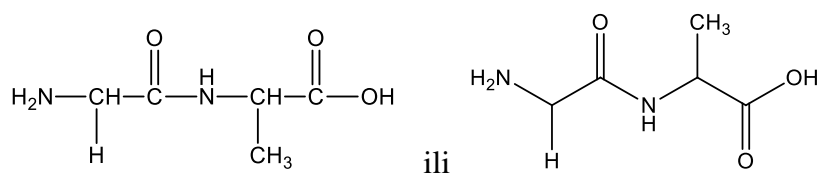
11.2. $m = 1{,}48 \times 10^{-22}$ **g**

$N(\text{alanin}) = 1$

$M_r(\text{alanin}) = 89{,}07$

$$n(\text{alanin}) = \frac{N}{L} = \frac{1}{6{,}02 \times 10^{23}\ \text{mol}^{-1}} = 1{,}66 \times 10^{-24}\ \text{mol}$$
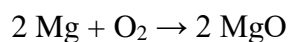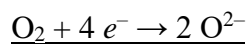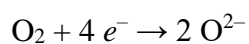
$m(\text{alanin}) = n \cdot M = 1{,}66 \times 10^{-24}\ \text{mol} \cdot 89{,}07\ \text{gmol}^{-1} = 1{,}48 \times 10^{-22}\text{g}$ ili
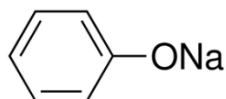
$m(\text{alanin}) = M_r(\text{alanin}) \cdot \text{u} = 89{,}07 \cdot 1{,}66 \times 10^{-24}\text{g} = 1{,}48 \times 10^{-22}\text{g}$

12.1 $C_2H_5OH + 3\ O_2 \rightarrow 2\ CO_2 + 3\ H_2O$;   Agregacijska stanja se ne razmatraju.

12.2 98,5%

$$\Delta H = \Delta_r H \frac{m(C_2H_5OH)}{M(C_2H_5OH)} = -1\ 234{,}7\ \text{kJ mol}^{-1} \frac{10{,}0\ \text{g}}{46{,}06\ \text{g mol}^{-1}} = -268{,}1\ \text{kJ}$$

$$\eta = \frac{\Delta H_{\text{izmjereno}}}{\Delta H_{\text{teorijski}}} = \frac{-264\ \text{kJ}}{-268{,}1\ \text{kJ}} = 0{,}985 = 98{,}5\% \quad (\pm 0{,}2\%)$$

13.1. $Mg \rightarrow Mg^{2+} + 2\ e^- \ / \times 2$

   $\underline{O_2 + 4\ e^- \rightarrow 2\ O^{2-}}$

   $2\ Mg \rightarrow 2\ Mg^{2+} + 4\ e^-$

   $\underline{O_2 + 4\ e^- \rightarrow 2\ O^{2-}}$

   $2\ Mg + O_2 \rightarrow 2\ MgO$

13.2. Magnezijev hidroksid ili magnezijeva lužina ili $Mg(OH)_2$

14.1

14.2. $N(\text{Na}) = 2$
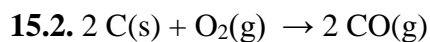
$\rho(\text{Na}) = 0{,}97 \text{ g cm}^{-3}$

$a = 429 \text{ pm} = 4{,}29 \times 10^{-8} \text{ cm}$

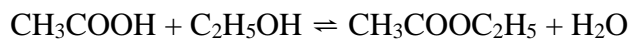$V(\text{el.ćelije}) = a^3 = 7{,}895 \times 10^{-23} \text{ cm}^3$

$m(\text{el.ćelije}) = \rho(\text{Na}) \times V(\text{el.ćelije}) = 0{,}97 \text{ g cm}^{-3} \cdot 7{,}895 \times 10^{-23} \text{ cm}^3 = 7{,}658 \times 10^{-23} \text{ g}$

$m_a(\text{Na}) = A_r(\text{Na}) \times u = 23 \cdot 1{,}66 \times 10^{-24} \text{ g} = 3{,}818 \times 10^{-23} \text{ g}$

$\dfrac{m(\text{el.ćelije})}{m_a(\text{Na})} = 2$

15.1. Londonovom privlačnom silom.

15.2. $2 \text{ C(s)} + \text{O}_2\text{(g)} \rightarrow 2 \text{ CO(g)}$

16.1. $K_c = \dfrac{[\text{CH}_3\text{COOC}_2\text{H}_5] \cdot [\text{H}_2\text{O}]}{[\text{CH}_3\text{COOH}] \cdot [\text{C}_2\text{H}_5\text{OH}]}$

16.2. $n(\text{CH}_3\text{COOH}) = 0{,}67 \text{ mol}$

$$\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightleftharpoons \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$$

$c/\text{mol L}^{-1} \qquad 2-x \qquad 2-x \qquad x \qquad x$

$K_c = \dfrac{[\text{CH}_3\text{COOC}_2\text{H}_5] \cdot [\text{H}_2\text{O}]}{[\text{CH}_3\text{COOH}] \cdot [\text{C}_2\text{H}_5\text{OH}]} \qquad 4 = \dfrac{x^2}{(2-x)^2} \qquad x = 1{,}33$
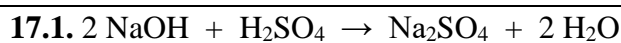
$c(\text{CH}_3\text{COOH}) = 2 \text{ mol/L} - 1{,}33 \text{ mol/L} = 0{,}67 \text{ mol/L}$

$n(\text{CH}_3\text{COOH}) = c(\text{CH}_3\text{COOH}) \, V(\text{CH}_3\text{COOH}) = 0{,}67 \text{ mol/L} \times 1 \text{ L} = 0{,}67 \text{ mol}$

17.1. $2 \text{ NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2 \text{ H}_2\text{O}$

17.2. $n(\text{NaOH}) = 0{,}0046 \text{ mol}$

$n(\text{NaOH}) = 2 \cdot n(\text{H}_2\text{SO}_4)$

$c(\text{H}_2\text{SO}_4) = 0{,}1032 \text{ mol L}^{-1}$

$\underline{V(\text{H}_2\text{SO}_4) = 22{,}5 \text{ mL} = 0{,}0225 \text{ L}}$

$n(\text{H}_2\text{SO}_4) = c \cdot V = 0{,}1032 \text{ mol L}^{-1} \cdot 0{,}0225 \text{ L} = 0{,}002322 \text{ mol}$

$n(\text{NaOH}) = 2 \; 0{,}002322 \text{ mol} = 0{,}0046 \text{ mol}$

18.1. $V(CO_2) = 2{,}48$ **L**

$M(Na_2CO_3) = 106$ g/mol

$m(Na_2CO_3) = 10{,}6$ g

$n(Na_2CO_3) = m/M = 0{,}1$ mol

$n(CO_2) = n(Na_2CO_3)$

$V(CO_2) = n(CO_2)RT/p = 2{,}48 \times 10^{3}$ m^3 = 2,48 L

18.2. Nema izmjene tvari niti energije između sustava i okoline, jer je kalorimetar izolirani zatvoreni sustav.