Kemija na državnoj maturi 2016. – inačica S025

Ključ za odgovore - ispitna knjižica 1

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

Ključ za odgovore - ispitna knjižica 2

1.1. etil-butanoat

1.2. $Ca_3(PO_4)_2$

1 BOD za svaki točan odgovor

2.1.

$$\frac{N(C)}{N(H)} = \frac{N(CO_2)}{2 \times N(H_2O)} = \frac{\dfrac{m(CO_2)}{M(CO_2)}}{2 \cdot \dfrac{m(H_2O)}{M(H_2O)}} = \frac{\dfrac{3,960\ g}{44,00\ g\ mol^{-1}}}{2 \cdot \dfrac{0,810\ g}{18,02\ g\ mol^{-1}}} = \frac{0,09}{0,09} = 1$$

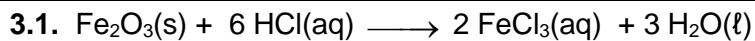Empirijska formula je CH.

$M_r(CH) = 13,01$

M_r (arena) = 78,06

78,06/13,01 = 6 $\rightarrow$ molekulska formula C_6H_6.   **1 BOD**

2.2.

$w(O, C_6H_6O)$ = 16,0 / (6×12,0 + 6×1,01 + 16,0) = 16,0 / 94,06 = 0,17 = 17 %   **1 BOD**

3.1. $Fe_2O_3(s)$ + 6 HCl(aq) $\longrightarrow$ 2 $FeCl_3(aq)$ + 3 $H_2O(\ell)$ **1 BOD**

3.2. sinteza, redoks reakcija   **1 BOD**

3.3. 44,8 L

$n(HCl)$= 2 mol

$V(HCl) = V_m \cdot n$ = 22,4 L $mol^{-1} \cdot$ 2 mol = 44,8 L   **1 BOD**

3.4. Ca

$M(MCl_2)= m/n$ = 55,55 g / 0,5 mol = 111,10 g/mol

$A_r(M)$= 111,10 − 2·35,5 = 40,1

M= Ca   **1 BOD**

4.1.

1 BOD

4.2.

$CH_3CH_2CBr_2CH_2CH_2CH_3$,
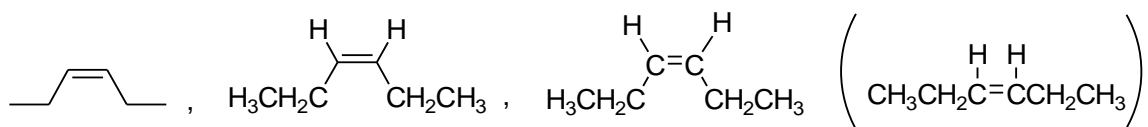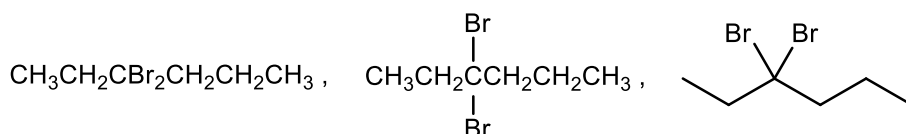
1 BOD

Napomena: priznaje se i ispravno napisana jednadžba kemijske reakcije u kojoj nastaje traženi produkt

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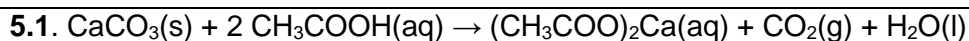
5.1. $CaCO_3(s) + 2\ CH_3COOH(aq) \rightarrow (CH_3COO)_2Ca(aq) + CO_2(g) + H_2O(l)$ **1 BOD**

5.2.

$n(CaCO_3) = n(CaO)$

$m(CaO) = \dfrac{m(CaCO_3)}{M(CaCO_3)}\,M(CaO)\ = \dfrac{900\,000\ \text{g}}{100{,}1\ \text{g mol}^{-1}}\ \cdot 56{,}1\ \text{g mol}^{-1}$

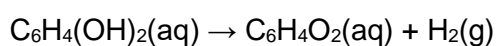$m(CaO) = 504\,395{,}6\ \text{g} = 504{,}4\ \text{kg}$ **1 BOD**

5.3. B_2 **1 BOD**

6.1. $2\ H_2O_2(aq) \rightarrow 2\ H_2O(\ell) + O_2(g)$ **1 BOD**

6.2.

$C_6H_4(OH)_2(aq) \rightarrow C_6H_4O_2(aq) + H_2(g)$ $\Delta_rH_1^\circ = +177{,}4\ \text{kJ mol}^{-1}$

$H_2O_2(aq) \rightarrow H_2(g) + O_2(g)$ $\Delta_rH_2^\circ = 191{,}2\ \text{kJ mol}^{-1}$
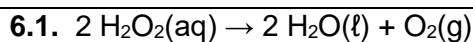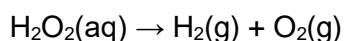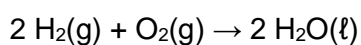
$2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(\ell)$ $\Delta_rH_3^\circ = -570{,}8\ \text{kJ mol}^{-1}$

$\Delta_rH^\circ = \Delta_rH_1^\circ + \Delta_rH_2^\circ + \Delta_rH_3^\circ$

$\Delta_rH^\circ = 177{,}4\ \text{kJ mol}^{-1} + (191{,}2\ \text{kJ mol}^{-1}) + (-570{,}8\ \text{kJ mol}^{-1})$

$\Delta_rH^\circ = -202{,}2\ \text{kJ mol}^{-1}$ **1 BOD**

7.1.

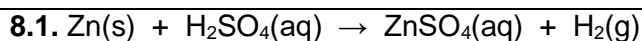$n(C_2H_2) = N/N_A = 2{,}5 \times 10^{22} / 6{,}022 \times 10^{23} \text{ mol}^{-1} = 0{,}0415 \text{ mol}$

$n(O_2) = 5/2 \cdot n(C_2H_2) = 5/2 \cdot 0{,}0415 \text{ mol} = 0{,}1038 \text{ mol}$

$m(O_2) = n \cdot M = 0{,}1038 \text{ mol} \cdot 32 \text{ g mol}^{-1} = 3{,}32 \text{ g}$ **1 BOD**

7.2. Brzina kemijske reakcije će se smanjiti.   **1 BOD**

8.1. $Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$ **1 BOD**

8.2. 1,71 dm³

$n(Zn) = m/M$

$n(Zn) = 4{,}5 \text{ g} / 65{,}4 \text{ g mol}^{-1} = \textbf{0,069 mol}$

$n(H_2) = n(Zn) = 0{,}069 \text{ mol}$

$V(H_2) = \dfrac{n(H_2)RT}{p(H_2)} = \dfrac{0{,}069 \text{ mol} \cdot 8{,}31 \text{ J K}^{-1} \text{mol}^{-1} \cdot 298 \text{ K}}{100\,000 \text{ Pa}} = 0{,}00171 \text{ m}^3 = \textbf{1,71 dm}^3$

1 BOD za točno izračunatu množinu vodika

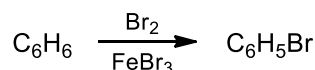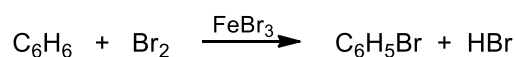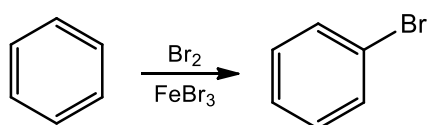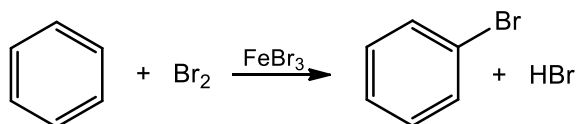**1 BOD** za točno izračunati volumen vodika

8.3. $CaCO_3(s) + H_2SO_4(aq) \rightarrow CaSO_4(s) + CO_2(g) + H_2O(\ell)$
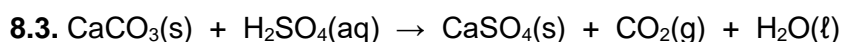
(agregacijska stanja se ne razmatraju)   **1 BOD**

9.1

(Željezo (Fe) također može biti katalizator (umjesto FeBr₃).
Jednadžba reakcije napisana bez katalizatora nije točna.)   **1 BOD**

9.2. Ugljikov(IV) oksid i voda, CO_2 i H_2O **1 BOD**

10.1.

$CH_3CH_2CH_2COOH + KOH \rightarrow CH_3CH_2CH_2COOK + H_2O$

$CH_3CH_2CH_2COOH + KOH \rightarrow CH_3CH_2CH_2COO^-K^+ + H_2O$

 COOH + KOH $\longrightarrow$ COOK + H₂O

$C_3H_7COOH + KOH \rightarrow C_3H_7COOK + H_2O$

$C_3H_7COOH + KOH \rightarrow C_3H_7COO^-K^+ + H_2O$ **1 BOD**
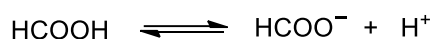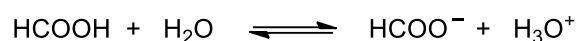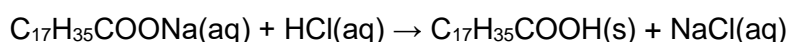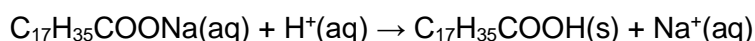

10.2

$HCOOH + H_2O \rightleftharpoons HCOO^- + H_3O^+$

$HCOOH \rightleftharpoons HCOO^- + H^+$

$HCOO^- + H_2O \rightleftharpoons HCOOH + OH^-$ **1 BOD**

11.1.

$C_{17}H_{35}COONa(aq) + H^+(aq) \rightarrow C_{17}H_{35}COOH(s) + Na^+(aq)$
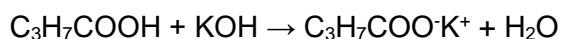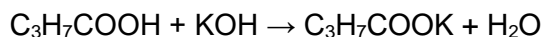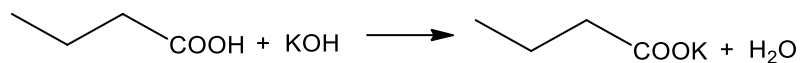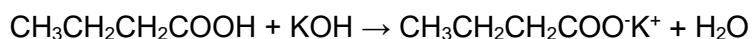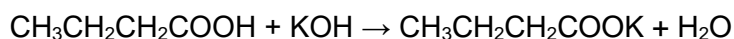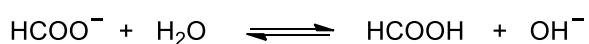
$C_{17}H_{35}COONa(aq) + HCl(aq) \rightarrow C_{17}H_{35}COOH(s) + NaCl(aq)$ **1 BOD**

(agregacijska stanja se ne razmatraju)

11.2. 0,35 mol

$n(C_{17}H_{35}COOH) = m(C_{17}H_{35}COOH) / M(C_{17}H_{35}COOH)$

$n(C_{17}H_{35}COOH) = 100 \text{ g} / 284{,}36 \text{ g mol}^{-1}$

$n(C_{17}H_{35}COOH) = 0{,}35 \text{ mol}$ **1 BOD**

11.3. 5,5

$pH = -\log c(H_3O^+) / \text{mol dm}^{-3}$

$pH = 5{,}5$ **1 BOD**

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12. 1. 5 mmol L^{-1} **(±0, 1 mmol L^{-1})** **1 BOD**

12.2. $v = \Delta c(A) / (-1 \Delta t) = \Delta c(B) / 2 \Delta t$ **1 BOD**

Priznati izraze i s oznakama stehiometrijskih koeficijenata.

12.3.

Konačne koncentracije produkata ostale bi nepromijenjene.
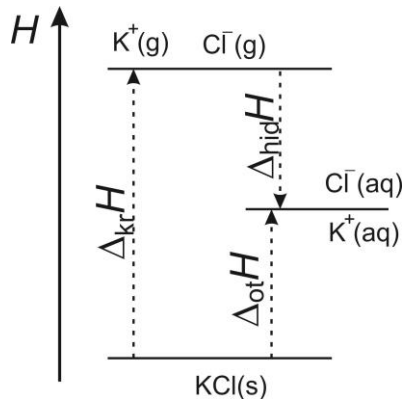(Katalizator ne utječe na koncentracije produkata.) **1 BOD**

13.1. 0,42 kJ

$\Delta H = (\Delta_{hid}H + \Delta_{kr}H) \cdot n(KCl) = (-685 \text{ kJ mol}^{-1} + 717 \text{ kJ mol}^{-1}) \cdot (1g/74{,}6 \text{ g mol}^{-1}) = 0{,}43 \text{ kJ}$

1 BOD

13.2.

1 BOD

14.1

$Al \mid Al^{3+} \parallel Fe^{2+} \mid Fe$ ili $Al(s) \mid Al^{3+}(aq) \parallel Fe^{2+}(aq) \mid Fe(s)$ **1 BOD**

14.2. 1,22 V

$E_{čl} = E(\text{katoda}) - E(\text{anoda})$

$E_{čl} = E(Fe^{2+}/Fe) - E(Al^{3+}/Al) = -0{,}44 \text{ V} - (-1{,}66 \text{ V}) = 1{,}22 \text{ V}$ **1 BOD**

15.1. $8{,}6 \times 10^4$ C

$$n(H_2) = \frac{V(H_2)}{V_m} = \frac{10 \text{ dm}^3}{22{,}4 \text{ dm}^3 \text{ mol}^{-1}} = 0{,}446 \text{ mol}$$

1 BOD

$$Q = n(H_2) \times z \times F = 0{,}446 \text{ mol} \times 2 \times 96\,500 \text{ C mol}^{-1} = 8{,}6 \times 10^4 \text{ C}$$

15.2. pH >7, lužnato   **1 BOD**

16.1.

$$c(CH_3COOH) = \frac{n}{V} = \frac{m}{M\,V} = \frac{w\,m(\text{otopine})}{M\,V} = \frac{w\,\rho}{M} = \frac{0,09 \cdot 1,01\ \text{g cm}^{-3}}{60,04\ \text{g mol}^{-1}} = 1,51\ \text{mol dm}^{-3}$$ **1 BOD**

16.2. $c_2 = c_1 V_1 / V_2 = 0,05\ \text{mol dm}^{-3}$ **1 BOD**

17.1.

$w(KBr) = m(KBr) / m(KBr) + m(H_2O)$

0,41 = x / (x + 250)

x = 173,7

$m(KBr)$ = 173,7 g **1 BOD**

17.2. Nezasićena otopina. **1 BOD**

18.1. $H_3O^+(aq) + OH^-(aq) \rightarrow 2\ H_2O(\ell)$
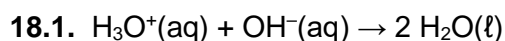
(priznati i jednadžbu $CH_3COOH(aq) + NaOH(aq) \rightarrow CH_3COONa(aq) + H_2O(\ell)$) **1 BOD**

18.2. Fenolftalein mijenja boju iz bezbojne u ružičastu. **1 BOD**

18.3. $1,0 \times 10^{-3}\ \text{mol L}^{-1}$

$\bar{V}(NaOH) = (19,9\ \text{mL} + 20,1\ \text{mL} + 20,0\ \text{mL}) / 3$

$\qquad\quad = 20,0\ \text{mL}$

$c(CH_3COOH) \cdot V(CH_3COOH) = c(NaOH) \cdot V(NaOH)$

$c(CH_3COOH) = c(NaOH) \cdot \bar{V}(NaOH) / V(CH_3COOH)$

$\qquad\quad = 5 \times 10^{-4}\ \text{mol L}^{-1} \cdot 20,0\ \text{mL} / 10,0\ \text{mL}$

$\qquad\quad = 1,0 \times 10^{-3}\ \text{mol L}^{-1}$ **1 BOD**

18.4. 10,7

$c(OH^-) = c(NaOH) = 5 \times 10^{-4}\ \text{mol L}^{-1}$

$pOH = -\log[c(OH^-) / \text{mol L}^{-1}] = 3,3$

$pH = 14 - 3,3 = 10,7$

$pH = 10,7$ **1 BOD**