Nacionalni centar
za vanjsko vrednovanje
obrazovanja

Ispitna knjižica 1

15. 06. 2018.

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

15. 06. 2018.

Ispitna knjižica 2

1.1. propanal

1.2. $Mg(NO_3)_2$

2.1. Ucrtane točke na dijagramu.
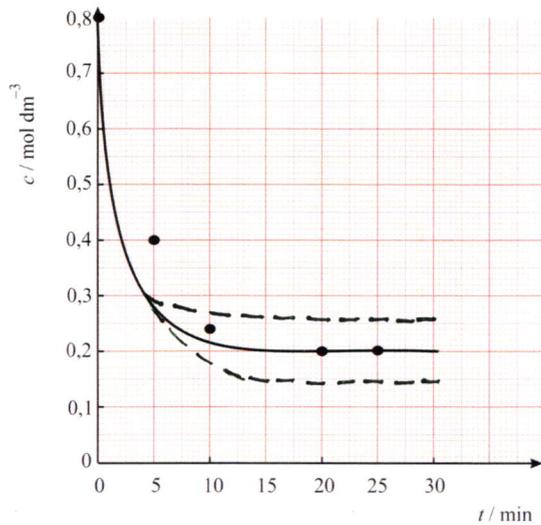
2.2. Reakcija se ubrzava.

2.3. m(glukoza + fruktoza) = 2,16 g

$c(C_{12}H_{22}O_{11}) = 0,60$ mol dm^{-3}

V(otopine) = 10,0 mL

$C_{12}H_{22}O_{11}$(aq, saharoza) + H_2O() $\xrightarrow{H_2SO_4 \, (aq)}$ $C_6H_{12}O_6$(aq, glukoza) + $C_6H_{12}O_6$(aq, fruktoza)
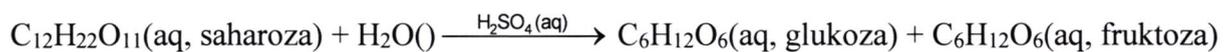
n(saharoza) = n(glukoza) = n(fruktoza)

n(glukoza) = $n(C_{12}H_{22}O_{11})$ = 0,60 mol dm^{-3} · 0,01 dm^3 = 0,006 mol

n(glukoza + fruktoza) = 2 · 0,006 mol = 0,012 mol

m(glukoza + fruktoza) = 0,012 mol · 180,12 g/mol = 2,16 g

2.4. Ucrtana krivulja/e na dijagramu. Priznaje se svaki prikaz gdje se vidi da je nagib krivulje u prvim minutama reakcije strmiji u odnosu na krivulju (točke) dobivenu na temelju podataka pri 60 °C.

3.1. Lijevak za dokapavanje. Odgovor lijevak ili stakleni lijevak se ne priznaje.

3.2.
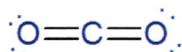
3.3. Polimorfija ili polimorfizam

3.4. $1{,}088 \times 10^{-3}$ g cm^{-3} ili $0{,}001088$ g cm^{-3}

4.1. $K_{w,\,15\,°C} = 0{,}5 \times 10^{-14}$ mol^2 dm^{-6} (5×10^{-15} mol^2 dm^{-6})

Napomena: Priznati odstupanja $\pm 0{,}1 \times 10^{-14}$ mol^2 dm^{-6} odnosno $\pm 1 \times 10^{-15}$ mol^2 dm^{-6}

4.2

$$K_w = \frac{[H_3O^+] \cdot [OH^-]}{x(H_2O)}; \quad K_w = [H_3O^+] \cdot [OH^-]$$

4.3. pH = 6,8

$$[H_3O^+] = \sqrt{K_w} = \sqrt{2{,}3 \times 10^{-14}\ \text{mol}^2\ \text{dm}^{-6}} = 1{,}5 \times 10^{-7}\ \text{mol dm}^{-3}$$

$$pH = -\log([H_3O^+]/\text{mol dm}^{-3}) = -\log(1{,}5 \times 10^{-7}) = 6{,}8$$

4.4. Omjer množinskih koncentracija iznosi **jedan (1)**.

5.1. Oksidacijski broj središnjeg atoma ugljika je **nula (0)**.

5.2. $2\ C_3H_8O + 9\ O_2 \rightarrow 6\ CO_2 + 8\ H_2O$

ili

$C_3H_8O + 9/2\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$
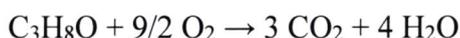
5.3. $(100{,}94 \pm 0{,}01)$ °C

100 g otopine sadrži 10 g propan-2-ola (C_3H_8O; $M = 60{,}08$ g mol^{-1}) i 90 g vode.

$$b = \frac{n(B)}{m(A)} = \frac{m(B)}{M(B)m(A)} = \frac{10\ \text{g}}{60{,}08\ \text{g/mol} \cdot 10\ \text{g}} = 1{,}85\ \text{mol/kg}$$

$$\Delta T = i\,K_b\,b = 1 \cdot 0{,}51\ \text{K kg mol}^{-1} \cdot 1{,}85\ \text{mol kg}^{-1} = 0{,}94\ \text{K}$$

$\Delta T = T_V - T_V{}^*$

$T_V = \Delta T + T_V{}^* = 100\ °C + 0{,}94\ °C = 100{,}94\ °C$

**6.1.** $2\ NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$ (sa ili bez agregacijskih stanja)

6.2. Izlučuje se kalcijev karbonat ($CaCO_3$).

6.3. Ugljikov(IV) oksid ne gori i ne podržava gorenje. U epruveti nema kisika.

7.1. $Cl^-(aq) + Ag^+(aq) \rightarrow AgCl(s)$ ili

$Cl^-(aq) + AgNO_3(aq) \rightarrow AgCl(s) + NO_3^-(aq)$
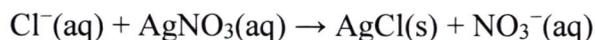
7.2. $c(AgCl) = 1{,}3 \times 10^{-5}\ mol\ L^{-1}$
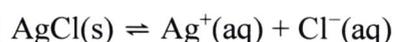
$AgCl(s) \rightleftharpoons Ag^+(aq) + Cl^-(aq)$

$[Ag^+,aq] = [Cl^-,aq] = c(AgCl,aq)$

$K_s = [Ag^+] \cdot [Cl^-] = c(AgCl)^2$

$c(AgCl) = \sqrt{K_s} = \sqrt{1{,}8 \times 10^{-10}\ mol^2\ L^{-2}} = 1{,}3 \times 10^{-5}\ mol\ L^{-1}$

7.3. Dodatkom natrijeva klorida povećava se količina taloga srebrova klorida (masa istaloženog srebrova klorida).

8.1.
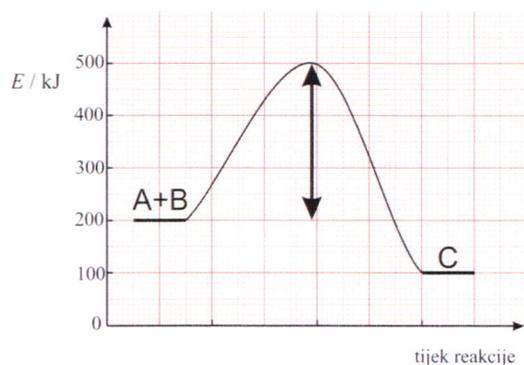
8.2. Brzina kemijske reakcije će se smanjiti.

9.1. $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$ ili

$Ba^{2+}(aq) + H_2SO_4(aq) \rightarrow BaSO_4(s) + 2\ H^+(aq)$
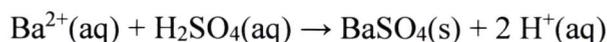
9.2. $N(S) = 6{,}02 \times 10^{22}$

$V(H_2SO_4) = 1\ L = 1\ dm^3 \qquad c(H_2SO_4) = 0{,}1\ mol\ dm^{-3}$

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

$n(S) = n(H_2SO_4) = 0{,}1\ mol$

$N(S) = n \cdot L = 0{,}1\ mol \cdot 6{,}02 \times 10^{23}\ mol^{-1} = 6{,}02 \times 10^{22}$

10.1. (52 200 ± 100) J mol^{-1}

r1: $C_2H_4(g) + 3\ O_2(g) \rightarrow 2\ CO_2(g) + 2\ H_2O(\ell)$ $\Delta_cH° = -\ 1411,2\ \text{kJ mol}^{-1}$

r2: $C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta_cH° = -\ 393,5\ \text{kJ mol}^{-1}$

r3: $H_2(g) + {}^1\!/_2\ O_2(g) \rightarrow H_2O(\ell)$ $\Delta_cH° = -\ 286,0\ \text{kJ mol}^{-1}$

r4: $2\ C(s) + 2\ H_2(g) \rightarrow C_2H_4(g)$
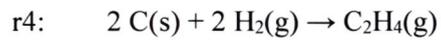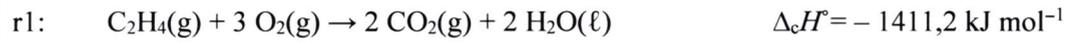
$\Delta_fH°(r4) = ?$

$\Delta_fH°(r4) = -\Delta_cH°(r1) + 2\ \Delta_cH°(r2) + 2\ \Delta_cH°(r3) = 52,2\ \text{kJ mol}^{-1} = 52\ 200\ \text{J mol}^{-1}$

10.2.
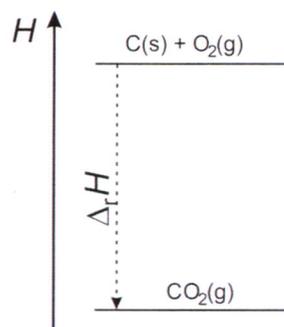
11.1.
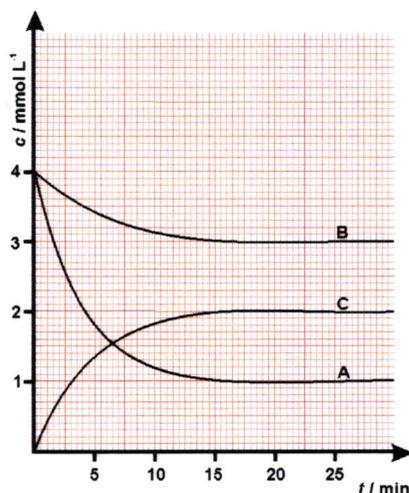
11.2. Moguća je izmjena energije, ali ne i tvari između sustava i okoline.

Napomena: Također priznati drugačije formulacije odgovora iz kojih se vidi da nije moguća izmjena tvari, ali je moguća izmjena energije između sustava i okoline.

12.1.

$$H_2C = CH_2 + I_2 \longrightarrow IH_2C - CH_2I$$
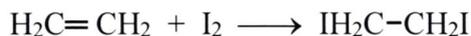
Napomena: Priznati i drugačije prikazane strukturne formule organskih molekula. Strukturna formula produkta mora biti prikazana tako da se jasno vidi da se na svaki atom ugljika vezao jedan atom joda. Prikaz organskih spojeva molekulskim formulama se ne priznaje. Agregacijska stanja se ne boduju.

12.2. Adiciji

13.1. $w_{sat}(KNO_3) = 28 \ \%$

$$w_{sat}(KNO_3) = \frac{m(KNO_3)}{m(KNO_3) + m(H_2O)}$$

$$= \frac{56 \ g}{56 \ g + 144 \ g} = 0{,}28 = 28 \ \%$$

13.2. $m(KNO_3, \text{izlučeni}) = 22{,}2 \ g$

$$w(KNO_3) = \frac{m(KNO_3)}{m(KNO_3) + m(H_2O)}$$

$$m(H_2O, 25 \ °C) = m(H_2O, 10 \ °C) = 144 \ g$$

$$0{,}19 = \frac{m(KNO_3)}{m(KNO_3) + 144 \ g} \qquad m(KNO_3, \ _{10°C}) = 33{,}8 \ g$$

$$m(KNO_3, \text{izlučeni}) = 56 \ g - 33{,}8 \ g = 22{,}2 \ g$$

14.1. $m = (7,4 \pm 0,1)$ g

$\underline{m(Al) = 1,50\ g}$

$m(AlCl_3) = ?$

$n(AlCl_3) = n(Al)$

$m(AlCl_3) = \dfrac{m\,(Al)}{M\,(Al)} \cdot M(AlCl_3) = \dfrac{1,50\ g}{27,0\ g\,mol^{-1}} \cdot 133,5\ g\,mol^{-1}\ = 7,4\ g$

14.2. $\eta = 94,0\ \%$

$m(AlCl_3,\ teoretski) = 9,85\ g$

$\eta = \dfrac{9,26\ g}{9,85\ g} = 0,\,940 = 94,0\ \%$


15.1.
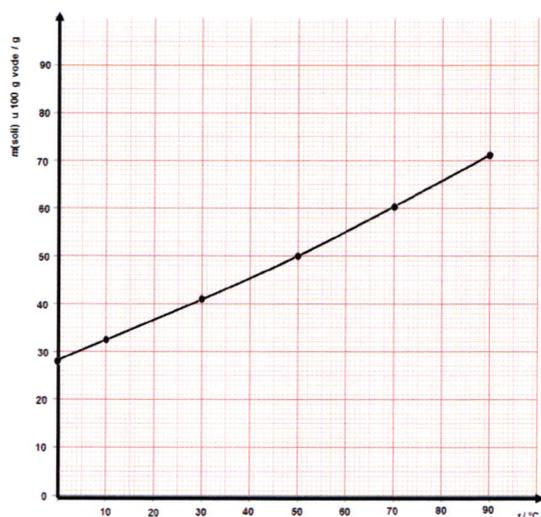
Napomena: Priznati bilo koji točno prikazan dijagram s pravilno označenim osima.

15.2. Amonijev ion:

ili
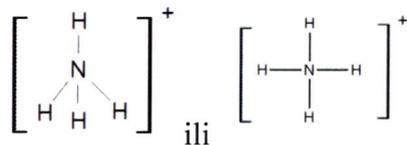
Kloridni ion:
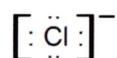
Napomena: Oba iona moraju biti točno prikazana za jedan bod.

16.1. $V = (12,6 \pm 0,1)$ dm³

$n(\text{H}_2) = n(\text{NaH})$

$pV = n\,R\,T \qquad\qquad V = \dfrac{nRT}{p}$

$V(\text{H}_2) = \dfrac{n(\text{NaH})RT}{p} = \dfrac{m(\text{NaH})RT}{M(\text{NaH})p} = \dfrac{12,2\text{ g} \cdot 8,31\text{ Pa m}^3\text{ K}^{-1}\text{ mol}^{-1} \cdot 298\text{ K}}{24,01\text{ g mol}^{-1} \cdot 1{\times}10^5\text{ Pa}} = 0,0126\text{ m}^3 = 12,6\text{ dm}^3$

16.2. $2\,\text{Na}(\ell) + \text{H}_2(\text{g}) \rightarrow 2\,\text{NaH}(\text{s})$

17.1. $V(\text{H}_2\text{O}) = 70$ mL

$\varphi_1 \cdot V_1 = \varphi_2 \cdot V_2$

$V_1 = (\varphi_2 \cdot V_2) / \varphi_1 = (0,9 \times 100\ \text{mL}) / 0,3 = 30\ \text{mL}$

$V(\text{H}_2\text{O}_2) = 30\ \text{mL}$

$V(\text{H}_2\text{O}) = 100\ \text{mL} - 30\ \text{mL} = 70\ \text{mL}$

17.2. Menzura.

Napomena: Priznati i odgovor: pipeta, odmjerna tikvica.

18.1. olovov(II) nitrat.

$n(\text{K}_2\text{SO}_4) = \dfrac{m(\text{K}_2\text{SO}_4)}{M(\text{K}_2\text{SO}_4)} = \dfrac{0,2\text{ g}}{174,3\text{ g mol}^{-1}} = 1,1 \times 10^{-3}\text{ mol}$

$n(\text{Pb(NO}_3)_2) = \dfrac{m(\text{Pb(NO}_3)_2)}{M(\text{Pb(NO}_3)_2)} = \dfrac{0,2\text{ g}}{331\text{ g mol}^{-1}} = 6,0 \times 10^{-4}\text{ mol}$

$n(\text{K}_2\text{SO}_4) > n(\text{Pb(NO}_3)_2)$

18.2. $c(\text{K}^+) = 1,1 \times 10^{-2}$ mol/L

$n(\text{K}^+) = 2\,n(\text{K}_2\text{SO}_4) = 2 \cdot 1,1 \times 10^{-3}\text{ mol} = 2,2 \times 10^{-3}\text{ mol}$

$c(\text{K}^+) = n/V = 2,2 \times 10^{-3}\text{ mol} / 0,2\text{ L} = 1,1 \times 10^{-2}\text{ mol/L}$