Vermes Eszter

BIOFIZIKA 1. HF

① 0,6 g urea 500 ml oldat

$m_{H_2O} = 500\,g$

$n_{H_2O} = \frac{m_{H_2O}}{M_{H_2O}} = \frac{500\,g}{18\,g/mol} = 27{,}78\,mol$

$n_{urea} = \frac{0{,}6\,g}{60\,g/mol} = 0{,}01\,mol$

- móltört: $x_u = \frac{0{,}01}{27{,}78 + 0{,}01} = 0{,}00036$
- molalitás
  - 500 g oldószer → 0,01 mol urea
  - 1000 g — " — → 0,02 mol urea
  - $m_u = 0{,}02\,mol/kg$
- molaritás (urea koncentrációja az oldatban)

$$c_u = \frac{0{,}01\,mol}{0{,}5\,dm^3} = 0{,}02\,mol/dm^3$$

② $\left(\frac{\partial \mu_w}{\partial P}\right)_T = \bar{V}$ $\qquad PV = nRT \rightarrow P\bar{V} = RT \rightarrow \bar{V} = \frac{RT}{P}$

Kezdeti érték: $\mu_w(P_0) = \mu_w^\circ$

$$\int \partial \mu_w = \int \bar{V}\, dP + C = RT \int \frac{1}{P}\, dP + C$$

$$\mu_w = RT \cdot \ln(P) + C$$

→ kezdeti értéket behelyettesítve: $\mu_w^\circ = RT \ln(P_0) + C$

$$C = \mu_w^\circ - RT \ln(P_0)$$

$$\mu_w = RT \ln(P) + \mu_w^\circ - RT \ln(P_0)$$

$$\boxed{\mu_w = \mu_w^\circ + RT \ln\left(\frac{P}{P_0}\right)}$$

③ Harmadrendű reakció: pl: $v = k[A]^3$

$$\rightarrow \frac{mol}{dm^3} \cdot \frac{1}{t} = [k] \cdot \left(\frac{mol}{dm^3}\right)^3$$

$$[k] = \boxed{\left(\frac{mol}{dm^3}\right)^{-2} \cdot \frac{1}{t}}$$

(4.) $\frac{x_0}{2} = x_0 e^{-\tau_{1/2}/\tau}$ $\quad \tau_{1/2} = 3$ minut

$-\ln 2 = -3/\tau$

$\tau = \frac{3}{\ln 2} = \underline{4{,}328}$ minut

$\lambda = \frac{1}{\tau} = \underline{0{,}231}$

(5.)

$\Delta G^\circ = -RT \ln K_{eq}$ $\quad T = 298$ K

$\ln K = \frac{\gamma_1}{RT} \Rightarrow K = e^{\frac{\gamma_1}{RT}} = 1{,}003$

1 G1P $\rightleftharpoons$ 1 G6P $\quad K_{eq} = \frac{[G6P]}{[G1P]} = 1$

$\Rightarrow$ 0,5 mol G1P es 0,5 mol G6P ekvilibrijumske

(6)

$k_2 = 10 \cdot k_1$

$A e^{-E_A/R \cdot 310} = 10 \cdot A \cdot e^{-E_A/R \cdot 303}$ $\quad 30^\circ C = 303$ K, $37^\circ C = 310$ K

$\frac{-E_A}{310 \cdot R} = \ln 10 + (-E_A/R \cdot 303)$

$E_A \left(\frac{1}{303 \cdot R} - \frac{1}{310 R}\right) = \ln 10$

$E_A = \underline{256{,}896\ 27}$ J/mol

(7.)

$M_{\text{jedinje}} = 45$ kDa $= 45 \cdot 10^3$ g/mol

$w = 10$ g/dm^3 $\quad T = 295$ K

$c = \frac{w}{M} = \frac{10 \text{ g/dm}^3}{45 \cdot 10^3 \text{ g/mol}} = 0{,}222 \cdot 10^{-3} \frac{\text{mol}}{\text{dm}^3}$

$\Pi_{\text{jed+Na}} = 2{,}152 \cdot 10^{-2}$ atm

$\Pi_{\text{jed}} = RT c_{\text{jed}} = 0{,}0821 \frac{\ell \text{ atm}}{K \text{ mol}} \cdot 295 K \cdot 0{,}222 \cdot 10^{-3} \frac{\text{mol}}{\text{dm}^3}$

$\Pi = 5{,}377 \cdot 10^{-3}$ atm

$\frac{\Pi_{\text{jed+Na}}}{\Pi_{\text{jed}}} = 4{,}002 \Rightarrow \underline{3\ Na^+}$ disocijacija

(5)

$\Delta G^\circ = -RT \ln K_{eq}$

$-7{,}1 \cdot 10^3$ J/mol $= -8{,}3145$ J/K mol $\cdot 298$ K $\cdot \ln K_{eq}$

$\ln K_{eq} = 2{,}8655$

$K_{eq} = 17{,}558$

$K_{eq} = \dfrac{[G6P]}{[G1P]} = 17{,}558$

$[G6P] = 17{,}558\ [G1P]$

~~$x \cdot [G6P] + (1-x)[G1P]$~~

equilibrium: x mol G6P, y mol G1P $\rightarrow$ $\dfrac{x}{y} = 17{,}558$ $\quad x + y = 1$

$x = 1 - y$

$\dfrac{1-y}{y} = 17{,}558$

$1 = 18{,}558\ y$

$y = 0{,}0539$ mol

$x = 0{,}9461$ mol