NBE-C2101 Biofysiikka Vakioiden arvoja ja kaavoja

$e = 1{,}602\cdot10^{-19}$ C
$R = 8{,}31$ J/(K mol) = 1,99 cal/(K mol)
mM = millimoolia/litra
$N_A = 6{,}022\cdot10^{23}$ mol^{-1}
$M_{\text{vesi}} = 18$ g/mol
$\rho_{\text{vesi}} = 1000$ kg/m^3
$\eta_{\text{vesi}} = 1\cdot10^{-3}$ Pa s

$k_B = 1{,}381\cdot10^{-23}$ J/K
$F = 96\,487$ C/mol = 23061 cal/(V mol)
0 °C = 273,15 K
$\varepsilon_0 = 8{,}854\cdot10^{-12}$ CV^{-1}m^{-1}
$g = 9{,}81$ m/s^2
$h = 6{,}26\cdot10^{-34}$ Js
1 cal = 4,187 J

Differentiaaliyhtälön $\frac{d^2y}{dx^2} = a^2$ ratkaisu on muotoa $y(x) = A_1e^{ax} + A_2e^{-ax}$

$$e^x - e^{-x} = 2\sinh x \approx 2x, \text{kun } x \ll 1$$

$$e^{-\frac{a}{2}} - e^{\frac{a}{2}} = e^{-a} + e^{a} - 2$$

$$\ln N! \approx N\ln N - N$$

Pallokoordinaatiostossa radiaalisuuntaan: $\nabla^2 = \frac{1}{r^2}\frac{d}{dr}\left(r^2\frac{d}{dr}\right)$

$$pV = Nk_BT = nRT$$

$$P(v_x) = \frac{1}{\sigma_x\sqrt{2\pi}}e^{-\frac{(v_x-\langle v_x\rangle)^2}{2\sigma_x^2}} \quad 1-\text{dim.}$$

$$\left\langle\left(\overline{r_N}\right)^2\right\rangle = \left\langle(x_N)^2\right\rangle + \left\langle(y_N)^2\right\rangle + \left\langle(z_N)^2\right\rangle = 6Dt$$

$$v_{drift} = \frac{f}{\varsigma}$$

$$\varsigma = 6\pi\eta R$$

$$\varsigma D = k_BT$$

$$R_G = \sqrt{\frac{\sum_{i=1}^{N} m_i\overline{r_i}^2}{\sum_{i=1}^{N} m_i}} = \sqrt{\frac{\left\langle\overline{r_N}^2\right\rangle}{6}}$$

$$D\nabla^2c = \frac{\partial c}{\partial t}$$

$$j = D\left(-\frac{\partial c}{\partial x} + \frac{q}{k_BT}\varepsilon c\right)$$

$$\kappa = \frac{l}{A}\frac{1}{R} = \sum_i \frac{D_iq_i^2c_i}{k_BT}$$

$$Q = \frac{\pi R^4}{8L\eta}p$$

$$I = -NK\sum_{j=1}^{M} P_j \ln P_j$$

$$S = k_B \ln \Omega \qquad S = k_B \ln\left[\frac{1}{2}\left(\frac{2\pi^{3N/2}}{\left(\frac{3N}{2}-1\right)!}\right)(2mE)^{3N/2} V^N \frac{1}{N!} h^{-3N}\right]$$

$$T = \left(\frac{dS}{dE}\right)^{-1}$$

$$F = E - TS \qquad H = E + pV \qquad G = E + pV - TS$$

$$P_i(E_i) = \frac{1}{Z} e^{-\frac{E_i}{k_B T}}$$

$$p_{equil} = c k_B T$$

$$\Sigma = \frac{Rp}{2}$$

$$j_V = -L_p\left(\Delta p - \Delta c \cdot k_B T\right)$$

$$\phi = \oint_A \overline{\mathrm{E}} \cdot d\overline{A} = \frac{q}{\varepsilon}$$

$$\frac{d\mathrm{E}}{dx} = \frac{\rho_q}{\varepsilon} \qquad \frac{d^2V}{dx^2} = -\frac{\rho_q}{\varepsilon}$$

$$\frac{d^2V}{dx^2} = -\sum_i \frac{z_i e N_A}{\varepsilon} c_{i0} e^{-\frac{z_i e V(x)}{k_B T}}$$

$$\lambda_D = \sqrt{\frac{\varepsilon k_B T}{\sum_i (z_i e)^2 N_A c_0}}$$

$$\mu_\alpha = -T \left.\frac{dS}{dN_\alpha}\right|_{E, N_{\beta,\beta\neq\alpha}} \qquad \mu = k_B T \ln\left(\frac{c}{c_0}\right) + \mu^0(T) + zeV \qquad a = e^{\frac{\mu-\mu^0}{k_B T}}$$

$$\Delta G^0 = \nu_{k+1}\mu_{k+1}^0 + \ldots + \nu_m \mu_m^0 - \nu_1 \mu_1^0 - \ldots - \nu_k \mu_k^0$$

$$K_{eq} \equiv e^{-\frac{\Delta G^0}{k_B T}} = \frac{[X_{k+1}]^{\nu_{k+1}} \cdots [X_m]^{\nu_m}}{[X_1]^{\nu_1} \cdots [X_k]^{\nu_k}}$$

$$pK_{eq} = -\log_{10} K_{eq}$$

$$\beta = -\frac{d[HA]}{d(pH)}$$

$$V_0 = \frac{V_{\max}[S]}{[S] + K_m}$$

$$j_{q,i} = z_i e j_i = (\Delta V - V_i^{Nernst}) g_i$$

$$\Delta V = \frac{g_K V_K^{Nernst} + g_{Na} V_{Na}^{Nernst} + g_{Cl} V_{Cl}^{Nernst}}{g_K + g_{Na} + g_{Cl}}$$