MECH 221 **Equation Sheet** **Given in Final Exam**

The following equations will be given to you during the exam in Mech221.

It is strongly suggested that you know how to use the following equations and know what they mean. We will assume however that you know the normal general geometric formulae (eg. Area of circle) and physical formulae (eg. mass = density x volume).

$$F_{Net} = F_A + F_R \qquad E = \int F dr \qquad E_{Net} = E_A + E_R \qquad \rho = \frac{nA}{V_c N_A} \qquad n\lambda = 2d_{hkl}\sin\theta$$

$$\%ionicity = \left\{1 - \exp\left(-0.25[X_A - X_B]^2\right)\right\} x100 \qquad N_v = N\exp\left(\frac{-Q}{kT}\right) \qquad D = D_o\exp\left(\frac{-Q}{RT}\right)$$

$$\frac{C_X - C_0}{C_s - C_0} = 1 - erf\left(\frac{x}{2\sqrt{Dt}}\right) \qquad d_{hkl} = \frac{a}{\sqrt{h^2 + k^2 + l^2}} \qquad N = 2^{n-1} \qquad J = -\frac{M}{At}$$

$$J = -D\frac{dc}{dx} \qquad \frac{dC}{dt} = D\frac{d^2c}{dx^2} \qquad C_1 = \frac{m_1}{m_1 + m_2} x100$$

$$\tau = \frac{F}{A_0} = G\gamma \qquad \%El = \left(\frac{l_f - l_0}{l_o}\right) x100 \qquad E = 2G(1+\nu)$$

$$\nu = -\frac{\varepsilon_x}{\varepsilon_z} = -\frac{\varepsilon_y}{\varepsilon_z} \qquad \%AR = \left(\frac{A_o - A_i}{A_o}\right) x100 \qquad U_r = \frac{1}{2}\sigma_y\varepsilon_y = \frac{\sigma_y^2}{2E}$$

$$\tau = G\gamma \qquad \%crystallinity = \frac{\rho_c(\rho_s - \rho_a)}{\rho_s(\rho_c - \rho_a)} \qquad TS = TS_\infty - \frac{A}{\overline{M}_n}$$

$$K_{1c} = Y\sigma\sqrt{\pi a} \qquad \sigma_{fs} = \sigma_o\exp(-nP) \qquad E = E_o(1 - 1.9P + 0.9P^2)$$

$$\sigma_{fs} = \frac{3F_f L}{2bd^2} \qquad \sigma_{fs} = \frac{F_f L}{\pi R^3} \qquad E = \frac{F}{\delta}\frac{L^3}{4bd^3} \qquad E = \frac{F}{\delta}\frac{L^3}{12\pi R^4}$$

$$\Delta V = I\,R \qquad R = \frac{\rho L}{A} = \frac{L}{A\sigma}$$

$$\rho_{total} = \rho_{thermal} + \rho_{impurity} + \rho_{def} \qquad \rho_{thermal} = \rho_o + aT \qquad \rho_{impurity} = Ac_i(1 - c_i)$$

$$\sigma = n|e|\mu_e + p|e|\mu_h \qquad \mathbf{C = q/\Delta T = \delta q/dT}\ \text{[J/mol-K]} \qquad C_V = \left(\frac{\delta q}{dT}\right)_V \qquad C_P = \left(\frac{\delta q}{dT}\right)_P$$

$$\frac{\Delta L}{L_o} = \alpha(T_2 - T_1) \qquad q = -k\frac{dT}{dx} \qquad H = \frac{NI}{L} \qquad B = \mu H \qquad \mu_r = \frac{\mu}{\mu_0}$$

$$B = \mu_0 H + \mu_0 M \qquad M = \chi_m H \qquad \chi_m = \mu_r - 1$$

$$E = h\nu = hc/\lambda \qquad I_0 = I_T + I_A + I_P$$

Constants

$N_A = 6.023 \times 10^{23}$ atoms/mol   speed of light = 3×10^8 m/s

k = 8.62×10^{-5} eV/atom   Planck's constant = 6.63×10^{-34} J-s = 4.13×10^{-15} eV-s

R = 8.314 J/(mol.K)