Physics 102
Formula sheet for Final Exam
Fall Session 2000-2001 (Term 002)

$$v = \sqrt{\frac{F}{\mu}} \qquad v = \lambda f$$

$$v = \sqrt{\frac{Y}{\rho}} \qquad v = \sqrt{\frac{B}{\rho}}$$

$$S = S_m \cos(kx - \omega t)$$

$$I = \frac{\text{Power}}{\text{Area}}$$

$$y = y_m \sin(kx - \omega t - \varphi)$$

$$P = \frac{1}{2}\mu\omega^2 A^2 v$$

$$\Delta P = \Delta P_m \sin(kx - \omega t)$$

$$\Delta P_m = \rho v \omega S_m$$

$$I = \frac{1}{2}\rho(\omega S_m)^2 v$$

$$\beta = 10 \log \frac{I}{I_0}\ ,\ I_0 = 10^{-12}\,W/m^2$$

$$f' = f\left(\frac{v \pm v_D}{v \mp v_s}\right)$$

$$y = \left(2y_m \cos\frac{\varphi}{2}\right)\sin\left(kx - \omega t - \frac{\varphi}{2}\right)$$

$$\Delta L = \alpha L \Delta T \qquad \Delta L = \frac{\lambda}{2\pi}\varphi$$

$$\Delta L = n\frac{\lambda}{2} \qquad n = 0,2,4,...$$

$$\Delta L = n\frac{\lambda}{2} \qquad n = 1,3,5,....$$

$$\Delta L = m\lambda \qquad \Delta L = \left(m + \frac{1}{2}\right)\lambda$$

$$f_n = \frac{n}{2L}\sqrt{\frac{\tau}{\mu}}, \qquad n = 1,2,3,...$$

$$f_n = \frac{nv}{2L}, \qquad n = 1,2,3,...$$

$$f_n = \frac{nv}{4L}, \qquad n = 1,3,5,..$$

$$y = 2y_m \sin kx \cos\omega t$$

$$\alpha = \frac{\Delta L}{L}\frac{1}{\Delta T}, \quad F = \left(\frac{\Delta L}{L}\right)EA$$

$$n = 1,2,3,...$$

$$PV = nRT = NkT$$

$$\beta = \frac{1}{V}\frac{\Delta V}{\Delta T} \qquad n = \frac{m}{M} = \frac{N}{N_A}$$

$$Q = mL \qquad \Delta U = Q - W$$

$$W = \int P dV\ ,$$

$$P = \frac{2}{3}\frac{N}{V}\left(\frac{1}{2}m\vec{v}^2\right),\ v_{rms} = \sqrt{\frac{3RT}{M}}$$

$$\frac{1}{2}m\vec{v}^2 = \frac{3}{2}k_B T, \quad \Delta U = n c_v \Delta T$$

$$Q = m c \Delta T \quad , \quad Q = n c \Delta T$$

$$\Delta E_{int} = Q - W\ ,\ \Delta E_{int} = n c_v \Delta T$$

$$C_p - C_v = R$$

$$H = \frac{Q}{t} = \kappa A \frac{T_H - T_C}{L}$$

$$Q = n c_p \Delta T \ , \quad Q = n c_v \Delta T$$

$$P V^{\gamma} = \text{constant}\ ,\ T V^{\gamma - 1} = \text{constant}$$

$$F = \frac{9}{5}C + 32\ ,\ K = C + 273$$

$$W = Q_h - Q_c\ , \quad \varepsilon = \frac{W}{Q_h} = 1 - \frac{Q_c}{Q_h}$$

$$\frac{Q_c}{Q_h} = \frac{T_c}{T_h},\ (K)_{Ref} = \frac{Q_c}{W}$$

$$(K)_{Heat-Pump} = \frac{Q_h}{W},\ \Delta S = \int\frac{dQ_r}{T}$$

$$F = \frac{kq_1q_2}{r^2}\ ,\ F = q_0 E$$

$$\varphi = \int_{Surface}\vec{E}.d\vec{A}\ ,\ E = \frac{kq}{r^2}$$

$$E = \frac{kQ}{R^3}r \quad , \quad E = \frac{2k\lambda}{r}$$

$$U = -\vec{P}.\vec{E}\ ,\ \varphi_c = \oint\vec{E}.d\vec{A} = \frac{q_{in}}{\varepsilon_0}$$

$$E = \frac{\sigma}{2\varepsilon_o} \qquad E = \frac{\sigma}{\varepsilon_o}$$

$$\vec{\tau} = \vec{P}\times\vec{E}\ ,\ V = \frac{kQ}{r}$$

$$W = \Delta K = -\Delta U$$

$$\Delta V = V_B - V_A = -\int_A^B\vec{E}.d\vec{S} = \frac{\Delta U}{q_0}$$

$$E_x = -\frac{\partial V}{\partial x},\ E_y = -\frac{\partial V}{\partial y},\ E_z = -\frac{\partial V}{\partial z}$$

$$U = \frac{kq_1q_2}{r_{12}},\ C = \frac{Q}{V}\ ,\ C = \frac{\varepsilon_0 A}{d}$$

$$U = \frac{1}{2}CV^2,\ C = \kappa C_0,\quad E = \frac{E_0}{\kappa},$$

$$V = \frac{V_0}{\kappa},\ I = \frac{dQ}{dt}\ ,\ I = \frac{\Delta Q}{\Delta t},\ I = JA$$

$$R = \frac{V}{I} = \rho\frac{L}{A}\ ,\quad J = \sigma E$$

$$\rho = \rho_0[1 + \alpha(T - T_0)],\ P = IV$$

$$q(t) = C\varepsilon[1 - e^{-t/RC}],$$
$$q(t) = q_o e^{-t/RC}$$

$$d\vec{F} = I\,d\vec{s}\times\vec{B},\quad r = \frac{mv}{qB}$$

$$\vec{\tau} = \vec{\mu}\times\vec{B},\ \vec{\mu} = I\vec{A}$$

$$d\vec{B} = \frac{\mu_0}{4\pi}\frac{I\,d\vec{s}\times\vec{r}}{r^3},\ \oint\vec{B}.d\vec{s} = \mu_0 i$$

$$B = \frac{\mu_0 I}{4\pi R}\varphi\ ,\quad B = \frac{\mu_0 I}{2\pi a}$$

$$B_s = \mu_0\left(\frac{N}{L}\right)I = \mu_0 n I$$

$$\varphi_B = \int_{Surface}\vec{B}.d\vec{A}$$

$$\varepsilon = -\frac{d\varphi_B}{dt}\ ,\quad \varepsilon = BLv$$

$$\vec{v} = \vec{v}_o + \vec{a}t$$

$$x - x_o = v_o t + \frac{1}{2}at^2$$

$$v^2 = v_o^2 + 2a(x - x_o)$$

$\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/N.m^2$
$k = 9.0 \times 10^9\ N.m^2/C^2$
$q_e = -1.6 \times 10^{-19}\ C$
$m_e = 9.11 \times 10^{-31}\ kg$
$m_p = 1.67 \times 10^{-27}\ kg$
$1\ eV = 1.6 \times 10^{-19}\ J$
$1\ cal = 4.186\ J$
$micro = 10^{-6}$, $nano = 10^{-9}$,
$pico = 10^{-12}$
$\mu_0 = 4\pi \times 10^{-7}\ Wb/A.\ m$
$k = 1.38 \times 10^{-23}\ J/K$
$N_A = 6.02 \times 10^{23} molecules/mole$
$1\ atm = 1.013 \times 10^5\ N/m^2$
$R = 8.31\ J/mol.\ K$
$\rho(water) = 1\ g/cm^3$
$g = 9.8\ m/s^2$
$1\ cal = 4.186\ Joule$