

**Physics 102**  
**Formula sheet for Final Exam**  
**Fall Session 2000-2001(Term 001)**

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

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

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

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

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

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

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

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

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

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

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

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

$$\Delta L = \alpha L \Delta T \quad \Delta L = \frac{\lambda}{2\pi} \phi$$

$$\Delta L = n \frac{\lambda}{2} \quad n = 0, 2, 4, \dots$$

$$\Delta L = n \frac{\lambda}{2} \quad n = 1, 3, 5, \dots$$

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

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

$$f_n = \frac{nv}{2L}, \quad n = 1, 2, 3, \dots$$

$$f_n = \frac{nv}{4L}, \quad n = 1, 3, 5, \dots$$

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

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

$$n = 1, 2, 3, \dots$$

$$PV = nRT = NkT$$

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

$$Q = mL, \quad \Delta U = Q - W$$

$$W = \int PdV,$$

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

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

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

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

$$C_p - C_v = R$$

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

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

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

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

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

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

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

$$F = \frac{kq_1 q_2}{r^2}, \quad F = q_0 E$$

$$\phi = \int_{\text{Surface}} \vec{E} \cdot d\vec{A}, \quad E = \frac{kq}{r^2}$$

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

$$U = -\vec{P} \cdot \vec{E}, \quad \phi_c = \oint \vec{E} \cdot d\vec{A} = \frac{q_{\text{in}}}{\varepsilon_0}$$

$$E = \frac{\sigma}{2\varepsilon_0}, \quad E = \frac{\sigma}{\varepsilon_0}$$

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

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

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

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

$$U = \frac{kq_1 q_2}{r_{12}}, \quad C = \frac{Q}{V}, \quad C_0 = \frac{\varepsilon_0 A}{d}$$

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

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

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

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

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

$$q(t) = q_0 e^{-t/RC}$$

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

$$F_{ba} = \frac{\mu_0 I_a I_b}{2\pi d}$$

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

$$d\vec{B} = \frac{\mu_0 I d\vec{s} \times \vec{r}}{4\pi r^3}, \quad \oint \vec{B} \cdot d\vec{s} = \mu_0 i_{\text{enc}}$$

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

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

$$\phi_B = \int_{\text{Surface}} \vec{B} \cdot d\vec{A}$$

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


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$$x - x_0 = v_0 t + \frac{1}{2} at^2$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

$$\varepsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{N.m}^2$$

$$k = 9.0 \times 10^9 \text{ N.m}^2/\text{C}^2$$

$$q_e = -1.6 \times 10^{-19} \text{ C}$$

$$m_e = 9.11 \times 10^{-31} \text{ kg}$$

$$m_p = 1.67 \times 10^{-27} \text{ kg}$$

$$1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$$

$$1 \text{ cal} = 4.186 \text{ J}$$

$$\text{micro} = 10^{-6}, \quad \text{nano} = 10^{-9},$$

$$\text{pico} = 10^{-12}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ Wb/A.m}$$

$$k = 1.38 \times 10^{-23} \text{ J/K}$$

$$N_A = 6.02 \times 10^{23} \text{ molecules/mole}$$

$$1 \text{ atm} = 1.013 \times 10^5 \text{ N/m}^2$$

$$R = 8.31 \text{ J/mol.K}$$

$$\rho(\text{water}) = 1 \text{ g/cm}^3$$

$$g = 9.8 \text{ m/s}^2$$

$$1 \text{ cal} = 4.186 \text{ Joule}$$