PH112 PHYSICS EQUATIONS

$$\theta = \frac{s}{r}$$

$$\omega = \frac{d\theta}{dt}$$

$$\alpha = \frac{d\omega}{dt}$$

$$\theta_f = \theta_i + \omega_i t + \frac{1}{2}\alpha(\Delta t)^2$$

$$\omega_f = \omega_i + \alpha\Delta t$$

$$\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$$

$$v = R\omega \qquad a = R\alpha$$

$$\left|\vec{A}\times\vec{B}\right| = AB\sin(\theta)$$

$$\vec{\tau} = \vec{r}\times\vec{F}$$

$$\tau = rF\sin(\phi)$$

$$\sum\tau = I\alpha$$

$$I = \sum m_i r_i^2$$

$$I_p = I_{cm} + Md^2$$

$$\vec{L} = \vec{r}\times\vec{p}$$

$$\vec{L} = I\vec{\omega}$$

$$K_{rot} = \frac{1}{2}I\omega^2$$

$$x(t) = A\cos(\omega t + \phi_0)$$

$$v_{MAX} = \omega A$$

$$\omega = \sqrt{\frac{k}{m}}$$

$$\omega = \frac{2\pi}{T} = 2\pi f$$

$$E = \frac{1}{2}kA^2$$

$$T = 2\pi\sqrt{\frac{l}{g}}$$

$$D(x,t) = A\sin\left[kx - \omega t + \phi_o\right]$$

$$v = \frac{\omega}{k} = \lambda f \qquad v = \sqrt{\frac{T_s}{\mu}}$$

$$D(x,t) = \left[2a\sin(kx)\right]\cos(\omega t)$$

$$f = \frac{v}{\lambda} = m\frac{v}{2L} \qquad k = \frac{2\pi}{\lambda}$$

$$\vec{F}_{1on2} = k\frac{q_1 q_2}{r_{12}^2}\hat{r}_{12}$$

$$\vec{E} = \frac{\vec{F}}{q_o} \qquad E = \frac{1}{4\pi\varepsilon_o}\frac{q}{r^2}$$

$$E_{rod} = \frac{|Q|}{4\pi\varepsilon_o}\frac{1}{r\sqrt{r^2 + (L/2)^2}}$$

$$E_{ring} = \frac{1}{4\pi\varepsilon_o}\frac{zQ}{(z^2+R^2)^{3/2}}$$

$$E_{disk} = \frac{\eta}{2\varepsilon_o}\left[1 - \frac{z}{\sqrt{z^2+R^2}}\right]$$

$$E = \frac{1}{4\pi\varepsilon_o}\frac{p}{z^3}$$

$$\vec{F} = q\vec{E}$$

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

$$\Phi = \int \vec{E}\cdot d\vec{A}$$

$$\Phi_c = \oint \vec{E}\cdot d\vec{A} = \frac{Q_{enclosed}}{\varepsilon_0}$$

$$\lambda = Q/L \quad \eta = Q/A \quad \rho = Q/V$$

$$E = \frac{\eta}{2\varepsilon_0} \qquad E = \frac{1}{4\pi\varepsilon_0}\frac{2\lambda}{r}$$

$$E = \frac{\eta}{\varepsilon_0} \qquad V = Ed$$

$$V = \frac{U}{q_0} \qquad V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$$

$$\Delta V = V_f - V_i = -\int_i^f \vec{E}\cdot d\vec{s}$$

$$V_{Total} = \frac{1}{4\pi\varepsilon_o}\sum_{i=1}^{n}\left(\frac{q_i}{r_i}\right)$$

$$V = \frac{1}{4\pi\varepsilon_o}\int\frac{dq}{r}$$

$$U = \frac{1}{4\pi\varepsilon_o}\frac{q_1 q_2}{r}$$

$$Q = C\Delta V_C \qquad C = \frac{\varepsilon_O A}{d}$$

$$C = 4\pi\varepsilon_o\frac{R_1 R_2}{R_2 - R_1}$$

$$C = 2\pi\varepsilon_o\frac{L}{\ln(R_2/R_1)}$$

$$C_{eq} = \sum_{j=1}^{n} C_j \qquad \frac{1}{C_{eq}} = \sum_{j=1}^{n}\frac{1}{C_j}$$

$$U = \frac{Q^2}{2C} = \frac{1}{2}C\Delta V^2$$

$$v_d = \frac{e\tau}{m_e}E \qquad i = nAv_d$$

$$I = \frac{dq}{dt} = ei$$

$$J = \frac{I}{A} = \sigma E = nev_d$$

$$\sigma = \frac{1}{\rho} = \frac{ne^2\tau}{m_e}$$

$$R = \frac{\rho L}{A} \qquad \Delta V_R = IR$$

$$R_{eq} = \sum_{j=1}^{n} R_j \qquad \frac{1}{R_{eq}} = \sum_{j=1}^{n}\frac{1}{R_j}$$

$$P = I\Delta V = \frac{\Delta V^2}{R} = I^2 R$$

$$u = \frac{1}{2}\varepsilon_0 E^2$$

$$q(t) = q_o\left(e^{-t/RC}\right)$$

$$q(t) = C\varepsilon\left(1 - e^{-t/RC}\right)$$

$$K_{\max} = eV_{stop} = hf - E_0$$

$$E = hf \qquad c = f\lambda \qquad E_0 = hf_0$$

$$\lambda = h/p = h/mv$$

Physical Constants:

$k = 1/4\pi\varepsilon_o$

$\varepsilon_o = 8.854 \times 10^{-12}\ C^2/N.m^2$

$e = 1.602 \times 10^{-19}\ C$

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

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

$c = 3.00 \times 10^{8}\ m/s$

$h = 6.626 \times 10^{-34}\ J.s$