## EQUATIONS

$$\vec{F}_{net} = m\vec{a}$$

$$v = \frac{dx}{dt}, \quad a = \frac{d^2x}{dt^2}$$

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

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

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

$$\theta = \theta_0 + \omega_0 \Delta t + \frac{1}{2}\alpha \Delta t^2$$

$$\omega = \omega_0 + \alpha \Delta t$$

$$\omega^2 = \omega_0^2 + 2\alpha \Delta\theta$$

$$v_t = r\omega$$

$$a_t = r\alpha, \quad a_r = r\omega^2$$

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

$$\tau = rF \sin\phi$$

$$\tau_{net} = I\alpha$$

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

$$I = I_{CM} + Md^2$$

$$\vec{L} = \vec{r} \times m\vec{v}$$

$$\frac{d\vec{L}}{dt} = \vec{\tau}_{net}$$

$$L = I\omega$$

$$U_g = Mgy_{cm}$$

$$K_{cm} = \frac{1}{2}Mv_{cm}^2$$

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

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

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

$$\tan\phi_0 = -\frac{v_0}{\omega x_0}$$

$$F_{sp} = -kx$$

$$\omega = \sqrt{\frac{k}{m}}, \quad \omega = \sqrt{\frac{g}{L}}$$

$$E = \frac{1}{2}mv^2 + \frac{1}{2}kx^2 = \frac{1}{2}kA^2$$

$$y(x,t) = A\cos\left[kx \pm \omega t + \phi_0\right]$$

$$v = \frac{\omega}{k} = \lambda f$$

$$k = \frac{2\pi}{\lambda}$$

$$v = \sqrt{\frac{T}{\mu}}$$

$$y(x,t) = A_{SW} \sin kx \sin \omega t$$

$$\frac{2\pi}{\lambda}\Delta x + \Delta\phi_0 = 2m\pi$$

$$\frac{2\pi}{\lambda}\Delta x + \Delta\phi_0 = 2\left(m + \frac{1}{2}\right)\pi$$

$$f_n = \frac{v}{2L}n, \quad \lambda_n = \frac{2L}{n}$$

$$f_n = \frac{v}{4L}n, \quad \lambda_n = \frac{4L}{n}$$

$$F = \frac{1}{4\pi\varepsilon_0}\frac{|q_1||q_2|}{r^2}$$

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

$$E = \frac{1}{4\pi\varepsilon_o}\frac{q}{r^2}$$

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

$$E = \frac{\lambda}{2\pi\varepsilon_o r}$$

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

$$\Phi_e = \vec{E} \cdot \vec{A}$$

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

$$\Phi_e = \oint \vec{E} \cdot d\vec{A} = \frac{Q_{in}}{\varepsilon_0}$$

$$U = qV$$

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

$$V = Ed$$

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

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

$$E = \frac{1}{4\pi\varepsilon_o}\frac{xQ}{\left(a^2 + x^2\right)^{3/2}}$$

$$V = \frac{1}{4\pi\varepsilon_o}\frac{Q}{\sqrt{a^2 + x^2}}$$

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

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

$$E_s = -\frac{dV}{ds}$$

$$C = \frac{Q}{V}$$

$$C = \frac{\varepsilon_o A}{d}$$

$$C_{eq} = \sum_{i=1}^{n} C_i$$

$$\frac{1}{C_{eq}} = \sum_{i=1}^{n}\frac{1}{C_i}$$

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

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

$$J = \frac{I}{A}$$

$$J = \sigma E$$

$$\sigma = \frac{1}{\rho}$$

$$V = IR$$

$$R = \frac{\rho L}{A}$$

$$R_{eq} = \sum_{i=1}^{n} R_i$$

$$\frac{1}{R_{eq}} = \sum_{i=1}^{n}\frac{1}{R_i}$$

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

$$\sum_i \Delta V_i = 0$$

$$\sum I_{in} = \sum I_{out}$$

$$Q = Q_o\left(e^{-t/RC}\right)$$

$$I = I_0\left(e^{-t/RC}\right)$$