$K \equiv \frac{1}{2} m v^2$

$K = \frac{1}{2} I \omega^2$

$U = m g y$

$U = \frac{1}{2} k x^2$

$U = -\frac{G m_1 m_2}{r}$

$\vec{\mathbf{p}} \equiv m \vec{v}$

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

$\vec{\mathbf{L}} \equiv \vec{\mathbf{r}} \times \vec{\mathbf{p}}$

$L = r_\perp p$

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

$x = x_o + \frac{v_o + v}{2} t$

$v = v_o + a t$

$v^2 = v_o^2 + 2 a \Delta x$

$\theta = \theta_o + \omega_o t + \frac{1}{2} \alpha t^2$

$\theta = \theta_o + \frac{\omega_o + \omega}{2} t$

$\omega = \omega_o + \alpha t$

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

$v = r \omega$

$a_t = r \alpha$

$a_c = \frac{v^2}{r}$

$a_c = r \omega^2$

$\vec{a} = \frac{1}{m} \sum \vec{\mathbf{F}}$

$F_g = m g$

$F_S = k|x|$

$g = \frac{G m}{r^2}$

$\vec{\mathbf{F}} = m \vec{g}$

$F = \frac{G m_1 m_2}{r^2}$

$f_\kappa = \mu_\kappa F_N$

$f_s^{\text{MAX POSSIBLE}} = \mu_s F_N$

$\vec{\alpha} = \frac{1}{I} \sum \vec{\tau}$

$\vec{\tau} \equiv \vec{\mathbf{r}} \times \vec{\mathbf{F}}$

$\tau \equiv r_\perp F$

$I = m r^2$

$I = I_{cm} + m d^2$

$W = F_\parallel \Delta r$

$W = \vec{\mathbf{F}} \cdot \overrightarrow{\Delta \mathbf{r}}$

$W = \tau \Delta\theta$

$W = -\Delta U$

$F_x = -\frac{dU}{dx}$

$W = \Delta K$

$P \equiv \frac{dE}{dt}$

$P = \vec{\mathbf{F}} \cdot \vec{v}$

$\vec{\mathbf{J}} \equiv \vec{\mathbf{F}} \Delta t$

$\vec{\mathbf{J}} = \overrightarrow{\Delta \mathbf{p}}$

$\frac{d^2 x}{dt^2} = -(2\pi f)^2 x$

$x = x_{max} \cos(2\pi f t)$

$v = -v_{max} \sin(2\pi f t)$

$a = -a_{max} \cos(2\pi f t)$

$v_{max} = (2\pi f) x_{max}$

$a_{max} = (2\pi f)^2 x_{max}$

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

$T = 2\pi \sqrt{\frac{m}{k}}$

$f = \frac{1}{T}$

$\frac{\partial^2 y}{\partial x^2} = \frac{1}{v^2} \frac{\partial^2 y}{\partial t^2}$

$y = y_{max} \cos\left(\frac{2\pi}{\lambda} x - \frac{2\pi}{T} t\right)$

$v = \frac{\lambda}{T} = \lambda f$

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

$\mu = \frac{m}{L}$

$I \propto (\text{Amplitude})^2$

$f_{BEAT} = f_{HIGH} - f_{LOW}$

$f' = \frac{v \pm v_R}{v \mp v_S} f$

$\rho = \frac{m}{V}$

$P = \frac{F}{A}$

$P = P_o + \rho g h$

$P_G = P - P_o$

$\dot{m} = \rho A v$

$\dot{m}_1 = \dot{m}_2$

$A_1 v_1 = A_2 v_2$

$P + \frac{1}{2} \rho v^2 + \rho g h = \text{constant}$

$Q = m c \Delta T$

$Q = m \ell$

$\Delta U = Q - W$

***Trigonometric Identities***

$(\sin\theta)^2 + (\cos\theta)^2 = 1$

$2 \sin\theta \cos\theta = \sin(2\theta)$

***Constants***

$g = 9.80 \, \frac{\text{N}}{\text{kg}}$ (near earth)

$a_g = 9.80 \, \frac{\text{m}}{\text{s}^2}$

$G = 6.67 \times 10^{-11} \, \frac{\text{N} \cdot \text{m}^2}{\text{kg}^2}$

$m_E = 5.97 \times 10^{24} \, \text{kg}$

$r_E = 6.38 \times 10^6 \, \text{m}$

$I_o = 1.00 \times 10^{-12} \, \frac{\text{W}}{\text{m}^2}$

$v_{sound} = 343 \, \frac{\text{m}}{\text{s}}$

$1.000 \, \text{atm} = 1.013 \times 10^5 \, \text{Pa}$

$\rho_{water} = 1.00 \times 10^3 \, \frac{\text{kg}}{\text{m}^3}$

$1.000 \, \text{cal} = 4.186 \, \text{J}$

$c_{water} = 4186 \, \frac{\text{J}}{\text{kg} \cdot \text{C}^\circ}$

# Calculus-Based Physics II by Jeffrey W. Schnick

$$F = k\frac{|q_1||q_2|}{r^2}$$
$$\vec{\mathbf{F}} = q\vec{\mathbf{E}}$$
$$E = \frac{k|q|}{r^2}$$
$$U = q\varphi$$
$$\varphi = Ed$$
$$W = -q\,\Delta\varphi$$
$$\varphi = \frac{kq}{r}$$

$$I = \dot{Q}$$
$$V = IR$$
$$R = \rho\frac{L}{A}$$
$$P = IV$$
$$R_s = R_1 + R_2$$
$$R_p = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$$
$$\mathcal{E} = \mathcal{E}_{\text{MAX}}\sin(2\pi f t)$$
$$\mathcal{E}_{\text{RMS}} = \sqrt{\tfrac{1}{2}}\;\mathcal{E}_{\text{MAX}}$$
$$C_{sc} = \frac{Q}{\varphi}\;,\; C = \frac{Q}{V}$$
$$U = \tfrac{1}{2}CV^2$$
$$C = \kappa\,\epsilon_o\frac{A}{d}$$
$$C_s = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2}}$$
$$C_p = C_1 + C_2$$
$$\tau = RC$$
$$V = \mathcal{E}(1 - e^{-t/\tau})$$
$$V = V_o\,e^{-t/\tau}$$
$$I = I_o\,e^{-t/\tau}$$

$$\vec{\boldsymbol{\tau}} = \vec{\boldsymbol{\mu}}\times\vec{\mathbf{B}}$$
$$\vec{\boldsymbol{\mu}} = NI\vec{\mathbf{A}}$$
$$\vec{\mathbf{F}}_B = \nabla(\vec{\boldsymbol{\mu}}\cdot\vec{\mathbf{B}})$$
$$\vec{\mathbf{F}} = I\,\vec{\mathbf{L}}\times\vec{\mathbf{B}}$$
$$\vec{\mathbf{F}} = q\,\vec{\mathrm{v}}\times\vec{\mathbf{B}}$$
$$\vec{\mathbf{B}} = \frac{\mu_o}{4\pi}\frac{3(\vec{\boldsymbol{\mu}}\cdot\hat{\mathrm{r}})\hat{\mathrm{r}} - \vec{\boldsymbol{\mu}}}{r^3}$$
$$B = \frac{\mu_o}{2\pi}\frac{I}{r}$$
$$\vec{\mathbf{E}} = \vec{\mathrm{v}}_P\times\vec{\mathbf{B}}$$
$$\vec{\mathbf{B}} = -\mu_o\,\epsilon_o\,\vec{\mathrm{v}}_P\times\vec{\mathbf{E}}$$
$$\Phi_B = \int\vec{\mathbf{B}}\cdot\vec{\mathbf{dA}}$$
$$\Phi_B = \vec{\mathbf{B}}\cdot\vec{\mathbf{A}}$$
$$|\mathcal{E}| = N\left|\dot{\Phi}_B\right|$$
$$E = \frac{1}{2\pi r}\left|\dot{\Phi}_B\right|$$
$$m\lambda = d\sin\theta$$
$$(m + \tfrac{1}{2})\,\lambda = d\sin\theta$$
$$m\lambda = w\sin\theta$$
$$m\lambda_2 = 2t$$
$$(m + \tfrac{1}{2})\,\lambda_2 = 2t$$
$$\lambda_2 = \frac{n_1}{n_2}\lambda_1$$
$$I = I_o(\cos\theta)^2$$
$$n = \frac{c}{v}$$
$$n_1\sin\theta_1 = n_2\sin\theta_2$$
$$\sin\theta_c = \frac{n_2}{n_1}$$

$$\frac{1}{f} = \frac{1}{o} + \frac{1}{i}$$
$$M = \frac{h'}{h}$$
$$M = -\frac{i}{o}$$
$$P = \frac{1}{f}$$
$$P = P_1 + P_2$$
$$\frac{1}{f} = (n - n_o)\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$$

$$\int(\cos x)\,dx = \sin x$$
$$\int(\cos x)^2\,dx = \frac{x}{2} + \frac{\sin 2x}{4}$$
$$\int\frac{dx}{\cos x} = \tfrac{1}{2}\ln\frac{1 + \sin x}{1 - \sin x}$$
$$\int\frac{dx}{(\cos x)^2} = \tan x$$
$$\int\frac{dx}{\sqrt{x^2 + a^2}} = \ln\left(x + \sqrt{x^2 + a^2}\right)$$
$$\int\frac{x\,dx}{\sqrt{x^2 + a^2}} = \sqrt{x^2 + a^2}$$
$$\int\frac{x^2\,dx}{\sqrt{x^2 + a^2}} = \frac{x}{2}\sqrt{x^2 + a^2} - \frac{a^2}{2}\ln\left(x + \sqrt{x^2 + a^2}\right)$$
$$\int\frac{dx}{(x^2 + a^2)^{3/2}} = \frac{1}{a^2}\frac{x}{\sqrt{x^2 + a^2}}$$
$$\int\frac{x\,dx}{(x^2 + a^2)^{3/2}} = -\frac{1}{\sqrt{x^2 + a^2}}$$
$$\int\frac{x^2\,dx}{(x^2 + a^2)^{3/2}} = -\frac{x}{\sqrt{x^2 + a^2}} + \ln\left(x + \sqrt{x^2 + a^2}\right)$$

$$dq = \lambda\,dx$$
$$dE = \frac{k\,dq}{r^2}$$
$$d\varphi = \frac{k\,dq}{r}$$
$$\vec{\mathbf{F}} = -\nabla U$$
$$\vec{\mathbf{E}} = -\nabla\varphi$$
$$\Phi_E = \int\vec{\mathbf{E}}\cdot\vec{\mathbf{dA}}$$
$$\vec{\mathbf{dB}} = \frac{\mu_o}{4\pi}\frac{I\,\vec{\mathbf{d\ell}}\times\vec{\mathrm{r}}}{r^3}$$

$$\oint\vec{\mathbf{E}}\cdot\vec{\mathbf{d\ell}} = -\dot{\Phi}_B$$
$$\oint\vec{\mathbf{B}}\cdot\vec{\mathbf{dA}} = 0$$
$$\oint\vec{\mathbf{B}}\cdot\vec{\mathbf{d\ell}} = \mu_o I_{\text{THROUGH}} + \mu_0\epsilon_0\dot{\Phi}_E$$
$$\oint\vec{\mathbf{E}}\cdot\vec{\mathbf{dA}} = \frac{Q_{\text{ENCLOSED}}}{\epsilon_o}$$

$$1\,\mathrm{e} = 1.60\times10^{-19}\,\mathrm{C}$$
$$k = \frac{1}{4\pi\epsilon_o}$$
$$k = 8.99\times10^9\,\frac{\mathrm{N\cdot m^2}}{\mathrm{C^2}}$$
$$\epsilon_o = 8.85\times10^{-12}\,\frac{\mathrm{C^2}}{\mathrm{N\cdot m^2}}$$
$$\mu_o = 4\pi\times10^{-7}\,\frac{\mathrm{T\cdot m}}{\mathrm{A}}$$
$$n_{H_2O} = 1.33$$
$$m_e = 9.11\times10^{-31}\,\mathrm{kg}$$
$$m_p = 1.6726\times10^{-27}\,\mathrm{kg}$$
$$c = 3.00\times10^8\,\frac{\mathrm{m}}{\mathrm{s}}$$
$$N_A = 6.022\times10^{23}\,\frac{\text{particles}}{\text{mole}}$$