Equations for Calculus-Based Physics I

$$x_f = x_i + v_{ix}t + \tfrac{1}{2}a_x t^2 \qquad x_f = x_i + \tfrac{1}{2}\left(v_{ix} + v_{fx}\right)t \qquad v_{fx} = v_{ix} + a_x t \qquad {v_{fx}}^2 = {v_{ix}}^2 + 2a_x\left(x_f - x_i\right)$$

$$\sum \vec{F} = m\vec{a} = \frac{d\vec{p}}{dt} \qquad F_f = \mu F_N \qquad F_{sp,x} = -kx \qquad \sum F_c = m\frac{v^2}{r} \qquad v_t = \omega R \qquad a_t = \alpha R \qquad \omega = 2\pi f = \frac{2\pi}{T}$$

$$W = \int \vec{F}\cdot d\vec{\ell} = -\Delta PE \qquad P = \frac{dW}{dt} \qquad KE = \tfrac{1}{2}mv^2 \qquad PE_g = mgy \qquad PE_{sp} = \tfrac{1}{2}kx^2 \qquad W_{net} = \Delta KE$$

$$\vec{p} = m\vec{v} \qquad M\vec{r}_{cm} = \sum m_i \vec{r}_i = \int \vec{r}\, dm \qquad I = \sum r_i^2 m_i = \int r^2\, dm \qquad I = I_{cm} + MD^2 \qquad \vec{\tau} = \vec{r}\times\vec{F}$$

$$\vec{L} = \vec{r}\times\vec{p} = I\vec{\omega} \qquad \sum \vec{\tau} = I\vec{\alpha} = \frac{d\vec{L}}{dt} \qquad \rho = \frac{dm}{dV} \qquad p = \frac{dF_\perp}{dA} \qquad p = p_{top} + \rho g\,\Delta y \qquad v_1 A_1 = v_2 A_2$$

$$p_1 + \tfrac{1}{2}\rho {v_1}^2 + \rho g y_1 = p_2 + \tfrac{1}{2}\rho {v_2}^2 + \rho g y_2 \qquad F = G\frac{M_1 M_2}{r^2} \qquad PE = -G\frac{M_1 M_2}{r} \qquad \frac{d^2?}{dt^2} = -\left(\omega^2\right)?$$

$$x(t) = x_{max}\cos\left(\omega t + \varphi\right) \qquad \omega_o = \sqrt{\frac{k}{m}} \qquad \omega_o = \sqrt{\frac{g}{L}} \qquad y(x,t) = y_{max}\sin\left(kx \pm \omega t\right) \qquad k = \frac{2\pi}{\lambda}$$

$$v = \sqrt{\frac{F_T}{\mu}} \qquad \mu = \frac{dm}{d\ell} \qquad I = \frac{E}{A\cdot t} = \frac{P}{A} \qquad \beta = 10\log\left(\frac{I}{I_o}\right) \qquad f = f_o\left(\frac{v \pm v_o}{v \pm v_s}\right) \qquad f_n = \frac{nv}{2L} \text{ or } \frac{nv}{4L}$$

Some Constants...

$$1\text{ m} = 3.28\text{ ft} \qquad 1\text{ km} = 0.621\text{ mi} \qquad 1\text{ N} = 0.225\text{ lb} \qquad 1\text{ gal} = 3.786\text{ L} = 0.003786\text{ m}^3$$

$$\rho_{water} = 1000\,\frac{kg}{m^3} \qquad \rho_{air} = 1.20\,\frac{kg}{m^3} \qquad p_o = 1.01\times10^5\text{ Pa} \qquad G = 6.67\times10^{-11}\,\frac{N\cdot m^2}{kg^2}$$

$$M_{earth} = 5.98\times10^{24}\text{ kg} \qquad M_{moon} = 7.36\times10^{22}\text{ kg} \qquad M_{sun} = 1.99\times10^{30}\text{ kg} \qquad R_{earth} = 6.37\times10^6\text{ m}$$

$$R_{moon} = 1.74\times10^6\text{ m} \qquad R_{sun} = 6.96\times10^8\text{ m} \qquad D_{earth-moon} = 3.82\times10^8\text{ m} \qquad D_{earth-sun} = 1.50\times10^{11}\text{ m}$$

$$I_o = 1\times10^{-12}\,\frac{W}{m^2} \qquad \textit{For sound:} \quad v_{air} = \left(331\,\frac{m}{s}\right)\sqrt{1+\frac{T_C}{273}} \qquad v_{water} = 1460\,\frac{m}{s}$$

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