PH1013 Equation Sheet

g = 9.8 m/s^2	G = 6.67×10^{-11} N·m^2/kg^2	$M_E = 5.97 \times 10^{24}$ kg	$R_E = 6380$ km

$$\mathbf{v} = \frac{d\mathbf{r}}{dt}$$
$$\mathbf{a} = \frac{d\mathbf{v}}{dt}$$
$$v_x = v_{x0} + a_x t$$
$$x = x_0 + v_{x0}t + \frac{1}{2}a_x t^2$$
$$v_x^2 = v_{x0}^2 + 2a_x\left(x - x_0\right)$$
$$A = \sqrt{A_x^2 + A_y^2 + A_z^2}$$
$$\mathbf{A} = A_x\hat{\imath} + A_y\hat{\jmath} + A_z\hat{k}$$
$$\mathbf{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$$
$$a = \frac{v^2}{r}$$
$$\mathbf{F}_{\text{net}} = m\mathbf{a}$$
$$F_{\text{fr}} \leq \mu_s F_{\text{N}}$$
$$F_{\text{fr}} = \mu_k F_{\text{N}}$$
$$\mathbf{A}\cdot\mathbf{B} = AB\cos\theta = A_xB_x + A_yB_y + A_zB_z$$
$$W = \mathbf{F}\cdot\boldsymbol{\Delta}\mathbf{r}$$
$$K = \frac{1}{2}mv^2$$
$$W_{\text{net}} = K_f - K_i$$
$$P = \mathbf{F}\cdot\mathbf{v}$$
$$F_{\text{G}} = mg$$
$$F_{\text{sx}} = -kx$$
$$U_{\text{G}} = mgy$$
$$U_{\text{S}} = \frac{1}{2}kx^2$$
$$\mathbf{p} = m\mathbf{v}$$
$$\mathbf{J} = \mathbf{F}_{\text{av}}\Delta t = \Delta\mathbf{p}$$
$$(v_{1i} - v_{2i}) = -\left(v_{1f} - v_{2f}\right)$$
$$\mathbf{r}_{\text{cm}} = \frac{\left(\sum_{i=1}^{n} m_i\mathbf{r_i}\right)}{\left(\sum_{i=1}^{n} m_i\right)}$$
$$v = r\omega$$
$$a_r = \omega^2 r$$
$$a_t = r\alpha$$

$$I = \sum_i m_i r_i^2$$
$$K_{\text{rot}} = \frac{1}{2}I\omega^2$$
$$|\mathbf{A}\times\mathbf{B}| = AB\sin\theta$$
$$\hat{\imath}\times\hat{\jmath} = \hat{k}$$
$$\mathbf{L} = \mathbf{r}\times\mathbf{p} = I\vec{\omega}$$
$$\vec{\tau}_{\text{net}} = I\vec{\alpha} = \frac{d\mathbf{L}}{dt}$$
$$\vec{\tau} = \mathbf{r}\times\mathbf{F}$$
$$I_{\text{hoop}} = MR^2$$
$$I_{\text{disk}} = \frac{1}{2}MR^2$$
$$I_{\text{sphere}} = \frac{2}{5}MR^2$$
$$I_{\text{rod,middle}} = \frac{1}{12}ML^2$$
$$I_{\text{rod,end}} = \frac{1}{3}ML^2$$
$$\omega = \omega_0 + \alpha t$$
$$\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$$
$$\omega^2 = \omega_0^2 + 2\alpha\left(\theta - \theta_0\right)$$
$$\omega = \frac{d\theta}{dt}$$
$$T = \frac{1}{f} = \frac{2\pi}{\omega}$$
$$\omega^2 = \frac{k}{m}$$
$$\omega^2 = \frac{g}{l}$$
$$x = A\cos(\omega t + \phi)$$
$$x = Ae^{-\frac{b}{2m}t}\cos(\omega t + \phi)$$
$$E = \frac{1}{2}kA^2$$
$$F = G\frac{m_1 m_2}{r^2}$$
$$U = -G\frac{m_1 m_2}{r}$$
$$\frac{T^2}{r^3} = \text{constant}$$