

Formula Sheet for Physics 1D03

It is the students responsibility to know whether the formulae are correct and when they can be used.

$$\mathbf{v} \equiv \frac{d\mathbf{r}}{dt}$$

$$\mathbf{a} \equiv \frac{d\mathbf{v}}{dt}$$

$$\mathbf{r}(t) = \mathbf{r}_0 + \mathbf{v}_0 t + \frac{1}{2} \mathbf{a} t^2$$

$$v_x = v_{0x} + a_x t$$

$$x = x_0 + v_{0x} t + \frac{1}{2} a_x t^2$$

$$v_x^2 - v_0^2 = 2a_x(x - x_0)$$

$$\vec{v}_{a,b} + \vec{v}_{b,c} = \vec{v}_{a,c}$$

$$\sum \mathbf{F}_{ext} = m\mathbf{a}_{cm} = \frac{d\mathbf{p}}{dt}$$

$$f_s \leq \mu_s N \quad f_k = \mu_k N$$

$$F_s = -kx$$

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

$$a_t = \frac{d|v|}{dt}$$

$$W = \int F_x dx \text{ (motion along } x \text{ axis)}$$

$$W = \mathbf{F} \cdot \mathbf{d} \text{ (constant force)}$$

$$P = \frac{dW}{dt} = \mathbf{F} \cdot \mathbf{v}$$

$$K = \frac{1}{2} mv^2$$

$$U_g = mgy \quad U_s = \frac{1}{2} kx^2$$

$$K_f + U_f = K_i + U_i + W_{n.c.}$$

$$\mathbf{p} = m\mathbf{v}$$

$$\mathbf{I} \equiv \int_{t_1}^{t_2} \mathbf{F} dt \equiv \bar{\mathbf{F}} \Delta t = \Delta \mathbf{p}$$

$$M\mathbf{r}_{cm} = \sum_i m_i \mathbf{r}_i$$

$$M\mathbf{v}_{cm} = \sum_i m_i \mathbf{v}_i = \mathbf{p}_{total}$$

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

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

$$\omega = \sqrt{\frac{k}{m}} \quad \omega = \sqrt{\frac{g}{\ell}} \quad \omega = \sqrt{\frac{mgd}{I}}$$

Quadratic Equation:

$$\text{If: } ax^2 + bx + c = 0$$

$$\text{Then: } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$s = r\theta$$

$$v = r\omega$$

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

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

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

$$\omega^2 - \omega_0^2 = 2\alpha(\theta - \theta_0)$$

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

$$I = I_{cm} + MD^2$$

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

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

$$L = I\omega$$

$$L = mvr \sin \phi$$

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

$$\tau = I\alpha = \frac{dL}{dt}$$

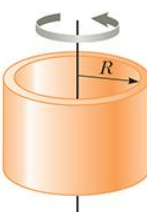

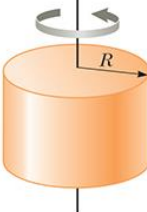

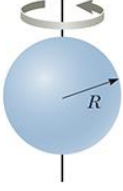
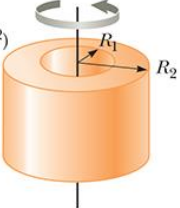
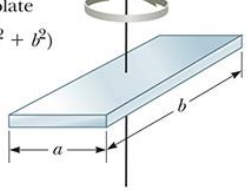
$$K = \frac{1}{2} I\omega^2$$

$$K = \frac{1}{2} I_{cm} \omega^2 + \frac{1}{2} mv_{cm}^2$$

$$W = \tau \Delta \theta$$

$$P = \tau \omega$$

TABLE 10.2 Moments of Inertia of Homogeneous Rigid Objects with Different Geometries

<p>Hoop or thin cylindrical shell $I_{CM} = MR^2$</p> 	<p>Long, thin rod with rotation axis through center $I_{CM} = \frac{1}{12} ML^2$</p> 	
<p>Solid cylinder or disk $I_{CM} = \frac{1}{2} MR^2$</p> 	<p>Long, thin rod with rotation axis through end $I = \frac{1}{3} ML^2$</p> 	<p>Solid sphere $I_{CM} = \frac{2}{5} MR^2$</p> 
<p>Hollow cylinder $I_{CM} = \frac{1}{2} M(R_1^2 + R_2^2)$</p> 	<p>Rectangular plate $I_{CM} = \frac{1}{12} M(a^2 + b^2)$</p> 	<p>Thin spherical shell $I_{CM} = \frac{2}{3} MR^2$</p> 