Formula Sheet for Physics 1D03

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

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

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

$$\boldsymbol{r}(t) = \boldsymbol{r_0} + \boldsymbol{v_0}t + \frac{1}{2}\boldsymbol{a}t^2$$

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

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

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

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

$$\sum \boldsymbol{F_{ext}} = m\boldsymbol{a_{cm}} = \frac{d\boldsymbol{p}}{dt}$$

$$f_s \le \mu_s N \qquad f_k = \mu_k N$$

$$F_s = -kx$$

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

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

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

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

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

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

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

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

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

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

$$M\boldsymbol{r_{cm}} = \sum_i m_i \boldsymbol{r_i}$$

$$M\boldsymbol{v_{cm}} = \sum_i m_i \boldsymbol{v_i} = \boldsymbol{p_{total}}$$

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

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

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

Quadratic Equation:

If: $ax^2 + bx + c = 0$

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

$$s = r\theta$$

$$v = r\omega$$

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

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

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

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

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

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

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

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

$$L = I\omega$$

$$L = mvr\sin\phi$$

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

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

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

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

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

$$P = \tau\omega$$

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