

Possibly Useful Information

Constants & Conversions:

$$g = 9.81 \text{ m/s}^2 \quad 1 \text{ rev} = 360^\circ = 2\pi \text{ rad} \quad 1 \text{ N} = 1 \text{ kgm/s}^2$$

$$c = \text{Speed of light} = 3.00 \times 10^8 \text{ m/s} \quad 1 \text{ u} = 1.67 \times 10^{-27} \text{ kg}$$

$$1 \text{ J} = 1 \text{ Nm} \quad 1 \text{ W} = \text{J/s}$$

Forces:

$$\sum \vec{F} = m\vec{a} \quad \vec{F}_g = mg \quad \vec{F}_{AB} = -\vec{F}_{BA} \quad F_{sp} = -kx$$

$$f_s \leq \mu_s N \quad f_{s,\max} = \mu_s N \quad f_k = \mu_k N \quad F_c = \frac{mv^2}{r}$$

Work and Energy:

$$W = \vec{F} \cdot \vec{d} \quad W = \int_{x_i}^{x_f} F_x dx + \int_{y_i}^{y_f} F_y dy + \int_{z_i}^{z_f} F_z dz \quad W_{sp} = -\frac{1}{2}k(x_f^2 - x_i^2)$$

$$W = \Delta K \quad K = \frac{1}{2}mv^2 \quad P_{ave} = \frac{\Delta W}{\Delta t} \quad P = \frac{dW}{dt} = \vec{F} \cdot \vec{v}$$

$$E_{mec} = U + K$$

$$U(x_f) - U(x_i) = -\int_{x_i}^{x_f} F(x) dx \quad \vec{F}(x) = -\frac{dU}{dx} \hat{i} \quad \vec{F}(x, y, z) = -\vec{\nabla}U$$

$$U_g = mgy \quad U_{sp} = \frac{1}{2}kx^2 \quad E = mc^2$$

Systems:

$$x_{cm} = \frac{1}{M} \sum_i m_i x_i \quad x_{cm} = \frac{1}{M} \int x dm \quad \vec{r}_{cm} = \frac{1}{M} \sum_i m_i \vec{r}_i \quad \vec{r}_{cm} = \frac{1}{M} \int \vec{r} dm$$

$$\vec{v}_{cm} = \frac{d\vec{r}_{cm}}{dt} \quad \vec{a}_{cm} = \frac{d\vec{v}_{cm}}{dt} = \frac{d^2\vec{r}_{cm}}{dt^2} \quad \sum \vec{F}_{ext} = M\vec{a}_{cm}$$

$$\int_{x_i}^{x_f} F_{ext} dx_{cm} = \Delta K_{cm} \quad K_{cm} = \frac{1}{2}Mv_{cm}^2 \quad M = \sum_i m_i \quad M = \int dm$$

$$Rv_{rel} = Ma \quad v_f - v_i = v_{rel} \ln \frac{M_i}{M_f}$$

Momentum & Collisions:

$$\vec{I} = \Delta \vec{p} = \int_{t_1}^{t_2} \vec{F}(t) dt \quad \vec{I} = \vec{F}_{ave} \Delta t \quad \vec{p} = m\vec{v} \quad \vec{p}_f = \vec{p}_i$$

$$\vec{P} = M\vec{v}_{cm} \quad \sum \vec{F} = \frac{d\vec{P}}{dt} \quad \sum \vec{F}_{ext} = \frac{d\vec{P}}{dt}$$

1-D Elastic: $K_{1i} + K_{2i} = K_{1f} + K_{2f}$

$$v_{1f} = \frac{m_1 - m_2}{m_1 + m_2} v_{1i} + \frac{2m_2}{m_1 + m_2} v_{2i} \quad v_{2f} = \frac{2m_1}{m_1 + m_2} v_{1i} + \frac{m_2 - m_1}{m_1 + m_2} v_{2i}$$

Even More Possibly Useful Information

Rotational Motion:

$$\Delta\omega = \alpha t \qquad \Delta\theta = \omega_0 t + \frac{1}{2}\alpha t^2 \qquad \omega^2 = \omega_0^2 + 2\alpha(\Delta\theta)$$

$$\Delta\theta = \frac{1}{2}(\omega + \omega_0)t \qquad \Delta\theta = \omega t - \frac{1}{2}\alpha t^2$$

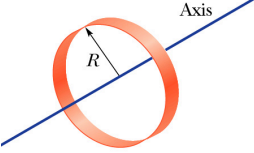
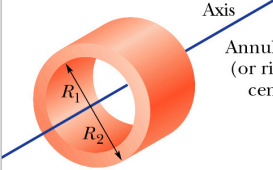
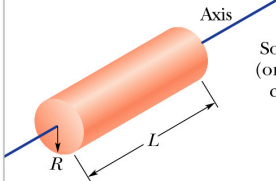
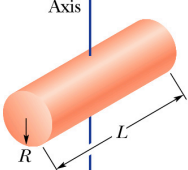
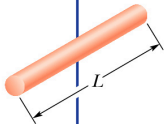

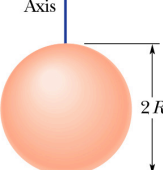
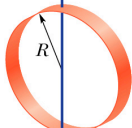
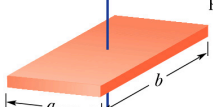
$$s = r\theta \qquad v = r\omega \qquad a_t = r\alpha \qquad a_r = r\omega^2$$

$$I = \sum_i m_i r_i^2 \qquad I = \int r^2 dm \qquad I = I_{cm} + Md^2 \qquad I_{cm} = \beta MR^2$$

$$\vec{\tau} = \vec{r} \times \vec{F} = r_{\perp} F = I\vec{\alpha} \qquad W = \int_{\theta_i}^{\theta_f} \tau d\theta \qquad P_{ave} = \tau\omega \qquad P = \int_{\omega_i}^{\omega_f} \tau d\omega$$

$$K_{tot} = K_{cm} + K_{rot} \qquad K_{rot} = \frac{1}{2}I\omega^2$$

$$\vec{\tau} = \frac{d\vec{L}}{dt} \qquad \vec{l} = \vec{r} \times \vec{p} \qquad \vec{\tau}_{ext} = \frac{d\vec{L}}{dt} \qquad \vec{L} = I\vec{\omega} \qquad \vec{L}_i = \vec{L}_f$$

 $I = MR^2$	 $I = \frac{1}{2}M(R_1^2 + R_2^2)$	 $I = \frac{1}{2}MR^2$
 $I = \frac{1}{4}MR^2 + \frac{1}{12}ML^2$	 $I = \frac{1}{12}ML^2$	 $I = \frac{2}{5}MR^2$
 $I = \frac{2}{3}MR^2$	 $I = \frac{1}{2}MR^2$	 $I = \frac{1}{12}M(a^2 + b^2)$