

Formula Sheets (PHY111)

Vectors and Vector Components (angle is counterclockwise from positive x-axis)

$$A_x = A \cos \theta$$

$$A_y = A \sin \theta$$

$$A = \sqrt{(A_x^2 + A_y^2)}$$

$$\theta = \tan^{-1} \left(\frac{A_y}{A_x} \right)$$

Linear Equations of Motion (x and y are interchangeable)

$$v_x = \frac{\Delta x}{\Delta t}$$

$$a = \frac{\Delta v}{\Delta t}$$

$$v_y = v_0 + at$$

$$\Delta y = \left(\frac{v_0 + v}{2} \right) t$$

$$\Delta y = v_0 t + \frac{1}{2} at^2$$

$$v^2 = v_0^2 + 2a \Delta x$$

$$\text{Range} = \frac{v_0^2 \sin 2\theta_0}{g}$$

Work Energy and Power

$$K.E._{lin} = \frac{1}{2} mv^2$$

$$U_g = mgy$$

$$F = kx$$

$$U_e = \frac{1}{2} kx^2$$

$$W = F \cdot s = F s \cos \theta$$

$$P = \frac{W}{t} = Fv$$

$$f_k = \mu_k n$$

$$f_s \leq \mu_s n$$

Momentum

$$p = mv$$

Newton's law

$$\sum F = ma$$

Impulse

$$J = F\Delta t$$

Elastic collisions only

$$v_{bf} - v_{af} = -(v_{bi} - v_{ai})$$

Rotational motion equations

$$\omega = \frac{\Delta\theta}{\Delta t}$$

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

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

$$\omega^2 = \omega_0^2 + 2\alpha\Delta\theta$$

$$a_{tan} = r\alpha$$

$$a_{linear} = \sqrt{a_{tan}^2 + a_{rad}^2}$$

$$I = mr^2$$

$$\Sigma\tau = I\alpha$$

$$P = \tau\omega$$

$$\alpha = \frac{\Delta\omega}{\Delta t}$$

$$\Delta\theta = \left(\frac{\omega_0 + \omega}{2}\right)t$$

$$\Delta\theta = \omega t - \frac{1}{2}\alpha t^2$$

$$v_{lin} = \omega r$$

$$a_{rad} = \omega^2 r$$

$$K.E._{rot} = \frac{1}{2}I\omega^2$$

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

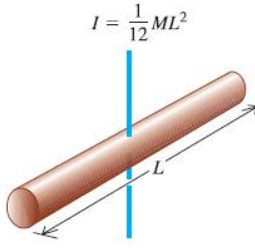
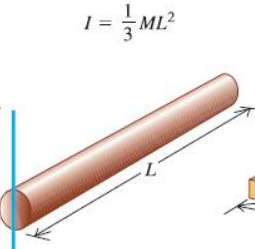
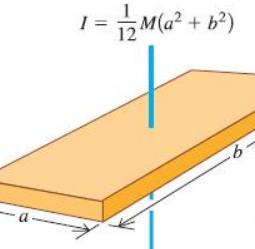
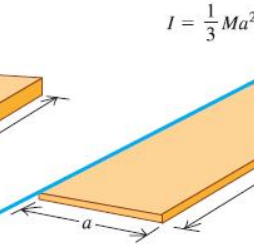
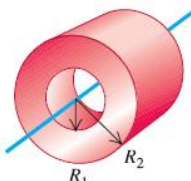
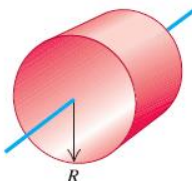
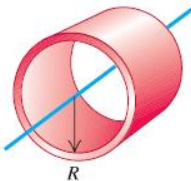
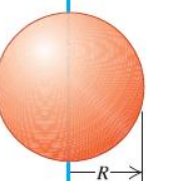
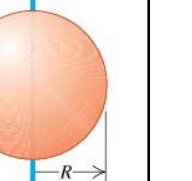
$$\tau = Fl$$

$$L = I\omega$$

Falling mass (m) from solid cylinder (M) only

$$a = \frac{g}{1 + \frac{M}{2m}}$$

$$\alpha = \frac{a}{r}$$

TABLE 9.2 Moments of inertia for various bodies				
$I = \frac{1}{12}ML^2$ 	$I = \frac{1}{3}ML^2$ 	$I = \frac{1}{12}M(a^2 + b^2)$ 	$I = \frac{1}{3}Ma^2$ 	
(a) Slender rod, axis through center	(b) Slender rod, axis through one end	(c) Rectangular plate, axis through center	(d) Thin rectangular plate, axis along edge	
$I = \frac{1}{2}M(R_1^2 + R_2^2)$ 	$I = \frac{1}{2}MR^2$ 	$I = MR^2$ 	$I = \frac{2}{5}MR^2$ 	$I = \frac{2}{3}MR^2$ 
(e) Hollow cylinder	(f) Solid cylinder	(g) Thin-walled hollow cylinder	(h) Solid sphere	(i) Thin-walled hollow sphere