UNIVERSITY PHYSICS II and IIA FORMULA SHEET

$\vec{F}_{net} = m\vec{a}$ $\quad \vec{a} = \dfrac{d\vec{v}}{dt}$ $\quad \vec{v} = \dfrac{d\vec{r}}{dt}$

$\vec{r} = \vec{r}_o + \vec{v}_o t + \frac{1}{2}\vec{a}\ t^2$ $\quad x = x_o + v_{ox}t + \dfrac{1}{2}a_x t^2$

$v^2 = v_o{}^2 + 2\vec{a}\cdot(\vec{r} - \vec{r}_o)$ $\quad v_x{}^2 = v_{ox}{}^2 + 2a_x(x - x_o)$

$\Delta\theta = \theta - \theta_0$ $\quad \omega_{avg} = \dfrac{\Delta\theta}{\Delta t}$ $\quad \omega = \dfrac{d\theta}{dt}$

$\Delta\omega = \omega - \omega_o$ $\quad \alpha_{avg} = \dfrac{\Delta\omega}{\Delta t}$ $\quad \alpha = \dfrac{d\omega}{dt} = \dfrac{d^2\theta}{dt^2}$

$\theta = \theta_o + \omega_o t + \dfrac{1}{2}\alpha t^2$ $\quad \omega^2 = \omega_o{}^2 + 2\alpha(\theta - \theta_0)$

$s = r\theta$ $\quad v = r\omega$ $\quad a_t = \dfrac{d|\vec{v}|}{dt} = r\alpha$ $\quad a_r = \dfrac{v^2}{r} = \omega^2 r$

$I = \sum_i m_i r_i^2$ $\quad I = \int_{\substack{rigid\\body}} r^2 dm$ $\quad I = I_{com} + Mh^2$

$\vec{\tau} = \vec{r} \times \vec{F}$ $\quad \tau = rF\sin\theta = rF_\perp = r_\perp F$

$\vec{\tau}_{net} = I\ \vec{\alpha}$

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

$W = \int_{\theta_i}^{\theta_f} \tau\ d\theta$ $\quad P = \tau\ \omega$

$W_{total} = K_{final} - K_{initial}$ $\quad K_{final} + U_{final} = K_{initial} + U_{initial} + W_{nonconserative}$

$v_{com} = \omega r$ $\quad a_{com} = \alpha r$

$\vec{\ell} = \vec{r} \times \vec{p} = \vec{r} \times m\vec{v}$ $\quad \ell = rp\sin\phi = rp_\perp = r_\perp p$

$\vec{L} = \sum \vec{\ell}$ $\quad \vec{L} = I\vec{\omega}$ $\quad \vec{\tau}_{net} = \dfrac{d\vec{L}}{dt}$

$\dfrac{F}{A} = E\left(\dfrac{\Delta L}{L}\right)$ $\quad \dfrac{F}{A} = G\left(\dfrac{\Delta x}{L}\right)$ $\quad p = B\left(\dfrac{|\Delta V|}{V}\right)$

$a(t) = -\omega^2 x(t)$ $\quad x(t) = x_m \cos(\omega t + \phi)$ $\quad f = \dfrac{1}{T} = \dfrac{\omega}{2\pi}$

$F = -kx$ $\quad U = \frac{1}{2}kx^2$ $\quad T = 2\pi\sqrt{\dfrac{m}{k}}$

$T = 2\pi\sqrt{\dfrac{I}{mgh}}$

$y(x,t) = h(x \pm vt)$ $v = \lambda f = \frac{\omega}{k}$ $k = \frac{2\pi}{\lambda}$

$$y(x,t) = y_m \sin\left(kx \pm \omega t + \phi\right)$$

$$y(x,t) = 2y_m \cos\left(\frac{\phi}{2}\right) \sin\left(kx - \omega t - \frac{\phi}{2}\right)$$

$v = \sqrt{\frac{F_T}{\mu}}$ $P_{avg} = \frac{1}{2}\mu v \omega^2 y_m^2$

$y(x,t) = \left[2\, y_m \sin(kx)\right] \cos(\omega t)$ $\lambda_n = \frac{2L}{n}$ $f_n = n f_1$ $n = 1, 2, 3, 4, 5 \ldots.$

$$\frac{\phi}{2\pi} = \frac{\Delta L}{\lambda}$$

$$v = \sqrt{\frac{B}{\rho}}$$

$\Delta p(x,t) = \Delta p_m \sin(kx - \omega t)$ $s(x,t) = s_m \cos(kx - \omega t)$ $\Delta p_m = \rho v \omega s_m$

$I = \frac{P}{A}$ $I = \frac{P}{4\pi r^2}$ $I = \frac{1}{2}\rho v \left(\omega s_m\right)^2$

$\beta = \left(10.0\text{ dB}\right) \log\left(\frac{I}{I_o}\right)$ $I_o = 10^{-12}\,\frac{\text{W}}{\text{m}^2}$

$y(x,t) = 2\, y_m \cos\left(\frac{\Delta k}{2}x - \frac{\Delta\omega}{2}t\right) \sin\left(k_{avg}\, x - \omega_{avg}\, t\right)$ $f_{beat} = \left|f_2 - f_1\right|$

$$f' = f\left(\frac{v \pm v_D}{v \pm v_S}\right)$$

$n = \frac{c}{v}$ $n_1 \sin\theta_1 = n_2 \sin\theta_2$

$\frac{1}{f} = \frac{1}{p} + \frac{1}{i}$ $m = -\frac{i}{p}$ $|m| = \frac{h'}{h}$

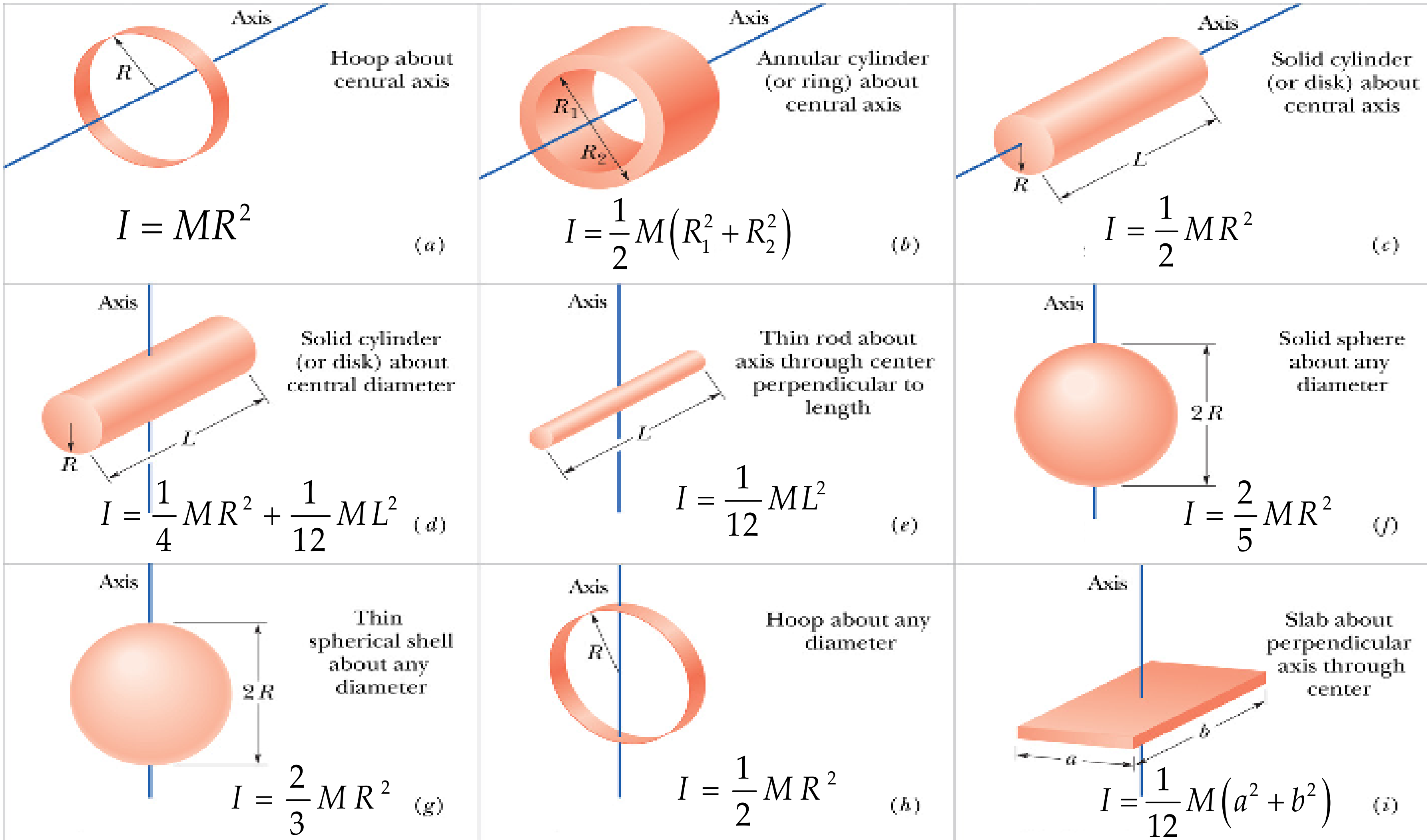
$d \sin\theta = m\lambda$ $m = 0, \pm1, \pm2, \ldots$ (constructive)

$I = 4 I_0 \left(\cos\frac{\phi}{2}\right)^2$ $\phi = \frac{2\pi d}{\lambda}\sin\theta$

$a \sin\theta = m\lambda$ $m = \pm1, \pm2, \pm3, \ldots$ (destructive)

$I = I_m \left(\frac{\sin\alpha}{\alpha}\right)^2$ $\alpha = \frac{\pi a}{\lambda}\sin\theta$

$I = I_0 \cos^2\theta$ $\tan\theta_B = \frac{n_2}{n_1}$



Axis
R
Hoop about central axis
$I = MR^2$
(a)
Axis
R_1
R_2
Annular cylinder (or ring) about central axis
$I = \frac{1}{2}M\left(R_1^2 + R_2^2\right)$
(b)
Axis
R
L
Solid cylinder (or disk) about central axis
$I = \frac{1}{2}MR^2$
(c)
Axis
R
L
Solid cylinder (or disk) about central diameter
$I = \frac{1}{4}MR^2 + \frac{1}{12}ML^2$
(d)
Axis
L
Thin rod about axis through center perpendicular to length
$I = \frac{1}{12}ML^2$
(e)
Axis
2 R
Solid sphere about any diameter
$I = \frac{2}{5}MR^2$
(f)
Axis
2 R
Thin spherical shell about any diameter
$I = \frac{2}{3}MR^2$
(g)
Axis
R
Hoop about any diameter
$I = \frac{1}{2}MR^2$
(h)
Axis
a
b
Slab about perpendicular axis through center
$I = \frac{1}{12}M\left(a^2 + b^2\right)$
(i)