For Rectangle:

$I = \frac{ml^2}{3}$

$I_{AA}: \frac{m(3l)^2}{3}, \quad I_{BB} = \frac{m(l)^2}{3}$

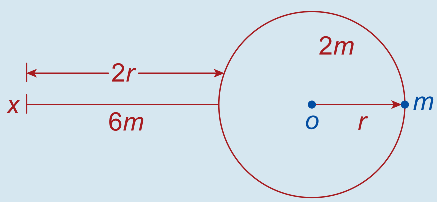
Perpendicular Axes Theorem:

$I_X = I_{AA} + I_{BB}$

$\Rightarrow I_X = \frac{9ml^2}{3} + \frac{ml^2}{3}$

$= \frac{10ml^2}{3}$

(iv)



Pt mass:

$I_X = m(4r)^2 = 16mr^2$

Disc:

$(I_X = I_O + mr^2)$

$= \frac{(2m)r^2}{2} + 2m(3r)^2$

$= 19mr^2$

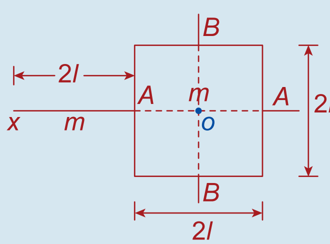
Rod:

$I_X = \frac{4}{3}(6m)r^2$

$= 8mr^2$

$I_{Total} = 19mr^2 + 8mr^2 + 16mr^2$
$= 43mr^2$

(v)



Lamina:

$I_{AA} = I_{BB} = \frac{ml^2}{3}$

$\Rightarrow \perp$ Axes $I_o = I_{AA} + I_{BB}$

$\Rightarrow I_o = \frac{2ml^2}{3}$

$\|$ Axes $(I_X = I_o + mr^2)$

$\Rightarrow I_o = \frac{2ml^2}{3} + m(3l)^2$

$\Rightarrow I_X = \frac{29ml^2}{3}$

Rod:

$I_X = \frac{4}{3}\,ml^2$

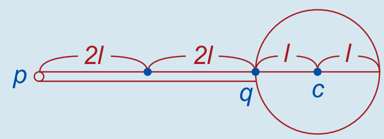
System:

$I_{Total} = I_{Rod} + I_{Lamina}$

$= \frac{29ml^2}{3} + \frac{4ml^2}{3}$

$= 11ml^2$

Q. 4.



Rod:

$I_p = \frac{4}{3}(m)(2l)^2$

$= \frac{16}{3}\,ml^2$

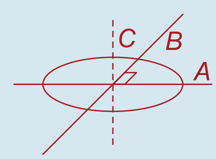
$= 5\frac{1}{3}\,ml^2$

Disc: $I_p = I_c + md^2$

$= \frac{1}{2}(2m)(l)^2 + (2m)(5l)^2 = 51\,ml^2$

Total $= 5\frac{1}{3}ml^2 + 51\,ml^2 = 56\frac{1}{3}ml^2$

Q. 5. (i)



By perpendicular axis theorem

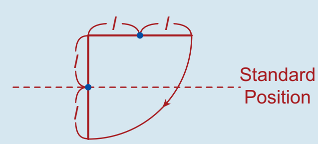
$I_A + I_B = I_C$

(ii) But since $I_A = I_B$ (by symmetry)

$\therefore I_A = \frac{1}{2}I_C$

$\therefore I_A = \frac{1}{2}\left(\frac{1}{2}mr^2\right) = \frac{1}{4}\,mr^2$

Q. 6. $I_p = \frac{4}{3}ml^2$



$mgh_1 + \frac{1}{2}\,I\,\omega_1^2 = mgh_2 + \frac{1}{2}\,I\,\omega_2^2$

$\Rightarrow mg(1) + \frac{1}{2}I(0) = mg(0) + \frac{1}{2}I\,\omega_2^2$

$\Rightarrow I\,\omega_2^2 = 2mg$

$\Rightarrow \frac{4}{3}ml^2\,\omega_2^2 = 2mg$

$\Rightarrow \omega_2 = \sqrt{\frac{3g}{2l}}$