

1996. HLC Q8

$v = r\omega$ Key



micro
 $dm = \rho dA$
 $dA = 2\pi x dx$

macro
 $M = \pi r^2 \rho$

$dI = (dm)x^2$ (5)

$dI = (2\pi \rho x dx)x^2$ (5)

$I = \int_0^r 2\pi \rho x^3 dx$ (5)

$= 2\pi \rho \frac{x^4}{4} \Big|_0^r$ (5)

$= 2\pi \rho \frac{r^4}{4} - \frac{0}{4}$

$= \frac{\pi \rho r^4}{2}$

$= \frac{\pi \rho r^2 r^2}{2}$

$= \frac{Mr^2}{2}$ (5)

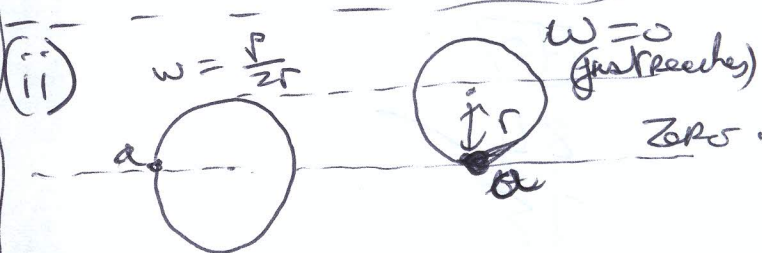
$\Rightarrow \frac{3Mr^2 p^2}{4 \cdot 4r^2} + mgr = \frac{3Mr^2 \omega^2}{4} + 0$

$\Rightarrow \frac{3Mp^2}{16} + mgr = \frac{Mr^2 3\omega^2}{4}$ (5)

$\Rightarrow \frac{3p^2 + 16gr}{16} = \frac{3r^2}{4} \omega^2$

$\Rightarrow \frac{12p^2 + 16gr}{48r^2} = \omega^2$

$\Rightarrow \frac{3p^2 + 16gr}{12r^2} = \omega$ (5)



$E_1 = E_3$

$\frac{1}{2} I \left(\frac{p}{2r}\right)^2 + 0 = 0 + mgr$

$\frac{1}{2} \left(\frac{3Mr^2}{2}\right) \frac{p^2}{4r^2} = mgr$ (5)

$\Rightarrow \frac{3}{16} p^2 = gr$

$\Rightarrow p^2 = \frac{16gr}{3}$

$\Rightarrow p = \sqrt{\frac{16gr}{3}}$

$\Rightarrow p = 4\sqrt{\frac{gr}{3}}$ (5)

Q8

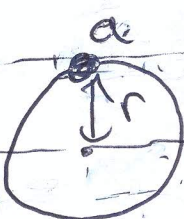


$I_a = I_c + mr^2$
 $= \frac{1}{2} mr^2 + mr^2$
 $= \frac{3}{2} mr^2$ (5)

NB (A) $v = p \Rightarrow \omega = \frac{p}{2r}$ when at horizontal

Sol (1) $\omega = \frac{p}{2r}$

Sol (2) $\omega = ?$



zero level

$E_1 = E_2$ PCF

$\frac{1}{2} I \left(\frac{p}{2r}\right)^2 + mgr = \frac{1}{2} I \omega^2 + mg(0)$ (5)