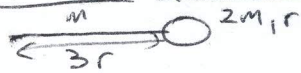
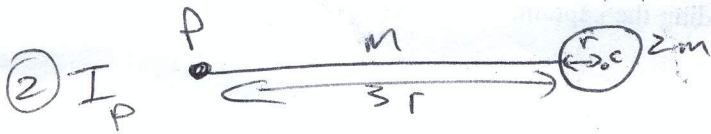


MLC Q8 1994 RBM



(1) $T = 2\pi \sqrt{\frac{I}{\text{mass} \cdot g \cdot \text{distance to CG}}}$

(1) $M_{\text{rod}} = m + 2m = 3m$



$$I_{P-O} = I_P + I_{P-CG}$$

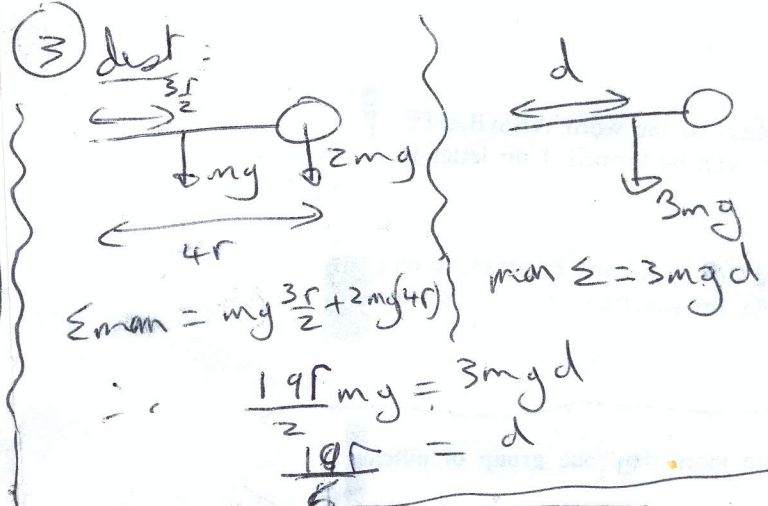
$$= \frac{4}{3} m \left(\frac{3r}{2}\right)^2 + \left[I_{CG} + (2m)(r)^2 \right]$$

|| axis of rotation

$$= 3mr^2 + \left[\frac{1}{2}(2m)r^2 + 2m(4r)^2 \right]$$

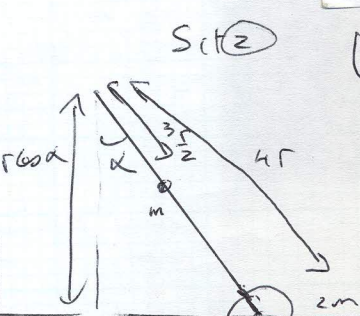
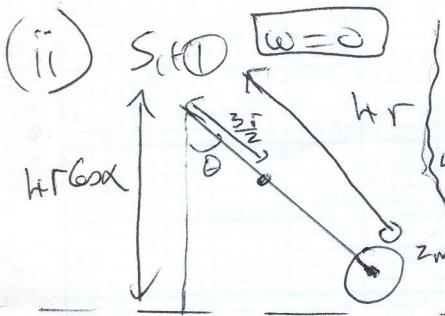
$$= 3mr^2 + mr^2 + 32mr^2$$

$$= 36mr^2$$



$$\therefore T = 2\pi \sqrt{\frac{36mr^2}{3m \cdot g \cdot \frac{19r}{6}}}$$

$$T = 2\pi \sqrt{\frac{72r}{19g}}$$



$$E_1 = PE_{\text{rod}} + PE_{\text{mass}} + KE$$

$$= mg \left[4r \cos \alpha - \frac{3r}{2} \cos \theta \right]$$

$$+ 2mg [4r \cos \alpha - 4r \cos \theta]$$

$$+ 0$$

$$E_1 = 12mgr \cos \alpha - \frac{19}{2} mgr \cos \theta$$

$$E_2 = PE_{\text{rod}} + PE_{\text{mass}} + KE$$

$$= mg \left[4r \cos \alpha - \frac{3r}{2} \cos \alpha \right]$$

$$+ 2mg(0)$$

$$+ \frac{1}{2} I \omega^2$$

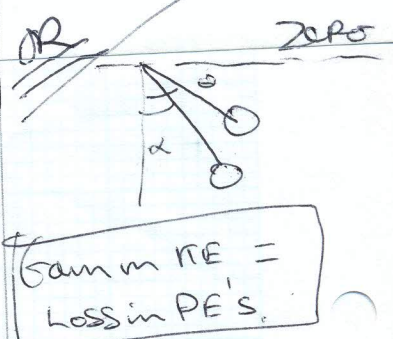
$$E_2 = \frac{5mgr}{2} \cos \alpha + \frac{1}{2} (36mr^2) \omega^2$$

PCF $\Rightarrow E_1 = E_2$

$$\Rightarrow 12mgr \cos \alpha - \frac{19}{2} mgr \cos \theta = \frac{5mgr}{2} \cos \alpha + 18mr^2 \omega^2$$

$$\frac{19mgr \cos \alpha - 19mgr \cos \theta}{2} = 18mr^2 \omega^2$$

$$\frac{19g}{36r} (\cos \alpha - \cos \theta) = \omega^2 \quad \text{qed.}$$



$$\frac{1}{2} I \omega^2 =$$

$$\frac{3}{2} mgr (\cos \alpha - \cos \theta)$$

$$+ 2mg \cdot 4r (\cos \alpha - \cos \theta)$$

$$\Rightarrow 18mr^2 \omega^2$$

$$=$$

$$\frac{19}{2} mgr (\cos \alpha - \cos \theta)$$

$$\Rightarrow \omega^2 = \frac{19g}{36r} (\cos \alpha - \cos \theta)$$