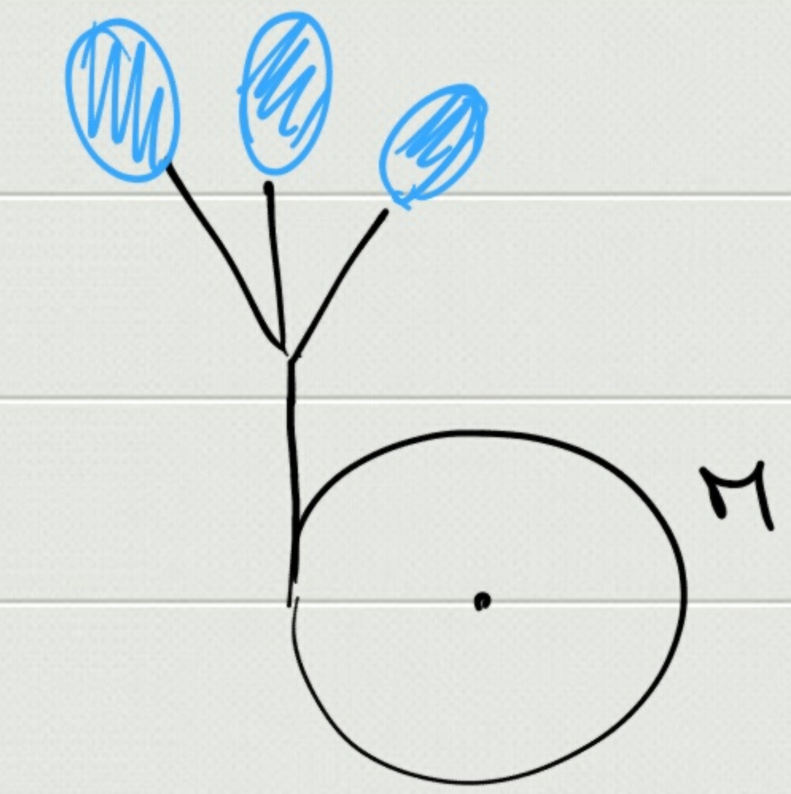


$M = 0.1\ kg$

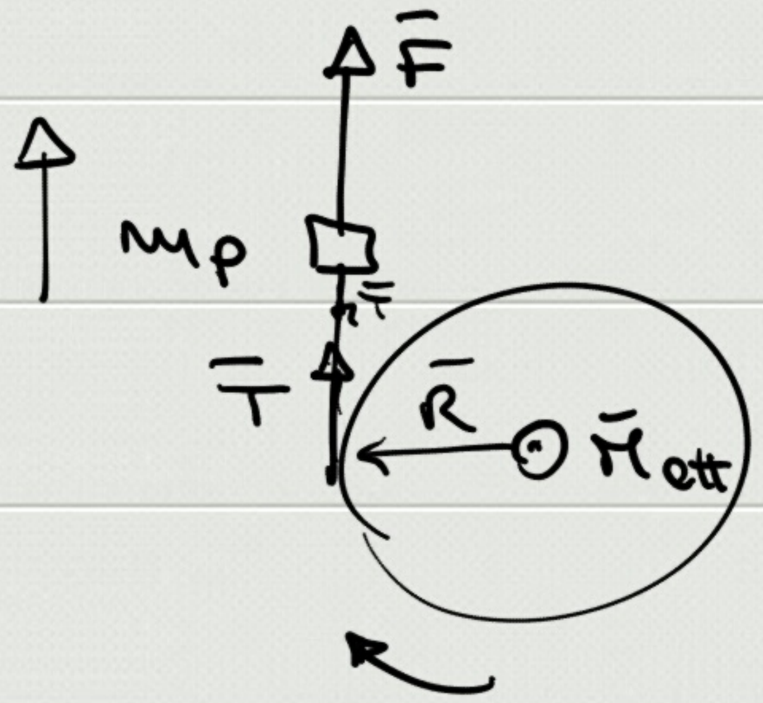
$R = 0.05\ m$

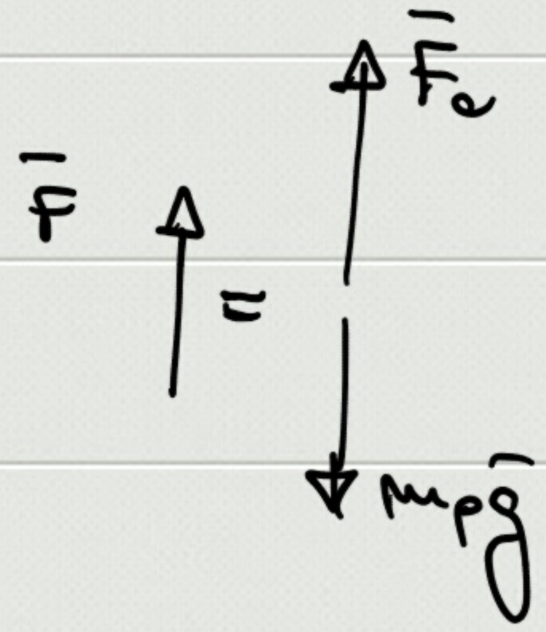
$M_{att} = 0.02\ Nm$

$l = 8\ m$

$m_p = 0.1\ kg$

$F = 1\ N$





$\boxed{\alpha = ?}$

$F - T = m_p a_p$

$$RF - \cancel{M_{att}} = \cancel{\frac{1}{2} M R^2 \alpha}$$

$$RF - \cancel{M_{att}} = \cancel{\left(\frac{1}{2} M R^2 + m_p R^2\right)\alpha}$$

$$RT - \cancel{M_{att}} = \cancel{m_p R^2 \alpha}$$

$$RT - M_{att} = \frac{1}{2} M R^2 \alpha \qquad *$$

$$\begin{cases} RT - M_{att} = \frac{1}{2} M R^2 \alpha \\ F - T = m_p a_p = m_p \alpha R \\ a_p = a_T = \alpha R \end{cases}$$

$$\Rightarrow \boxed{T = F - m_p \alpha R}$$

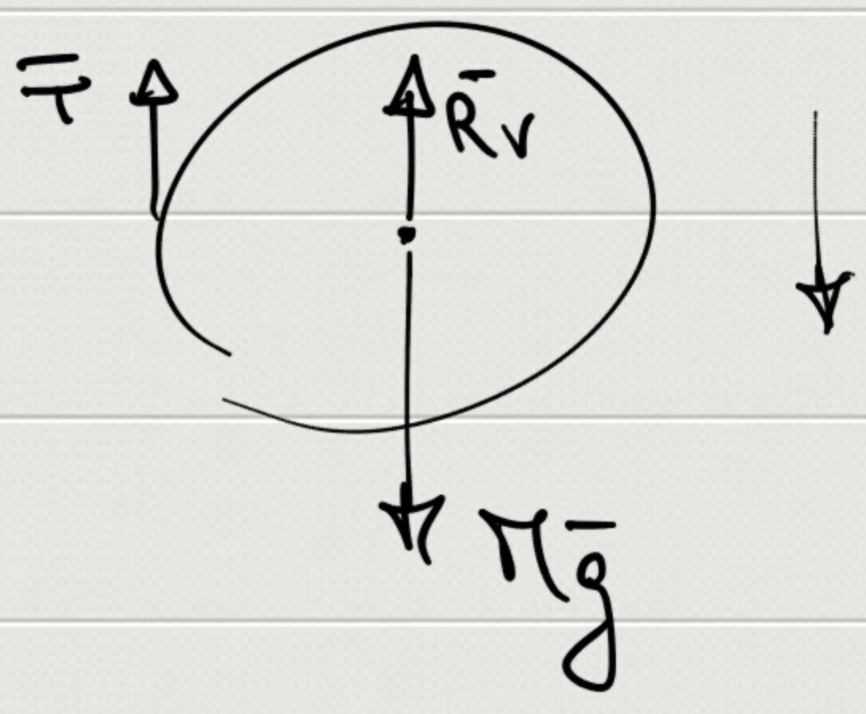
$$\Rightarrow RF - R^2 m_p \alpha - M_{att} = \frac{1}{2} M R^2 \alpha$$

$$\Rightarrow \alpha = \frac{RF - M_{att}}{R^2\left(m_p + \frac{1}{2} M\right)} = 80 \text{ rad/s}^2$$

$$T_{min,rott} = T = 0.6 \text{ N}$$

$R_{v,arse} = ?$

$$\bar{R}^E = M \bar{a}_{CM} = 0$$



$$\Rightarrow Mg - T - R_v = 0$$

$$\Rightarrow R_v = Mg - T = 0.4 \text{ N}$$

$v_p = ?$

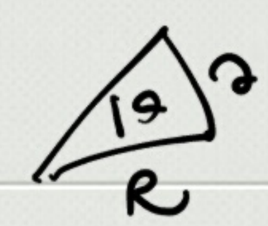
$v_p = a_p t \; ; \quad \ell = \frac{1}{2} a_p t^2 \quad *$

$v_p = \sqrt{2 a_p \ell} \quad * \quad = 8 \text{ m/s}$

$$\underbrace{-M_{att}\frac{\ell}{R}}_{W_{att}} = \underbrace{\frac{1}{2} m_p v_p^2 + \frac{1}{2}\left(\frac{1}{2} M R^2\right)\omega^2}_{\Delta E_{k,fm}} \underbrace{- F\ell}_{\Delta E_p = -W_F} \quad *$$

$W = \int M \, d\theta = M_{att} \Delta\theta$

$\hookrightarrow \Delta\theta = \frac{\ell}{R}$



$\theta = \frac{\ell}{R}$

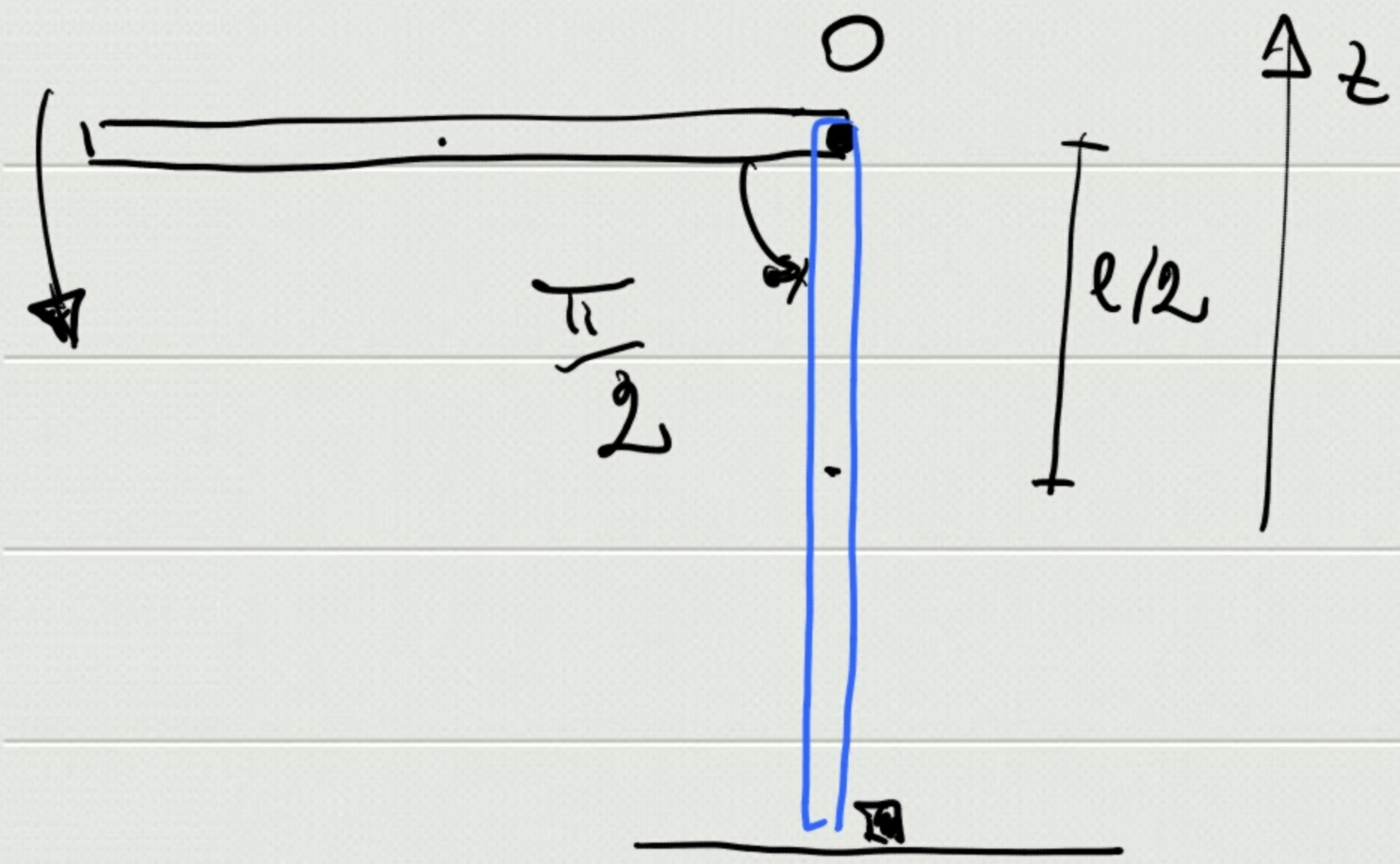
$E_{diss,TOT} = ?$

$$|E_{diss}| = M_{att}\frac{\ell}{R}$$

$$= M_{att}\frac{\ell}{R} + \frac{1}{2} I \left(\frac{v_p}{R}\right)^2 \quad *$$

$$= \frac{1}{2} I \left(\frac{v_p}{R}\right)^2$$

$$= \frac{1}{2} m_p v_p^2$$



$\ell = 3\ m$

$M = 1.5\ kg$

$M_{att} = \frac{9}{2\pi}\ Nm$

$E_{K,0} = 0$

$m = 0.5\ kg$

$v_0 = 0$

urto compl. anel.

$\omega_0 = ?$

$$\boxed{W_{att} = \Delta E_m}$$

$$\cancel{Mg\frac{\ell}{2} = \frac{1}{2} I \omega_0^2}$$

$$-M_{att}\frac{\pi}{2} = \frac{1}{2}\left(\frac{1}{3}M\ell^2\right)\omega_0^2 - Mg\frac{\ell}{2} \qquad *$$

$$-M_{att}\frac{\pi}{2} = \frac{1}{2}\left(\frac{1}{12}M\ell^2 + M\frac{\ell^2}{4}\right)\omega_0^2 - Mg\frac{\ell}{2} \qquad *$$

$$-M_{att}\frac{\pi}{2} = \frac{1}{2}\cancel{\left(\frac{1}{3}M\ell^2\right)\omega_0^2} - Mg\ell$$

$$\Rightarrow \omega_0 = \sqrt{\frac{3\left(Mg\ell - \frac{9}{2}\right)}{M\ell^2}} = 3\ rad/s$$

$\omega_1 = ?$

$$\frac{1}{3} M l^2 \omega_0 = \left(\frac{1}{3} M l^2 + m l^2\right) \omega_1 \qquad *$$

$\cancel{\omega_1 = 0}$

$$\frac{1}{3} M l^2 \omega_0 = \frac{1}{3} M l^2 \omega_1 + m l v_1 \qquad *$$

$$\frac{1}{12} M l^2 \omega_0 = \cancel{\frac{1}{12} M l^2 \omega_1} + \frac{l}{2} m v_1$$

$$\bar{L}_0 = \text{cost} \quad \Rightarrow \quad I_0 \omega_0 = I_0' \omega_1$$

$$I_0 \bar{\omega}_0 \overset{!}{=} I_0 \bar{\omega}_1 + \bar{r} \times m \bar{v}_1$$

$$\Rightarrow \omega_1 = \frac{M}{M + 3m} \omega_0 = 1.5 \text{ rad/s}$$

$|\bar{J}|$ asse rotazione $\Rightarrow$ $\boxed{\bar{J} = \Delta \bar{P}}$

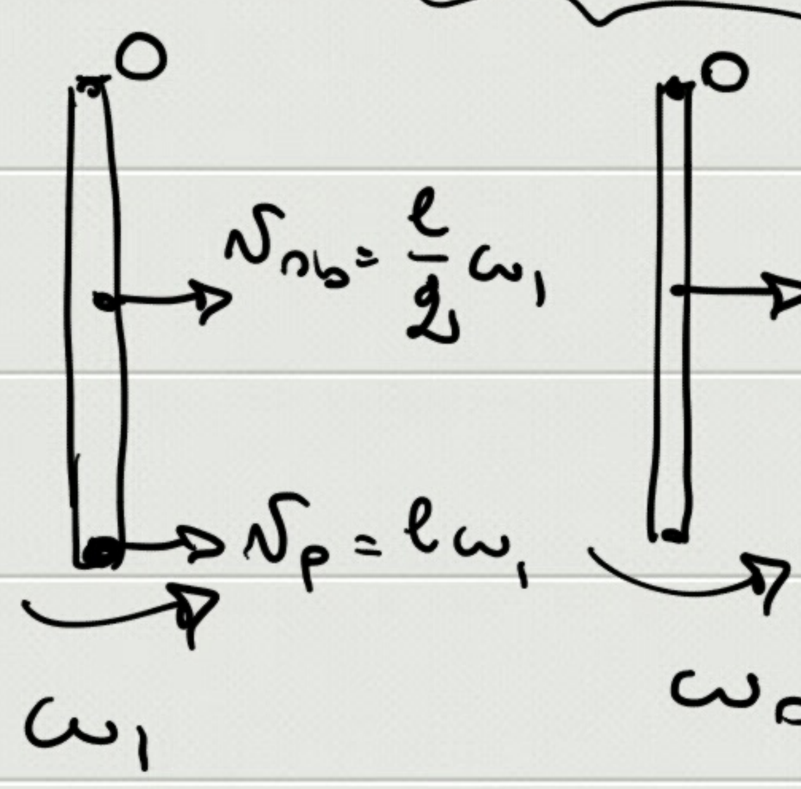
$\cancel{J = 0}$

$$* \quad J = (m+M)\omega_1 y_{CM} - M\omega_0 \frac{\ell}{2} \qquad y_{CM} = \frac{M\frac{\ell}{2} + m\ell}{m+M}$$

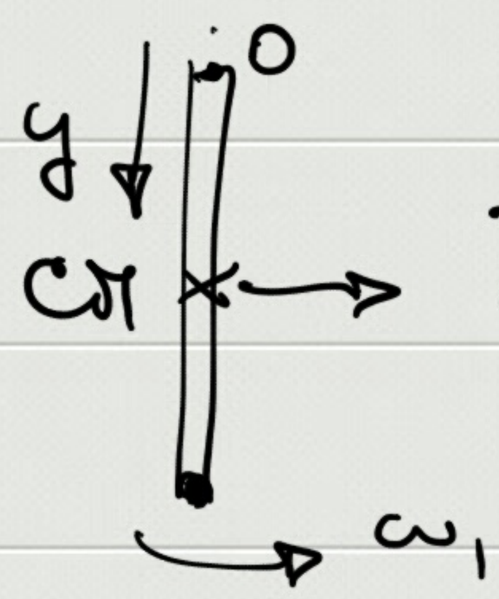
$$\cancel{J = -M\omega_0 \frac{\ell}{2}}$$

$$J = \left(M\omega_1 \frac{\ell}{2} + m\omega_1 \ell\right) - M\omega_0 \frac{\ell}{2} \qquad *$$

$$\bar{J} = \bar{P}(t_0^+) \underbrace{- \bar{P}(t_0^-)}$$



$$\boxed{J = 1.175 \text{ Ns}}$$



$$\bar{v}_{CM,rot} = \omega_1 y_{CM}$$