ΘΕΜΑ Δ

Δ1) Εφαρμόζουμε θεώρημα Steiner για τη ράβδο:

- $I_\rho^{(0)} = I_\rho^{(cm)} + M\cdot\left(\frac{\ell}{2}\right)^2 = \frac{1}{12} M\ell^2 + M\cdot\frac{\ell^2}{4} = \frac{1}{3} M\ell^2$

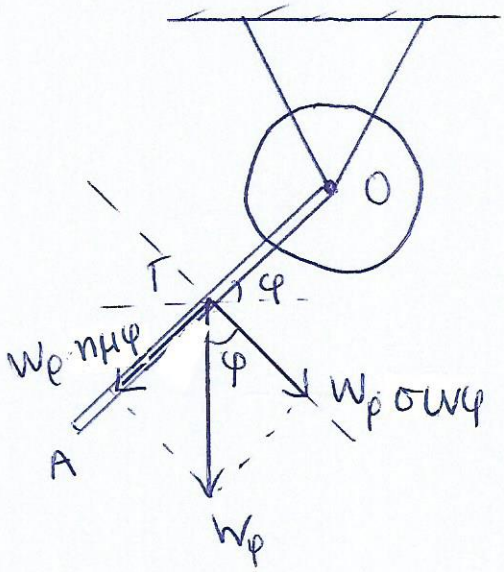
$I_\rho^{(0)} = \frac{1}{3} 8\cdot 3^2 \Rightarrow I_\rho^{(0)} = 24\,kgm^2$

- Για τον δίσκο:

$I_\Delta^{(0)} = \frac{1}{2} m_\Delta \cdot R_\Delta^2 = \frac{1}{2}\cdot 4\cdot\left(\frac{\sqrt{2}}{2}\right)^2 \Rightarrow I_\Delta^{(0)} = 1\,kg\cdot m^2$

$I_{o\lambda}^{(0)} = I_\rho^{(0)} + I_\Delta^{(0)} \Rightarrow \boxed{I_{o\lambda} = 25\,kg\cdot m^2}$

Δ2)

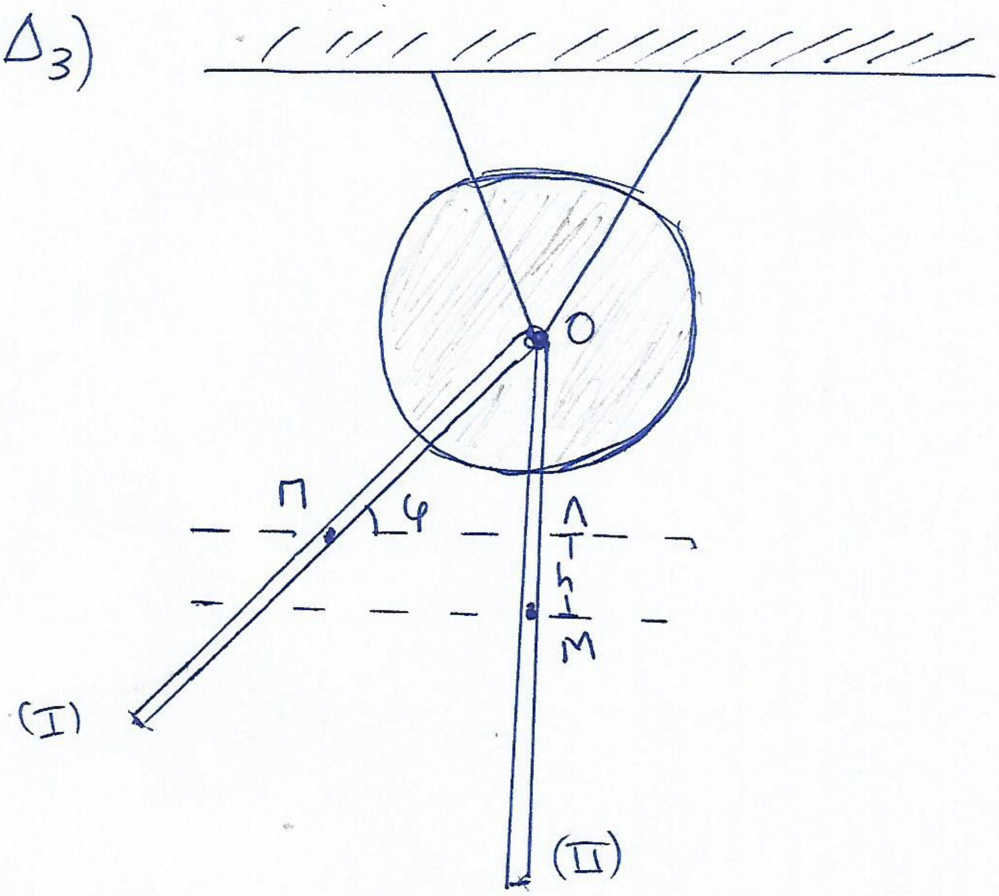


$\frac{dL}{dt} = \Sigma\tau_{\varepsilon\xi} = w_\rho\cdot\frac{\ell}{2}$ συνφ

$\frac{dL}{dt} = Mg\frac{\ell}{2}$ συνφ $= 8\cdot 10\cdot\frac{3}{2}\cdot 0,6$

$\boxed{\frac{dL}{dt} = 72\,N\cdot m}$

Δ3)



Εφαρμόζω ΘΜΚΕ (I → II) για το σύστημα ράβδος–δίσκος:

$K_{τελ} - \cancel{K_{αρχ}}^{0} = W_{w_p}$

$K_{τελ} = M \cdot g \cdot h$

$K_{τελ} = Mg\,\frac{\ell}{2} \cdot (1 - ημφ)$

$K_{τελ} = 8 \cdot 10 \cdot \frac{3}{2}(1 - 0{,}8)$

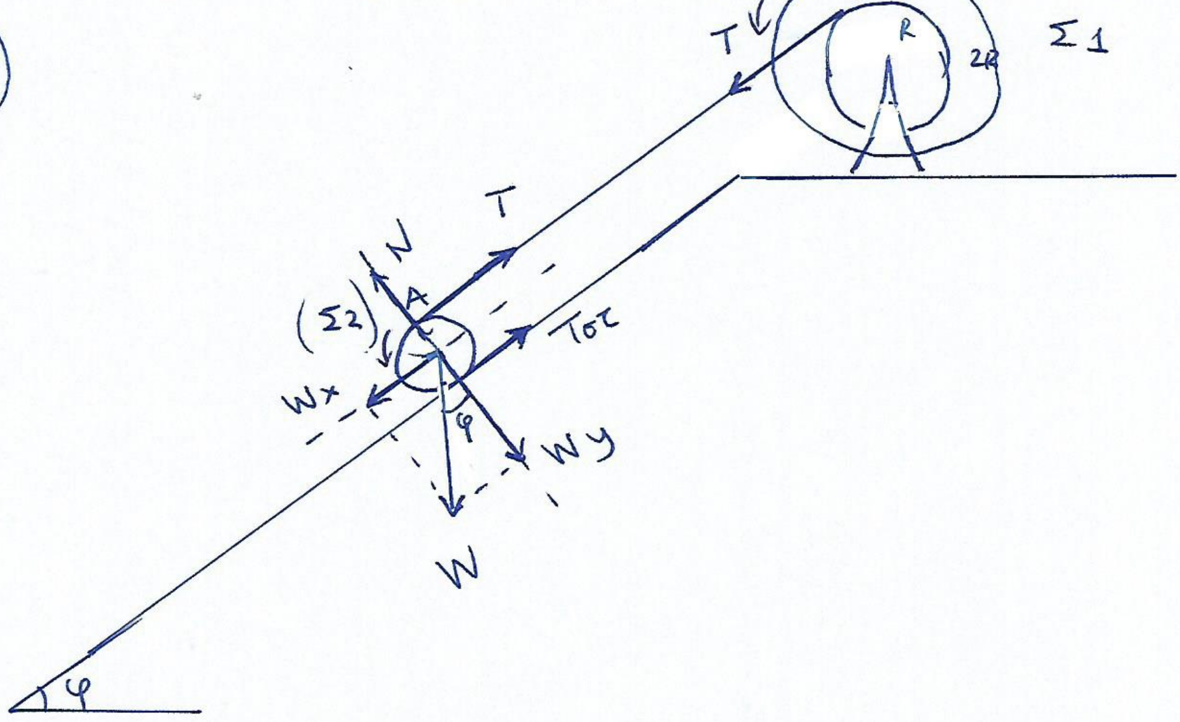
$\boxed{K_{τελ} = 24 J}$

Απο το σχημα:

$h = OM - OΛ$

$h = \frac{\ell}{2} - \frac{\ell}{2} \cdot ημφ$

Δ4



Για το (Σ2):

– μεταφορική κινηση

$$\Sigma \vec{F_x} = m \cdot \vec{a}_{cm} \Rightarrow mg\,\eta\mu\varphi - T - T_{\sigma\tau} = m \cdot a_{cm} \quad (1)$$

– Περιστροφική κινηση

$$\Sigma \tau = I \cdot a_{\gamma\omega\nu} \Rightarrow T_{\sigma\tau} \cdot R - T \cdot R = \frac{1}{2} m R^2 \cdot a_{\gamma\omega\nu}$$

$$\Rightarrow T_{\sigma\tau} - T = \frac{1}{2} m \cdot a_{cm} \quad (2)$$

$$(1), (2) \Rightarrow mg \cdot \eta\mu\varphi - 2T = \frac{3}{2} m \cdot a_{cm} \quad (3)$$

Για το (Σ1)

$$\Sigma \tau = I_{cm,\tau\rho} \cdot a_{\gamma\omega\nu,\tau\rho} \Rightarrow T \cdot R = I_{cm,\tau\rho} \cdot a_{\gamma\omega\nu,\tau\rho} \quad (4)$$

$$U_A = U_{γρ,\,τρ}$$

$$2U_{cm} = ω \cdot R$$

$$2\frac{dU_{cm}}{dt} = \frac{dω}{dt} R$$

$$2 \cdot a_{cm} = a_{γων} \cdot R$$

$$a_{γων} = \frac{2 \cdot a_{cm}}{R} \quad (5)$$

$$(4) \overset{(5)}{\Longrightarrow} T \cdot R = I_{cm,\,τρ} \frac{2a_{cm}}{R}$$

$$T = \frac{I_{cm,\,τρ} \cdot 2a_{cm}}{R^2}$$

$$(3) \Rightarrow m \cdot g \cdot ημφ - \frac{4 I_{cm(τροχ)} \cdot a_{cm}}{R^2} = \frac{3}{2} m \cdot a_{cm}$$

$$\Rightarrow a_{cm} = 1 \; m/s^2$$

- $S = \frac{1}{2} a_{cm} t^2 \Leftrightarrow t = \sqrt{\frac{2 \cdot S}{a_{cm}}} \Rightarrow t = 2s$

$$U_{cm} = a_{cm} \cdot t \Rightarrow U_{cm} = 2 \, m/s$$