ΠΑΝΕΛΛΑΔΙΚΕΣ ΕΞΕΤΑΣΕΙΣ

ΑΠΑΝΤΗΣΕΙΣ ΣΤΗΝ ΦΥΣΙΚΗ ΠΡΟΣ/ΣΜΟΥ

(ΠΑΛΑΙΟ ΣΥΣΤΗΜΑ)

22/06/2020

Α ΘΕΜΑ

Α1) β Α2) γ Α3) α Α4) α Α5) α)Σ β) Λ γ) Λ δ) Λ ε) Σ

Θέμα Β

Β1) $P_{ατμ}+\frac{F}{A_1}=P_{ατμ}+\frac{W}{A_2}+\rho gh \Rightarrow \frac{F}{A_1}=\frac{W}{A_2}+\rho gh \Rightarrow \boldsymbol{\frac{F}{A_1}=\frac{W+\rho gh\cdot A_2}{A_2}}$.

Το ii) Σωστό .

Β2) **Αρχική Θέση**

$$\left.\begin{matrix} r_1=2d+\pi R+2x_1 \\ r_2=2d+\pi R \end{matrix}\right\} \Rightarrow r_1-r_2=N\cdot\lambda \Rightarrow \boldsymbol{2x_1=N\cdot\lambda\ (1)\ \ N\in N}$$

Τελική Θέση

$$\left.\begin{matrix} r_1=2d+\pi R+2x_2 \\ r_2=2d+\pi R \end{matrix}\right\} \Rightarrow r_1-r_2=(2N+1)\cdot\frac{\lambda}{2} \Rightarrow 2x_2=N\cdot\lambda+\frac{\lambda}{2} \Rightarrow 2x_1+8=N\cdot\lambda+\frac{\lambda}{2} \overset{(1)}{\Rightarrow} \boldsymbol{\lambda=16\ cm}$$. Το **(ii) Σωστό.**

Β3)

Σωστή η (iii)

$v_2'=\frac{2m_1}{m_1+m_2}\ v_1$

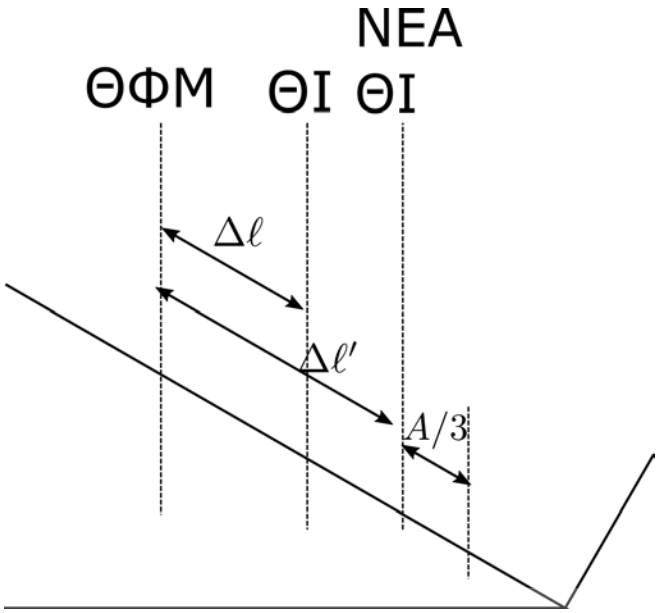
$$\Pi_1=\frac{K_2'}{K_1}\ 100 \Rightarrow \Pi_1=\frac{\frac{1}{2}m_2v_2'^2}{\frac{1}{2}m_1\ v_1^2}\ 100=\frac{\frac{1}{2}m_2\left(\frac{2m_1}{m_1+m_2}v_1\right)^2}{\frac{1}{2}m_1\ v_1^2}100=\frac{4m_1m_2}{(m_1+m_2)^2}\ 100$$

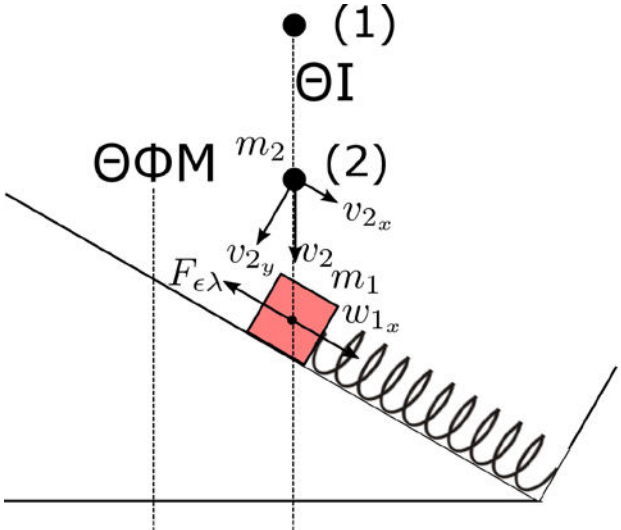
Ομοίως

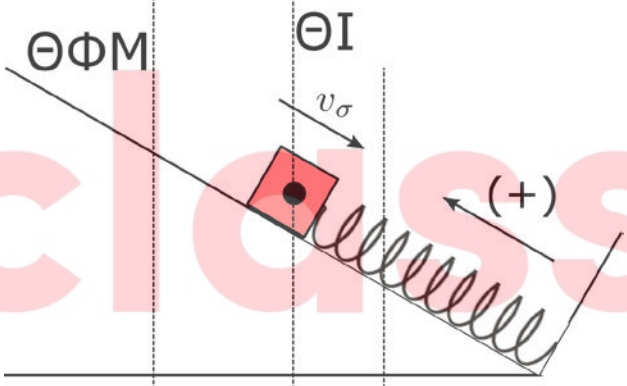
$$\Pi_2=\frac{K_1'}{K_2}\ 100 \Rightarrow \Pi_2=\frac{\frac{1}{2}m_1v_1'^2}{\frac{1}{2}m_2\ v_2^2}\ 100=\frac{\frac{1}{2}m_1\left(\frac{2m_2}{m_1+m_2}v_2\right)^2}{\frac{1}{2}m_2\ v_2^2}100=\frac{4m_1m_2}{(m_1+m_2)^2}\ 100$$

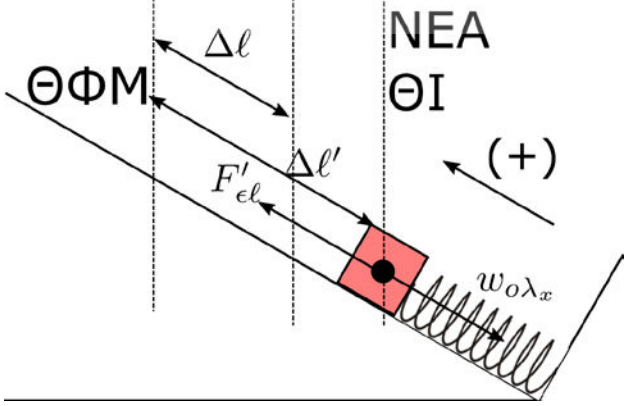
Άρα $\Pi_1=\Pi_2$

ΘΕΜΑ Γ









Γ1) Στην Θ.Ι. : $\Sigma F_x = 0 => F_{\varepsilon\lambda} = w_{1x} => k \cdot \Delta l = m_1 \cdot g \cdot \eta\mu 30^o => \boldsymbol{\Delta l = 0,05m}$.

Στην νέα Θ.Ι. : $\Sigma F_x = 0 => F_{\varepsilon\lambda} = w_{1x} => k \cdot \Delta l' = (m_1 + m_2) \cdot g \cdot \eta\mu 30^o => \boldsymbol{\Delta l' = 0,2m}$.

Για το m_2 Α.Δ.Μ.Ε. (1) →(2) : $m_2 \cdot g \cdot h = \frac{1}{2} \cdot m_2 \cdot v_2^2 => v_2 = \sqrt{2gh} => \boldsymbol{v_2 = 2\sqrt{3}\,\frac{m}{s}}$.

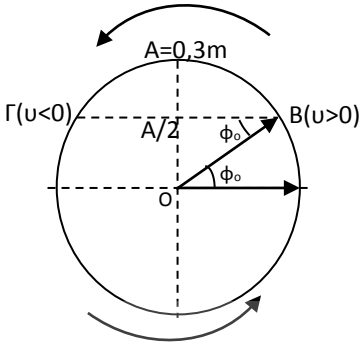
Για την κρούση →Α.Δ.Ο.χ : $m_2 \upsilon_{2x} = (m_1 + m_2) \cdot \upsilon_\sigma \Rightarrow 3 \cdot \upsilon_2 \cdot \eta\mu 30^o = 4 \cdot \upsilon_\sigma \Rightarrow \boldsymbol{\upsilon_\sigma = \frac{3\sqrt{3}}{4}\, m/s}$ **.**

Γ2) Α.Δ.Ε.Τ. (στη θέση της κρούσης) : $E_T = K + U_T \Rightarrow \omega^2 \cdot A^2 = \upsilon_\sigma^2 + \omega^2 \cdot x^2$ (1)

$\omega = \sqrt{\frac{k}{m_1+m_2}} = 5\, rad/s.$

(1) => $25 \cdot A^2 = \frac{9 \cdot 3}{16} + 25(\Delta l' - \Delta l)^2 \Rightarrow \boldsymbol{A = 0,3m.}$

Γ3) $x = A\eta\mu(\omega t + \varphi_0).$ Για t=0 : $x = +\frac{A}{2}\ \mu\varepsilon\ \upsilon < 0.$



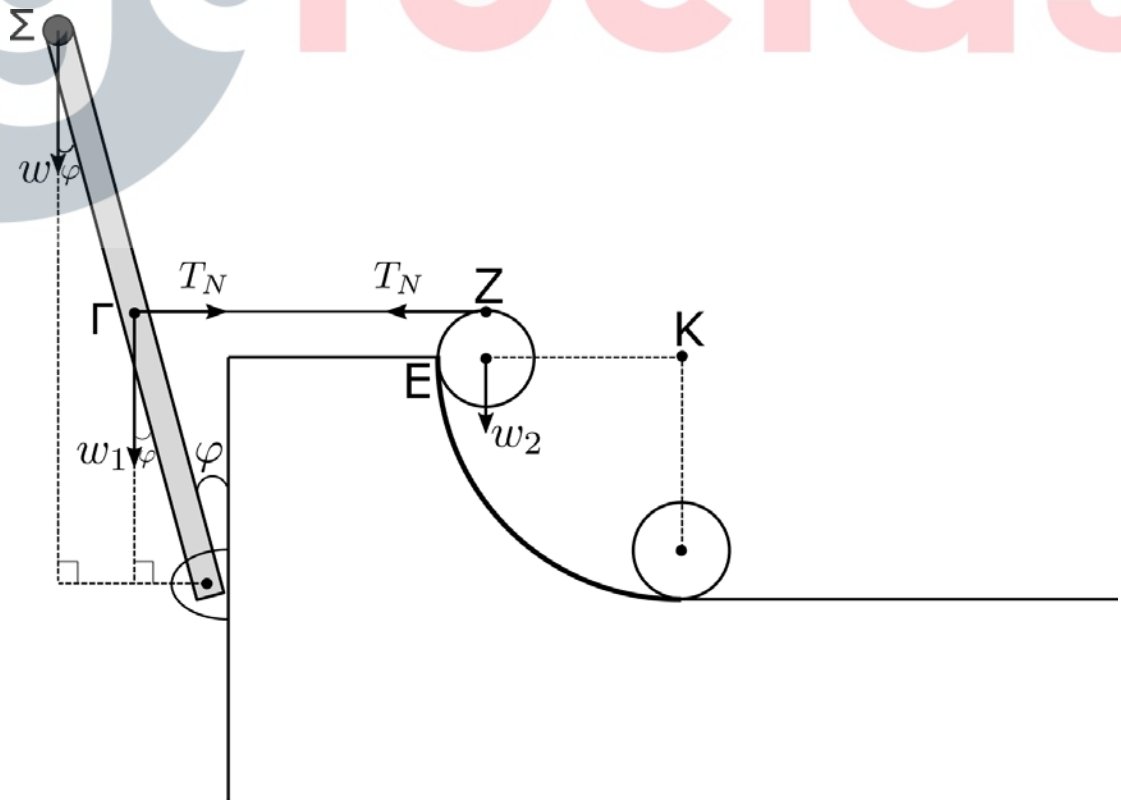
Οπότε φο=5π/6 rad.

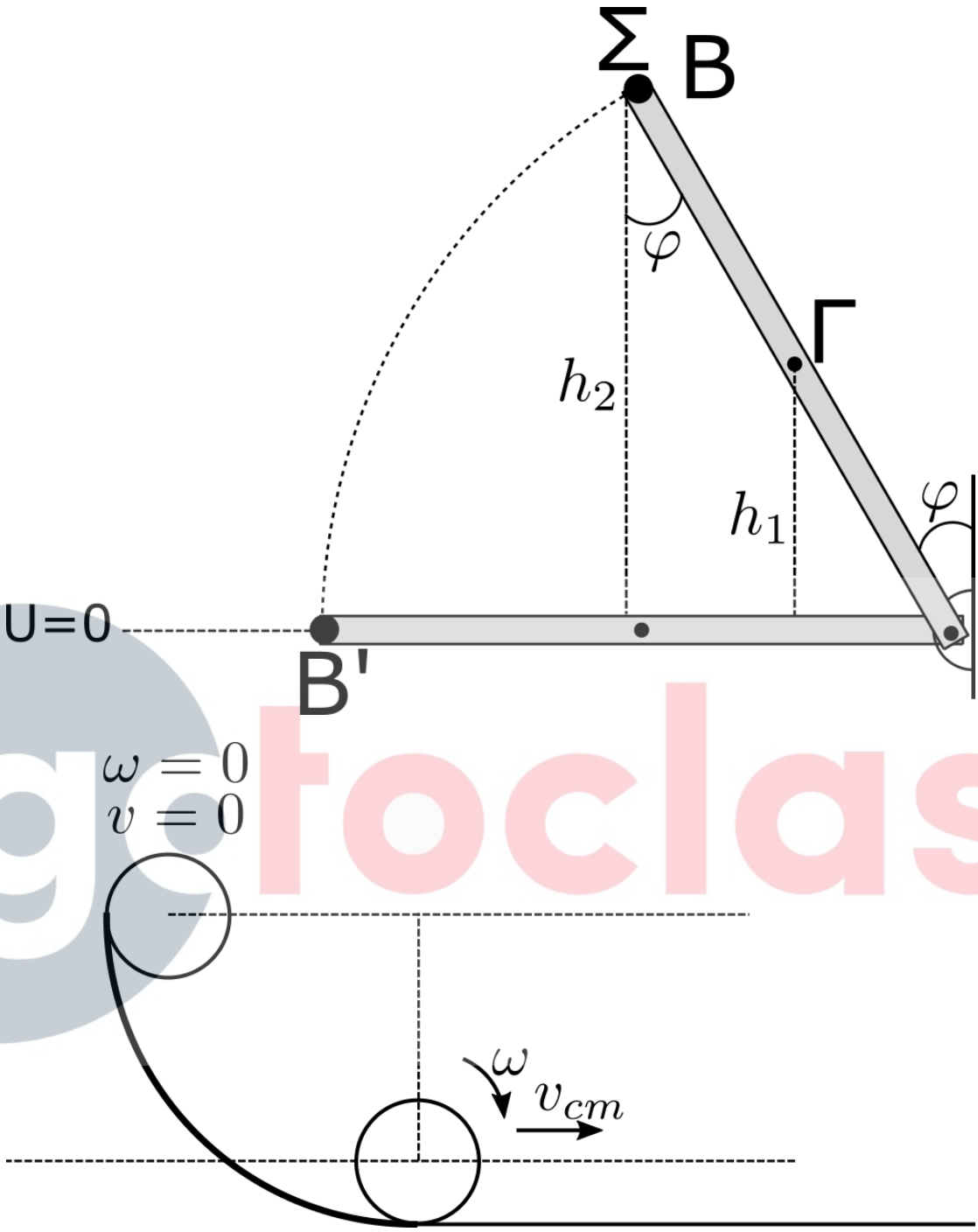
Οπότε : x=0,3ημ(5t+5π/6) (S.I.)

Γ4) Α.Δ.Ε.Τ. $E_T = K + U_T \Rightarrow E_T = 9U_T \Rightarrow \boldsymbol{x = \pm\frac{A}{3}}$**.**

$$\frac{|F_{\varepsilon\lambda_1}|}{|\Sigma F_1|} = \frac{\left|k\left(\Delta l' + \frac{A}{3}\right)\right|}{\left|D \cdot \frac{A}{3}\right|} = \frac{0,3}{0,1} \Rightarrow \boldsymbol{\frac{|F_{\varepsilon\lambda_1}|}{|\Sigma F_1|} = 3}$$

Θέμα Δ





Δ1) i) $\Sigma\tau_A = 0 => mgl\eta\mu\varphi + M_1 g\frac{l}{2}\eta\mu\varphi - T_N\frac{l}{2}\sigma\upsilon\nu\varphi = 0 => \boldsymbol{T_N = 60N}$

ii) $\Sigma\tau_E = 0 => T_N{}' \cdot r - M_2 gr = 0 => \boldsymbol{M_2 = 6kg}$

Δ2) $I_{\sigma\tau\varepsilon\rho} = I_\rho + I_m => I_{\sigma\tau\varepsilon\rho} = \left(\frac{1}{12}M_1 l^2 + M_1\frac{l^2}{4}\right) + ml^2 => I_{\sigma\tau\varepsilon\rho} = 3kgm^2$

$\Sigma\tau_{\varepsilon\xi(A)} = I_{\sigma\tau\varepsilon\rho}\cdot\alpha_{\gamma\omega\nu} => mgl\eta\mu\varphi + M_1 g\frac{l}{2}\eta\mu\varphi = I_{\sigma\tau\varepsilon\rho}\cdot\alpha_{\gamma\omega\nu} => \boldsymbol{\alpha_{\gamma\omega\nu} = 8r/s^2}$ **.**

Δ3) Εφαρμόζω Α.Δ.Μ.Ε. για το στερεό από την αρχική μέχρι την τελική θέση : $U_{\alpha\rho\chi} + K_{\alpha\rho\chi} = U_{\tau\varepsilon\lambda} + K_{\tau\varepsilon\lambda} => mgl\sigma\upsilon\nu\varphi + M_1 g\frac{l}{2}\sigma\upsilon\nu\varphi = \frac{1}{2}I_{\sigma\tau\varepsilon\rho}\omega^2 => \omega = \frac{8\sqrt{3}}{3}\frac{rad}{s}$.

Οπότε : $\overrightarrow{\Delta L}_{στερ} = \vec{L}_{στερ_{τελ}} - \vec{L}_{στερ_{αρχ}} = I_{στερ} \cdot \omega => \Delta L_{στερ} = 8\sqrt{3}\ kg \cdot m^2/s$

Δ4) Εφαρμόζω Α.Δ.Μ.Ε. για τον τροχό από την αρχική μέχρι την τελική θέση : $U_{αρχ} + K_{αρχ} = U_{τελ} + K_{τελ} => M_2 \cdot g(R-r) = \frac{1}{2} I_2 \cdot \omega^2 + \frac{1}{2} M_2 \cdot \upsilon_{cm}^2 => M_2 \cdot g(R-r) = \frac{1}{2} \cdot \frac{1}{2} M_2 r^2 \cdot \omega^2 + \frac{1}{2} M_2 \cdot \upsilon_{cm}^2 => M_2 \cdot g(R-r) = \frac{1}{4} M_2 \cdot \upsilon_{cm}^2 + \frac{1}{2} M_2 \cdot \upsilon_{cm}^2 => \boldsymbol{\upsilon_{cm} = 6m/s}$

Δ5) i) $\left.\begin{matrix} S = \frac{1}{4} 2\pi(R-r) \\ S = r\Delta\theta \end{matrix}\right\} \Rightarrow \Delta\theta = 13{,}5\pi\ rad$

Οπότε $N = \frac{\Delta\theta}{2\pi} \Rightarrow \boxed{N = 6{,}75\ περιστροφές}$

ii) $S = r \cdot \Delta\theta' => \Delta\theta' = 10\pi\ rad.$

Οπότε : $N' = \frac{\Delta\theta'}{2\pi} => \boldsymbol{N' = 5\ περιστροφές}$.