ΠΑΝΕΛΛΑΔΙΚΕΣ ΕΞΕΤΑΣΕΙΣ
ΓΕΝΙΚΟΥ ΛΥΚΕΙΟΥ
(ΠΑΛΑΙΟ ΣΥΣΤΗΜΑ)
ΦΥΣΙΚΗ ΠΡΟΣΑΝΑΤΟΛΙΣΜΟΥ
22 ΙΟΥΝΙΟΥ 2020

ΑΠΑΝΤΗΣΕΙΣ

ΦΡΟΝΤΙΣΤΗΡΙΟ ΦΑΣΜΑ
ΠΕΤΡΟΥΠΟΛΗ - ΙΛΙΟΝ

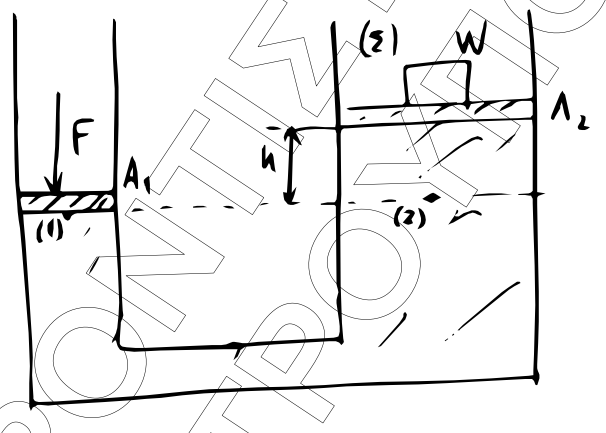
Θέμα Α

Α.1) β), Α.2) γ), Α.3) α), Α.4) α).

Α.5) α) σωστό, β) λάθος, γ) λάθος, δ) λάθος, ε) σωστό.

Θέμα Β

Β.1) Σωστή η (ii)

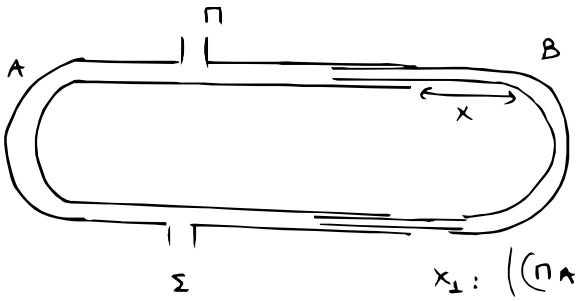


Στα σημεία (1) κ (2) έχουμε την ίδια πίεση αφού είναι το ίδιο υγρό στο ίδιο ύψος.

Άρα $p_1 = p_2 \Longrightarrow \frac{F}{A_1} + \cancel{p_{atm}} = \rho g h + \frac{W}{A_2} + \cancel{p_{atm}} \Longrightarrow$

$$\Longrightarrow \frac{F}{A_1} = \frac{W}{A_2} + \rho g h \Longrightarrow \frac{F}{A_1} = \frac{W + \rho g h A_2}{A_2}$$

B2.



$x_1: \ |(ΠΑΣ) - (ΠΒΣ) - 2x_1| = N\lambda$

$x_2: \ |(ΠΑΣ) - (ΠΒΣ) - 2x_2| = (2N+1)\frac{\lambda}{2}$

για $x = x_1 \rightarrow Σ$: ενισχυτική

$x = x_2 = x_1 + 4\,cm$ → αποσβεστική (1η φορά)

Αφαιρούμε κατά μέλη:

$$|\cancel{(ΠΑΣ)} - \cancel{(ΠΒΣ)} - 2x_2 - \cancel{(ΠΑΣ)} + \cancel{(ΠΒΣ)} + 2x_1| = (2N+1)\frac{\lambda}{2} - N\lambda$$

$$2x_2 - 2x_1 = \cancel{\frac{2N\lambda}{2}} + \frac{\lambda}{2} - \cancel{N\lambda}$$

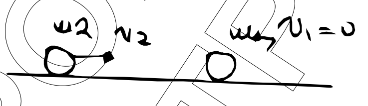
$$2(\cancel{x_1} + 4\,cm - \cancel{x_1}) = \frac{\lambda}{2}$$

$$\lambda = 8 \cdot 2 \rightarrow \underline{\lambda = 16\,cm} \quad (ii)$$

B3.

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

$$Π_1 = \frac{K_2'}{K_1} = \frac{\cancel{\frac{1}{2}} m_2 \frac{4 m_1^{\cancel{2}} \cancel{v_1^2}}{(m_1+m_2)^2}}{\cancel{\frac{1}{2}} \cancel{m_1} \cancel{v_1^2}} \Rightarrow \frac{K_2'}{K_1} = \frac{4 m_1 m_2}{(m_1+m_2)^2}$$



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

$$Π_2 = \frac{K_1'}{K_2} = \frac{\cancel{\frac{1}{2}} m_1 {v_1'}^2}{\cancel{\frac{1}{2}} m_2 v_2^2} = \frac{m_1 \cdot \frac{4 m_2^{\cancel{2}} \cancel{v_2^2}}{(m_1+m_2)^2}}{\cancel{m_2} \cancel{v_2^2}} = \frac{4 m_1 m_2}{(m_1+m_2)^2}$$

Άρα $\boxed{Π_1 = Π_2}$

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ΘΕΜΑ Γ

$m_1 = 1kg$

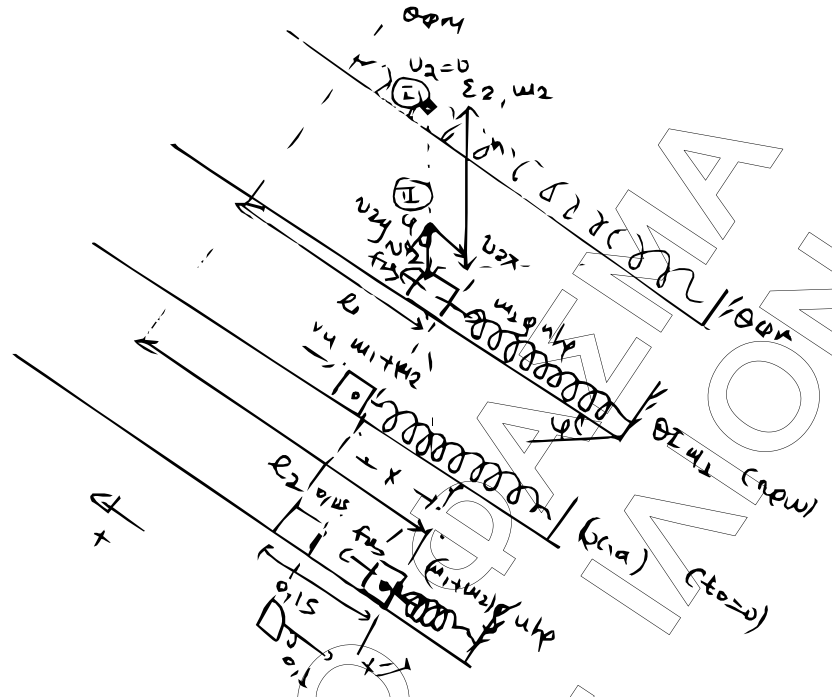
$\theta = 30^\circ$

$k = 100 N/m$

$h = 0,6 m$

$m_2 = 3kg$

$D = k$



Γ1. $V_k = ;$

Γ2. $A = ;$

Γ3. $x = f(t)$ ↑⊕

Γ4. $\frac{F_{ελ}}{ΣF} = ;$ $\quad k = B U$

Γ1. ΘΜΚΕ$_{Σ \to Π}$: $ΔK = W_w \to \frac{1}{2}\cancel{m_2}v_2^2 - 0 = \cancel{m_2}gh$

$v_2 = \sqrt{2gh} \to v_2 = \sqrt{2 \cdot 10 \cdot 0,6} \to$

$v_2 = \sqrt{12} = \sqrt{3 \cdot 4} \to v_2 = 2\sqrt{3}\ m/s$

ΑΔΟx : $\vec{p}_{αρχ_x} = \vec{p}_{τελ_x} \Rightarrow m_2 v_{2x} = (m_1+m_2) V_k \to$

$V_k = \frac{m_2 v_{2x}}{m_1+m_2} \to V_k = \frac{3 \cdot \sqrt{3}}{4} \to \boxed{V_k = \frac{3}{4}\sqrt{3}\ m/s}$

$v_{2x} = v_2 ημφ = \frac{v_2}{2} = \sqrt{3}\ m/s$

Γ2. ΘΙ m_1: $ΣF_x = 0 \to F_{ελ} = w_{1x} \to m_1 g ημφ = k l_1 \to$

$l_1 = \frac{m_1 g ημφ}{k} = \frac{1 \cdot 10 \frac{1}{2}}{100} \Rightarrow l_1 = \frac{5}{100} \to l_1 = 5 \cdot 10^{-2} m$

ΘΙ m_1+m_2: $ΣF'_x = 0 \to F'_{ελ} = (m_1+m_2)_x \to (m_1+m_2)g ημφ = k l_2 \to$

$l_2 = \frac{(m_1+m_2) g ημφ}{k} \to l_2 = \frac{4 \cdot 10 \cdot \frac{1}{2}}{100} \to l_2 = 20 \cdot 10^{-2} m$

Η κρούση συμβαίνει τη t=0 θέση της κρούσης.
όπου $x = l_2 - l_1 = 15 \cdot 10^{-2} m$

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ΑΔΕ$_1$ $(t_0=0)$: $E = K_0 + U_0 \rightarrow \cancel{\tfrac{1}{2}} D A^2 = \cancel{\tfrac{1}{2}} m_{01} v_\kappa^2 + \cancel{\tfrac{1}{2}} k x^2 \rightarrow$

$$A = \sqrt{\frac{m_1+m_2}{k} v_\kappa^2 + x^2} \Rightarrow A = \sqrt{\frac{4}{100} \cdot \frac{9}{\cancel{16}_4} \cdot 3 + 225 \cdot 10^{-4}}$$

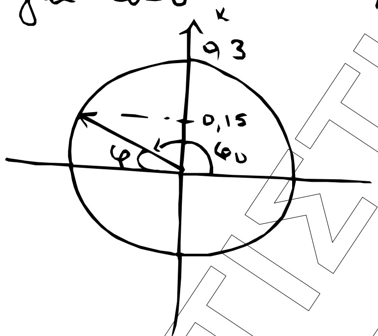
$$A = \sqrt{675 \cdot 10^{-4} + 225 \cdot 10^{-4}} \Rightarrow A = \sqrt{900 \cdot 10^{-4}} \rightarrow$$

$$A = \sqrt{9 \cdot 10^{-2}} \Rightarrow A = 3 \cdot 10^{-1} m \rightarrow \boxed{A = 0{,}3\,m}$$

Γ3. $x = A\,\eta\mu(\omega t + \varphi_0)$

$$\omega = \sqrt{\frac{k}{m_1+m_2}} = \sqrt{\frac{100}{4}} \Rightarrow \omega = \sqrt{25} \rightarrow \boxed{\omega = 5\,r/s}$$

για $t_0 = 0$ $x = +0{,}15\,m$. $v < 0$



$\varphi_0 = \pi - \varphi$

$\eta\mu\varphi = \frac{0{,}15}{0{,}3} = \frac{1}{2} \rightarrow \varphi = \frac{\pi}{6}$ $\Big\} \rightarrow \varphi_0 = \pi - \frac{\pi}{6} \rightarrow \boxed{\varphi_0 = \frac{5\pi}{6}\ rad}$

Άρα $x = 0{,}3\,\eta\mu\left(5t + \frac{5\pi}{6}\right)$ (S.I.)

Γ4. $K = 8U$

$$E = K + U \Rightarrow E = 8U + U \Rightarrow E = 9U \Rightarrow \cancel{\tfrac{1}{2}} \cancel{k} A^2 = 9 \cdot \cancel{\tfrac{1}{2}} \cancel{k} x^2$$

$$x = \pm \frac{A}{3}$$

2η φορά $x = -\frac{A}{3} \Rightarrow \boxed{x = -0{,}1\,m}$

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$F_{ελ} = k(\ell_2 + x) = 100(0{,}2 + 0{,}1) = 100 \cdot 0{,}3$

$= 30\,N$

$\Sigma F = k \cdot x = 100 \cdot 0{,}1 = 10\,N$

$$\boxed{\frac{F_{ελ}}{\Sigma F} = 3}$$

ΦΡΟΝΤΙΣΤΗΡΙΟ ΦΑΣΜΑ
ΠΕΤΡΟΥΠΟΛΗ - ΙΛΙΟΝ

ΘΕΜΑ Δ

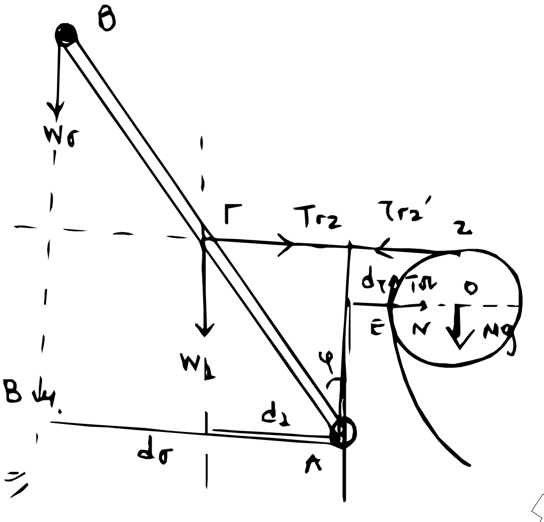
$M_1 = 6$ kg.

$L = 1$ m.

$m = 1$ kg

$r = 0,1$ m.

$KE = R = 3B$ m.



Δ1. i α) $T_{r2} = ;$

ii) $M_2 = ;$

Δ1 i) <u>Ισορροπία για ράβδο:</u>

$$\Sigma\tau_{(A)} = 0 \Rightarrow \tau_{w_{\sigma(A)}} + \tau_{w_1(A)} - \tau_{T_{r2}(A)} = 0 \Rightarrow$$

$$w_\sigma \cdot \ell\, ημφ + w_1 \frac{\ell}{2} ημφ - T_{r2}\cdot \frac{\ell}{2} συνφ = 0$$

$$mg\cancel{\ell}\, ημφ + M_1 g \frac{\cancel{\ell}}{2} ημφ = T_{r2}\frac{\cancel{\ell}}{2} συνφ \Rightarrow$$

$$1\cdot 10\cdot 0,6 + \frac{6\cdot 10\cdot 0,6}{2} = T_{r2}\cdot \frac{0,8}{2} \Rightarrow 0,4\,T_{r2} = 6+18$$

$$T_{r2} = \frac{24}{0,4} \Rightarrow$$

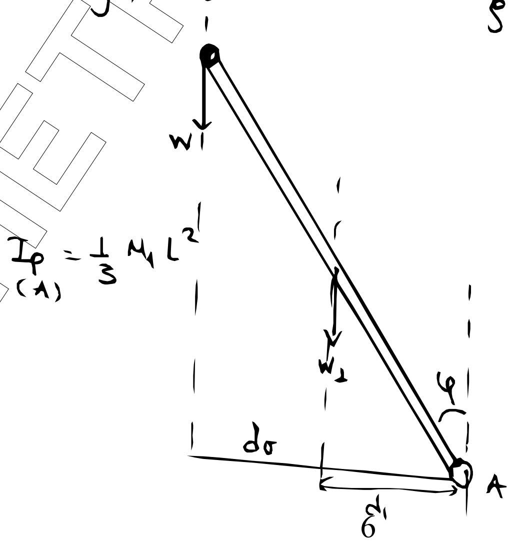
$$T_{r2} = \frac{240}{4} \rightarrow \boxed{T_{r2} = 60\,N}$$

ii)

$$\Sigma\tau_{(E)} = 0 \Rightarrow \tau_{T_{r2}(E)} - \tau_{w(E)} = 0 \Rightarrow$$

$$T_{r2}\cdot\cancel{R} - Mg\cancel{R} = 0 \rightarrow \quad M = \frac{T_{r2}}{g} \rightarrow \boxed{M = 6\,kg}$$

Δ2.



$$I_{συστ(A)} = I_{\rho(A)} + I_{m(A)} \Rightarrow$$

$$I_{συσ(A)} = \frac{1}{3} M_1 L^2 + m L^2 \Rightarrow$$

$$I_{συσ(A)} = \frac{1}{3}\cdot 6\cdot 1^2 + 1\cdot 1^2 \Rightarrow$$

$$I_{συστ(A)} = 2+1 \rightarrow$$

$$\boxed{I_{συστ(A)} = 3\ kg\,m^2}$$

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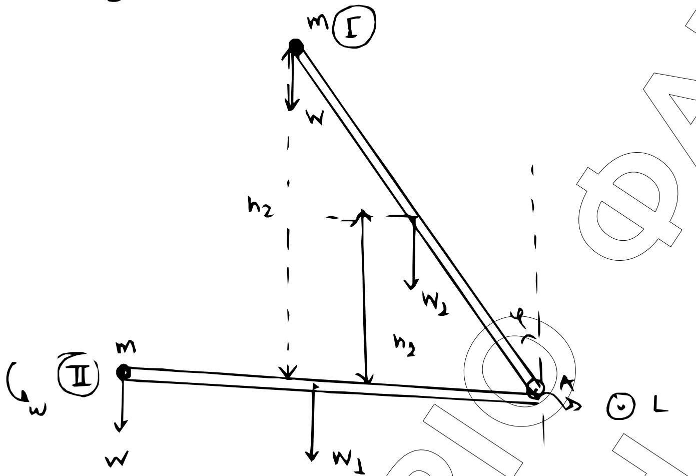
ΠΕΤΡΟΥΠΟΛΗ ΙΛΙΟΝ

$$\Sigma\tau_{(A)} = I_{(A)}\, a_{\gamma\omega\nu} \Rightarrow \frac{\tau_{w(A)} + \tau_{w_1(A)}}{I} = a_{\gamma\omega\nu} \Rightarrow$$

$$a_{\gamma\omega\nu} = \frac{mg\ell\,\eta\mu\varphi + M_1 g \frac{\ell}{2}\,\eta\mu\varphi}{I} \Rightarrow a_{\gamma\omega\nu} = \frac{1\cdot 10\cdot 1\cdot 0{,}6 + 6\cdot 10\cdot \frac{1}{2}\cdot 0{,}6}{3} \Rightarrow$$

$$a_{\gamma\omega\nu} = \frac{6+18}{3} \Rightarrow a_{\gamma\omega\nu} = \frac{24}{3} \rightarrow \boxed{a_{\gamma\omega\nu} = 8\ r/s^2}$$

Δ3. i)



$$\text{ΘΜΚΕ}_{I\to II}: \Delta K = W_{w_1} + W_w$$

$$\frac{1}{2} I_{(A)}\,\omega^2 = m_1 g h_1 + mg h_2 \Rightarrow$$

$$\frac{1}{2} I_{(A)}\,\omega^2 = m_1 g \frac{\ell}{2}\,\sigma\upsilon\nu\varphi + mg\ell\,\sigma\upsilon\nu\varphi.$$

$$\omega = \sqrt{\frac{2}{I}\left(m_1 g \frac{\ell}{2}\,\sigma\upsilon\nu\varphi + mg\ell\,\sigma\upsilon\nu\varphi\right)} \Rightarrow$$

$$\omega = \sqrt{\frac{2}{3}\left(\cancel{6}^{3}\cdot 10\cdot \frac{1}{\cancel{2}}\cdot 0{,}8 + 1\cdot 10\cdot 1\cdot 0{,}8\right)} \Rightarrow$$

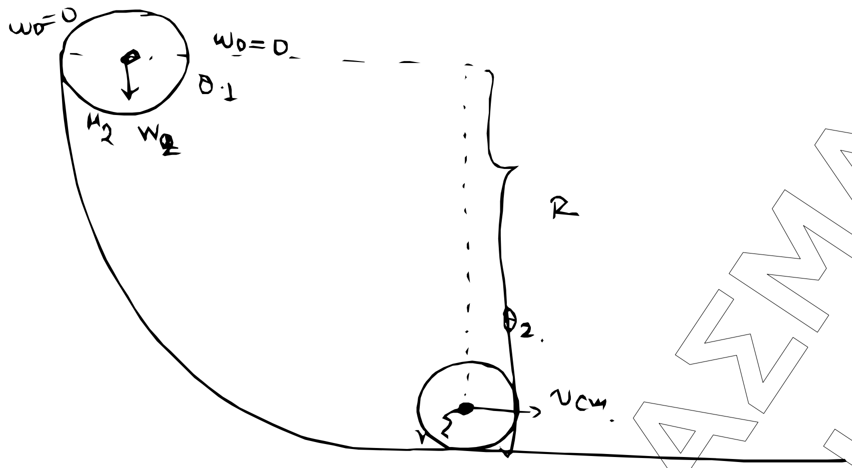
$$\omega = \sqrt{\frac{2}{3}(24+8)} = \sqrt{\frac{2\cdot 32}{3}} = \sqrt{\frac{64}{3}} = \frac{8}{\sqrt{3}} \rightarrow \boxed{\omega = \frac{8\sqrt{3}}{3}\ r/s}$$

$$\Delta L = L_{\tau\varepsilon\lambda} - \cancel{L_{\alpha\rho\chi}} \Rightarrow \Delta L = I\omega \Rightarrow \boxed{\Delta L = 8\sqrt{3}\ kg\,m^2/s}$$

$L_{\alpha\rho\chi} = 0$, $\omega_0 = 0$

ii) ⊙ ΔL

Δ4)



$I_{cm} = \frac{1}{2} m_2 r^2$

ΘΜΚΕ $_{1\to2}$: $\Delta K = W_w \Rightarrow$

$$\frac{1}{2} I_2 \omega^2 + \frac{1}{2} m_2 v_{cm}^2 = m_2 g (R - r) \Rightarrow$$

$$\frac{1}{2} \cdot \frac{1}{2} m_2 \cancel{r^2} \frac{v_{cm}^2}{\cancel{r^2}} + \frac{1}{2} m_2 v_{cm}^2 = m_2 g (R-r) \Rightarrow$$

$$\frac{1}{4} \cancel{m_2} v_{cm}^2 + \frac{1}{2} \cancel{m_2} v_{cm}^2 = \cancel{m_2} g (R-r) \Rightarrow$$

$$\frac{3}{4} v_{cm}^2 = g (R-r) \Rightarrow \quad v_{cm} = \sqrt{\frac{4}{3} g (R-r)} \Rightarrow$$

$$v_{cm} = \sqrt{\frac{4}{3} \cdot 10 (2,7)} = \sqrt{4 \cdot 9} \Rightarrow \quad v_{cm} = 2 \cdot 3 \Rightarrow$$

$$\rightarrow \boxed{v_{cm} = 6 m/s}$$

ΦΡΟΝΤΙΣΤΗΡΙΟ ΦΑΣΜΑ
ΙΛΙΟΝ ΠΕΤΡΟΥΠΟΛΗ

Δ.5) i) Το κέντρο μάζας του δίσκου διαγράφει τόξο $\widehat{\Delta S}_{cm} = \Delta\theta \cdot R_{cm} \xrightarrow[R_{cm}=R-r]{} \widehat{\Delta S}_{cm} = \frac{\pi}{2}(R-r)$.

Ως γνωστόν το cm του δίσκου μετακινείται όσο "τόξο απλώνει" στην επιφάνεια επαφής ο δίσκος

άρα $\widehat{\Delta S}_{cm} = N \cdot 2\pi r$ όπου N οι στροφές του δίσκου κ' $2\pi r$ η περιφέρεια του.

Άρα $N\, 2\cancel{\pi} r = \frac{\cancel{\pi}}{2}(R-r) \rightarrow N = \frac{R-r}{4r} = \frac{2,7}{0,4} = \boxed{\frac{27}{4} \text{ περιστροφές}}$

ii) Όμοια κ' στο οριζόντιο: $\Delta X_{cm} = N' 2\pi r \Rightarrow$

$\rightarrow \pi = N' \cdot 2\pi r \Rightarrow N' = \frac{1}{2r} = \boxed{5 \text{ περιστροφές}}$

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ΠΕΤΡΟΥΠΟΛΗ ΙΛΙΟΝ