ΠΑΝΕΛΛΑΔΙΚΕΣ ΕΞΕΤΑΣΕΙΣ
ΤΕΤΑΡΤΗ 12 ΙΟΥΝΙΟΥ 2019
ΑΠΑΝΤΗΣΕΙΣ ΣΤΟ ΕΞΕΤΑΖΟΜΕΝΟ ΜΑΘΗΜΑ:
ΦΥΣΙΚΗ ΠΡΟΣΑΝΑΤΟΛΙΣΜΟΥ

ΘΕΜΑ Α

Α1. β

Α2. γ

Α3. α

Α4. γ

Α5. α. Λ, β. Σ, γ. Λ, δ. Σ, ε. Σ

ΘΕΜΑ Β

Β1. $f_1 = \dfrac{Unx}{Unx + \dfrac{Unx}{20}} \cdot f_s = \dfrac{Unx}{\dfrac{21}{20}Unx} f_s = \dfrac{20}{21} f_s$

ΑΔΟ: $P_{ΟΛ(ΑΡΧ)} = P_{ΟΛ(ΤΕΛ)}$

$mU_s + 0 = 2m \cdot V \Rightarrow V = \dfrac{U_s}{2} = \dfrac{U_{nx}}{40}$

$f_2 = \dfrac{Unx}{Unx + \dfrac{Unx}{40}} \cdot f_s = \dfrac{Unx}{\dfrac{41}{40}Unx} \cdot f_s = \dfrac{40}{41} \cdot f_s$

$\dfrac{f_1}{f_2} = \dfrac{\dfrac{20}{21}}{\dfrac{40}{41}} = \dfrac{20 \cdot 41}{40 \cdot 21} = \dfrac{41}{42}$, η σωστή απάντηση είναι το ii

B2. Εξίσωση συνέχειας

$$\Pi_\Delta = \Pi_\Gamma$$

$$U_\Delta \cdot A_1 = U_\Gamma \cdot A_2$$

$$U_\Delta \cdot 2A_2 = U_\Gamma \cdot A_2 \Rightarrow U_\Gamma = 2U_\Delta \quad (1)$$

Εξίσωση Bernoulli: $\underset{\Delta\to\Gamma}{\rightarrow} 2 : P_\Delta + \frac{1}{2}\rho u_\Delta^2 = P_{atm} + \frac{1}{2}\rho u_\Gamma^2$

$$P_{atm} + \rho gh + \frac{1}{2}\rho \cdot \frac{U_\Gamma^2}{4} = P_{atm} + \frac{1}{2}\rho u_\Gamma^2$$

$$\rho gh = \frac{1}{2}\rho\left(U_\Gamma^2 - \frac{U_\Gamma^2}{4}\right)$$

$$gh = \frac{1}{2}\frac{3}{4}U_\Gamma^2 \Rightarrow gh = \frac{3}{8}U_\Gamma^2 \Rightarrow U_\Gamma = \sqrt{\frac{8gh}{3}} \quad (2)$$

Εξίσωση Bernoulli : $0 \rightarrow 3 : P_{atm} + 0 + \rho gH = P_{atm} + \frac{1}{2}PU_Z^2$

$$U_Z = \sqrt{2gH}$$

Εξίσωση συνέχειας

$$\Pi_\Gamma = \Pi_Z \Rightarrow A_2 \cdot U_\Gamma = A_3 \cdot U_Z$$

$$2A_3 U_\Gamma = A_3 U_Z$$

$$2\sqrt{\frac{8gh}{3}} = \sqrt{2gH} \Rightarrow 4\frac{8gh}{3} = 2gH \Rightarrow \frac{16h}{3} = H \Rightarrow \frac{h}{H} = \frac{3}{16}$$, η σωστή απάντηση είναι το iii

B3. $\Sigma\tau = I_{\alpha\gamma1} \Rightarrow F \cdot l = \frac{1}{3}Ml^2 \cdot \alpha\gamma1$

$$9\pi = \frac{1}{3}3 \cdot 1 \cdot \alpha_{\gamma1} \Rightarrow \alpha_{\gamma1} = 9\pi \ rad/s^2$$

- $\Delta\theta_1 = \frac{1}{2}\alpha_{\gamma1} \cdot t_1^2 \Rightarrow t_1 = \sqrt{\frac{2\Delta\theta_1}{\alpha_{\gamma1}}} = \sqrt{\frac{2\frac{\pi}{3}}{9\pi}} \Rightarrow t_1 = \frac{1}{3}sec$
- $\omega_1 = \alpha_{\gamma1} \cdot t_1 = 9\pi\frac{1}{3} \Rightarrow \omega_1 = 3\pi rad/s$

ΑΡΧΗ ΔΙΑΤΗΡΗΣΗΣ ΣΤΡΟΦΟΡΜΗΣ

$$\vec{L}_{ΟΛ} = \vec{L'}_{ΟΛ} \Rightarrow I_p \cdot \omega_1 = \left(I_p + ml^2\right)\omega_2$$

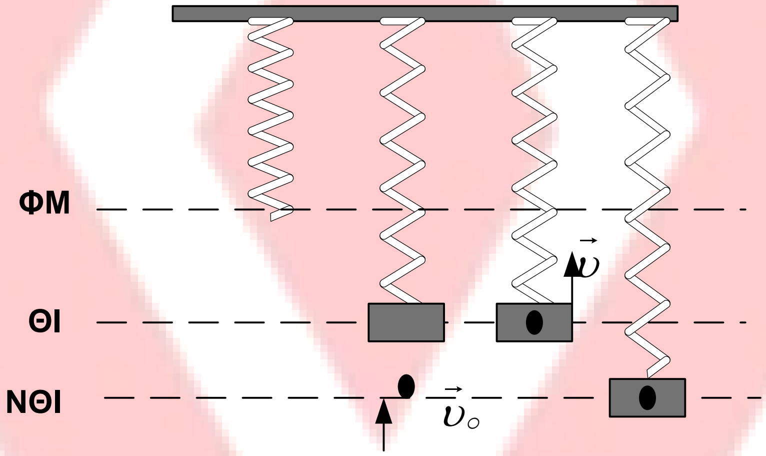
$$\frac{1}{3}Ml^2 \cdot \omega_1 = \left(\frac{1}{3}Ml^2 + ml^2\right)\omega_2 \Rightarrow \frac{1}{3}3 \cdot 1 \cdot 3\pi = \left(\frac{1}{3}3 \cdot 1 + 1\right)\omega_2 \Rightarrow 3\pi = 2\omega_2 \Rightarrow \omega_2 = \frac{3\pi}{2} rad/s$$

$\Sigma\tau = 0$ άρα $\omega = \omega_2 = \frac{3\pi}{2} = σταθ$

$\omega_2 = \frac{\Delta\theta_2}{\Delta t} \Rightarrow \Delta t = \frac{\Delta\theta_2}{\omega_2} = \frac{\frac{\pi}{2}}{\frac{3\pi}{2}} \Rightarrow \Delta t = \frac{1}{3} sec$, η απάντηση είναι το ii

ΘΕΜΑ Γ

Γ1. $\Sigma F = 0 \Rightarrow k\Delta l = m_1 g \Rightarrow k = \frac{m_1 g}{\Delta l} = \frac{10}{\frac{5}{100}} \Rightarrow k = 200 N/m$



συσσωμάτωμα $\Sigma F = 0 \Rightarrow kd = \left(m_1 + m_2\right)g \Rightarrow d = \frac{20}{200} \Rightarrow d = 0{,}1m = A$

Γ2. Όπου $\omega = \sqrt{\frac{k}{m_1 + m_2}} \Rightarrow \omega = 10 rad/s$

ΑΔΕΤ : $\frac{1}{2}kA^2 = \frac{1}{2}mol \cdot U_k^2 + \frac{1}{2}kx^2 \Rightarrow U_k = \omega\sqrt{A^2 - x^2} = 10\sqrt{\frac{1}{100} - \frac{3}{20}} = 10\frac{\sqrt{3}}{20} \Rightarrow U_k = \frac{\sqrt{3}}{2} m/s$

ΑΔΟ: $P_{ΟΛ(ΑΡΧ)} = P_{ΟΛ(ΤΕΛ)}$

$+m_2 U_O = \left(m_1 + m_2\right)U_k$

$$U_0 = 2 \cdot \frac{\sqrt{3}}{2} \Rightarrow U_0 = \sqrt{3}\ m/s$$

$$K = \frac{1}{2} m_2 U_0^2 \Rightarrow K = 1{,}5J$$

Γ3. $+\uparrow$

(2) $\uparrow U_0$ (2) $\uparrow U_k$ $\Delta p_2 = m_2 U_k - m_2 U_0 \Rightarrow \Delta p_2 = \frac{\sqrt{3}}{2} - \sqrt{3} = -\frac{\sqrt{3}}{2} kgm/s$

Άρα $\left|\Delta p_2\right| = \frac{\sqrt{3}}{2} kg\frac{m}{s}$ με φόρα προς τα κάτω

Γ4. $x = A\eta\mu(\omega t + \varphi_0) \overset{t=0}{\Rightarrow} \frac{A}{2} = A\eta\mu(\varphi_0)$

$$\frac{1}{2} = \eta\mu\varphi_0 \Rightarrow \eta\mu\frac{\pi}{6} = \eta\mu\varphi_0 \Rightarrow \begin{cases} \varphi_0 = 2k\pi + \frac{\pi}{6} \\ \text{ή} \\ \varphi_0 = 2k\pi + \frac{5\pi}{6} \end{cases}$$

$k = 0 \rightarrow \varphi_0 = \frac{\pi}{6}$

$k = 0 \rightarrow \varphi_0 = \frac{5\pi}{6}$

την $t = 0$ θέλω $u > 0$

$t = 0 : u = u_{max}\sigma\upsilon\nu\frac{\pi}{6} > 0$

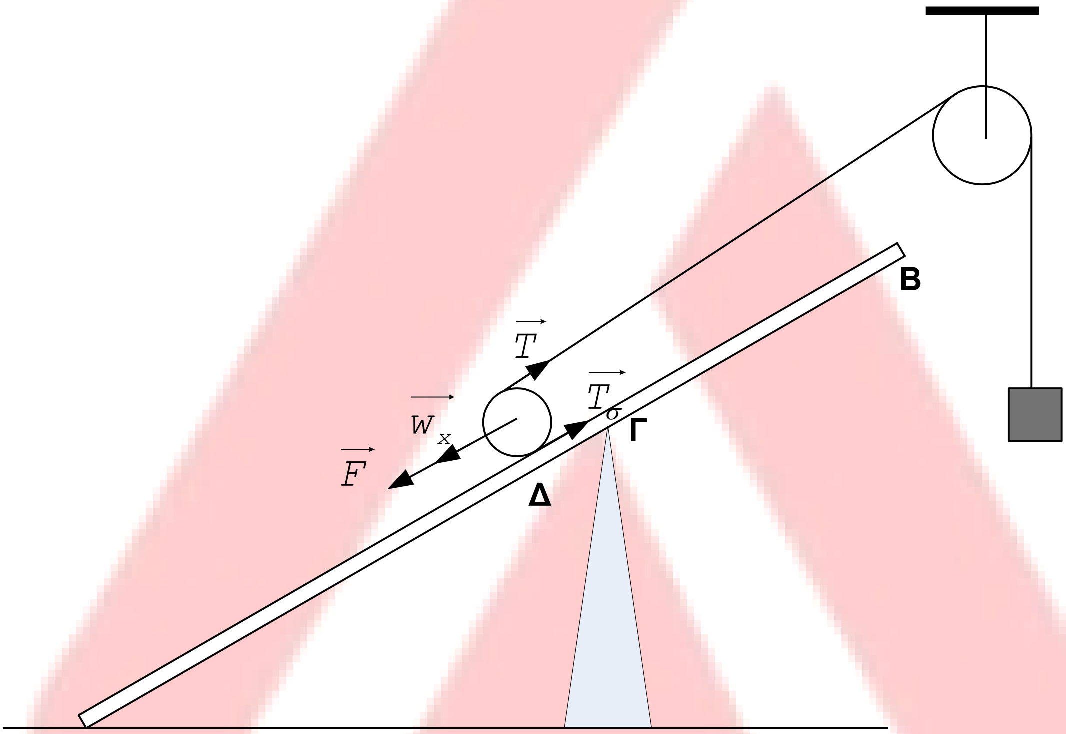
$t = 0 : u = u_{max}\sigma\upsilon\nu\frac{5\pi}{6} < 0$

Άρα $\varphi_0 = \frac{\pi}{6} rad$

$$x = 0{,}1\eta\mu\left(10t + \frac{\pi}{6}\right) \quad \text{(SI)}$$

ΘΕΜΑ Δ

Δ1.



Σώμα $\Sigma : \Sigma\vec{F}_y = 0 \Rightarrow T_2 = M_\Sigma g \Rightarrow T_2 = 20N$

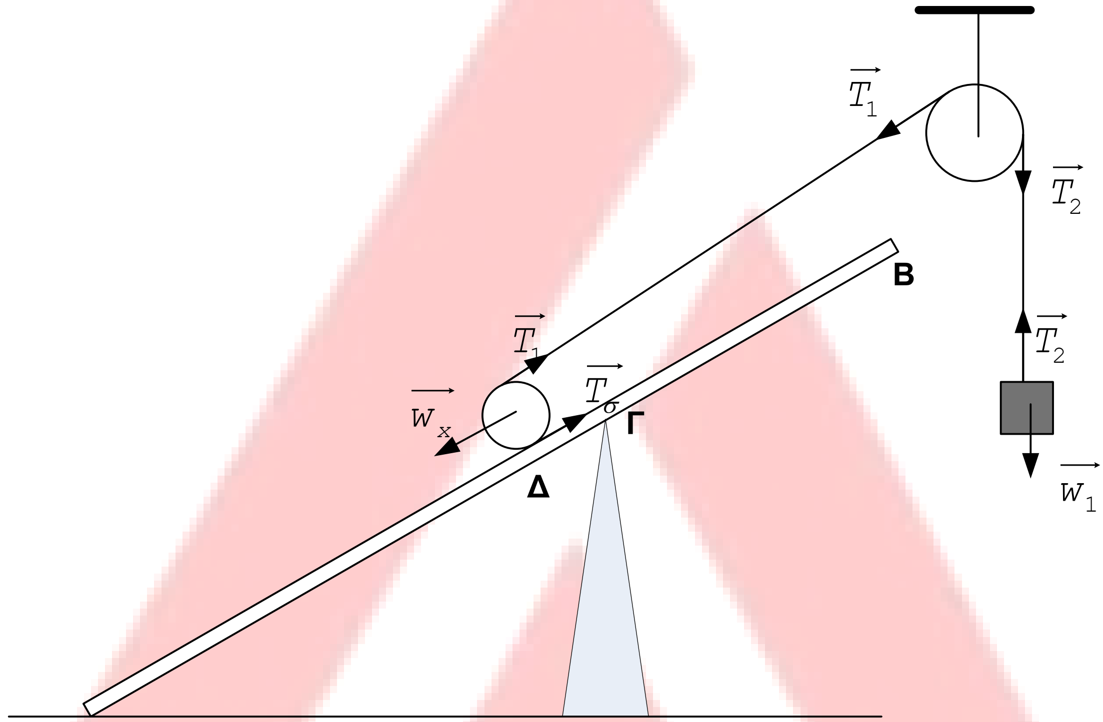
Τροχαλία : $\Sigma\tau = 0 \Rightarrow T_1 \cdot R_T = T_2 \cdot R_T \Rightarrow T_1 = T_2$

Κύλινδρος : $\Sigma\tau = 0 \Rightarrow T_1 \cdot R_k - T_{\sigma\tau} \cdot R_k = 0 \Rightarrow T_1 = T_{\sigma\tau} = 20N$

$\Sigma\vec{F}_x = 0 \Rightarrow F + M_k g\eta\mu 30 = T_1 + T_{\sigma\tau}$

$F + 10 = 2T_1 \Rightarrow F + 10 = 40 \Rightarrow F = 30N$

Δ2.



Κύλινδρος: $\vec{\Sigma F_x} = M_\kappa \cdot \vec{a}_{cm} \Rightarrow T_1' + T_{\sigma\tau}' - M_\kappa g\eta\mu 30 = M_\kappa \cdot a_{cm}$

$T_1' + T_{\sigma\tau}' - 10 = 2a_{cm}$ (1)

- $\Sigma_T = I a_{\gamma(\kappa)} \Rightarrow T_1' \cdot R_\kappa - T_{\sigma\tau}' \cdot R_\kappa = \frac{1}{2} M_\kappa R_\kappa{}^2 a_{\gamma(\kappa)}$

$T_1' - T_{\sigma\tau}' = a_{cm}$ (2)

Τροχαλία : $\Sigma\tau = I_{TP} \cdot a_{\gamma_{(T)}} \Rightarrow T_2' \cdot R_T - T_1' \cdot R_T = \frac{1}{2} M_T R_T{}^2 \cdot a_{\gamma_{(T)}} \Rightarrow T_2' - T_1' = a$ (3)

$\left(u_\Sigma = \omega R_T \overset{d/dt}{\Rightarrow} a = a_{\gamma_{(T)}} R_T \right)$

Σώμα Σ: $\Sigma F_y = M_T \cdot a \Rightarrow M_\Sigma g - T_2' = M_\Sigma a \Rightarrow 20 - T_2' = 2a$ (4)

Επίσης, $2u_{cm} = u_\Sigma \overset{d/dt}{\Rightarrow} 2a_{cm} = a$ (5)

$(1)+(2) \Rightarrow 2T_1' - 10 = 3a_{cm} \overset{(5)}{\Rightarrow} 2T_1' - 10 = \frac{3}{2}a_{cm} \Rightarrow T_1' - 5 = \frac{3}{4}a_{cm}$ (6)

$(3)+(4)+(6) \Rightarrow a = 4m/s^2$, άρα $a_{cm} = \frac{a}{2} = 2m/s^2$

Δ3. Κύλινδρος

$U_1 = a_{cm} \cdot t_1 \Rightarrow U_1 = 1m/s$

$S_1 = \frac{1}{2}a_{cm}t_1^2 = \frac{1}{2}2 \cdot \frac{1}{4} \Rightarrow S_1 = \frac{1}{4}m$

Κόβω νήματα

$\Sigma \vec{F}_x = M_k \cdot \vec{a}'_{cm}$

$T_{\sigma\tau} - M_k g\eta\mu 30 = Ma_{cm} \Rightarrow T_{\sigma\tau} - 10 = 2a_{cm}$ (1)

$\Sigma\tau = I a'_\gamma \Rightarrow -T_a R = \frac{1}{2}MR^2 \cdot a'_\gamma \Rightarrow -T_{\sigma\tau} = a_{cm}$ (2)

$(1) \overset{(2)}{\rightarrow} -10 - a_{cm} = 2a_{cm} \Rightarrow a_{cm} = -\frac{10}{3}m/s^2$

$U_2 = U_1 - a_{cm}t \Rightarrow t = \frac{U_1}{a_{cm}} = \frac{3}{10}sec$

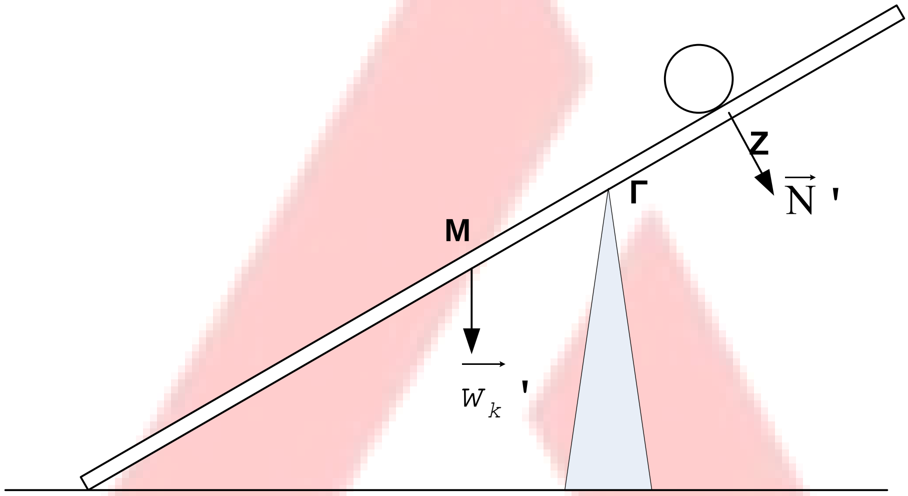
Άρα $t_2 = 0{,}5 + 0{,}3 = 0{,}8\,sec$

Δ4. $x_1 = \frac{1}{2}a_{cm}t^2 = \frac{1}{2}2\frac{1}{4} = \frac{1}{4}m$

$x_2 = \frac{U_0^2}{2a'} = \frac{1}{2 \cdot \frac{10}{3}} = \frac{3}{20} = \frac{1{,}5}{10} = 0{,}15m$

$x_{o\lambda} = 0{,}25 + 0{,}15 = 0{,}4m$

Δ5.



ψάχνω x τη θέση του κυλίνδρου ως προς το σημείο Γ όπου ο κύλινδρος θα ανατραπεί

$$\Sigma\tau_{(1)} = 0 \text{ και } N_A = 0$$

$$M_p \cdot g \cdot συνφ_0 0,5 = x \cdot M \cdot g \cdot συνφ_0 \Rightarrow x = 0,5m$$

Επειδή $x_{max} = 0,2m$ άρα δεν θα ανατραπεί

<u>ΣΧΟΛΙΟ</u>

Τα θέματα ήταν απαιτητικά και χρειαζόταν πολύς χρόνος για την επίλυσή τους .

<u>Συγγραφική Ομάδα Φυσικών ΡΟΜΒΟΥ</u>