ΕΠΑΝΑΛΗΠΤΙΚΕΣ ΠΑΝΕΛΛΑΔΙΚΕΣ ΕΞΕΤΑΣΕΙΣ
Γ΄ ΤΑΞΗΣ ΗΜΕΡΗΣΙΟΥ & Δ΄ ΤΑΞΗΣ ΕΣΠΕΡΙΝΟΥ ΓΕΝΙΚΟΥ ΛΥΚΕΙΟΥ

ΠΕΜΠΤΗ 5 ΣΕΠΤΕΜΒΡΙΟΥ 2019

ΑΠΑΝΤΗΣΕΙΣ ΣΤΑ ΦΥΣΙΚΗ ΠΡΟΣΑΝΑΤΟΛΙΣΜΟΥ

ΘΕΜΑ Α

Α1. β

Α2. α

Α3. δ

Α4. β

Α5. **α.** Σωστό, **β.** Λάθος, **γ.** Λάθος, **δ.** Σωστό, **ε.** Λάθος.

ΘΕΜΑ Β

Β1. **α.** Σωστή απάντηση η (i)

β. $\omega_1 = 399\pi$ r/s και $\omega_2 = 401\pi$ r/s

$$\omega = \frac{\omega_1 + \omega_2}{2} = \frac{399\pi + 401\pi}{2} = \frac{800\pi}{2} = 400\pi \text{ r/s}$$

$$f = \frac{\omega}{2\pi} = \frac{400\pi}{2\pi} = 200 \text{ Hz}$$

$$f_\delta = f_2 - f_1 = \frac{\omega_2}{2\pi} - \frac{\omega_1}{2\pi} = \frac{\omega_2 - \omega_1}{2\pi} = \frac{401\pi - 399\pi}{2\pi} = \frac{2\pi}{2\pi} = 1 \text{ Hz}$$

$$T_\delta = \frac{1}{f_\delta} = 1 \text{ s}$$

$$\Delta t = 2T_\delta = 2 \text{ s}$$

$$f = \frac{N_{\tau\alpha\lambda}}{\Delta t} \Rightarrow N_{\tau\alpha\lambda} = f \cdot \Delta t = 200 \cdot 2 = \textbf{400 ταλαντώσεις}$$

B2. α. Σωστή απάντηση είναι η (iii)

β. $\Pi_1 = \Pi_2 \Rightarrow A_1\upsilon_1 = A_2\upsilon_2 \overset{A_1 = 2A_2}{\Rightarrow} 2A_2\upsilon_1 = A_2\upsilon_2 \Rightarrow \upsilon_2 = 2\upsilon_1$

$$p_1 + \frac{1}{2}\rho\upsilon_1^2 = p_2 + \frac{1}{2}\rho\upsilon_2^2 \Rightarrow p_1 - p_2 = \frac{1}{2}\rho\upsilon_2^2 - \frac{1}{2}\rho\upsilon_1^2 \Rightarrow$$

$$\rho gh = \frac{1}{2}\rho(\upsilon_2^2 - \upsilon_1^2) \overset{\upsilon_2 = 2\upsilon_1}{\Rightarrow} gh = \frac{1}{2}\rho(4\upsilon_1^2 - \upsilon_1^2) \Rightarrow$$

$$gh = \frac{1}{2}\rho \cdot 3\upsilon_1^2 \Rightarrow h = \frac{3\upsilon_1^2}{2g}$$

$$h' = \frac{3\upsilon'^2_1}{2g} \overset{\upsilon'_1 = 2\upsilon_1}{\Rightarrow} h' = \frac{3 \cdot 4\upsilon_1^2}{2g} \Rightarrow h' = 4 \cdot \frac{3\upsilon_1^2}{2g} \Rightarrow h' = 4h$$

B3. α. Σωστή απάντηση η (ii).

β. Έχουμε ελαστική κρούση, $Q = 0$

$$K_{\pi\rho\iota\nu} = K_{\mu\varepsilon\tau\acute{\alpha}} \Rightarrow \frac{1}{2}m\upsilon^2 = \frac{1}{2}m\upsilon_1^2 + \frac{1}{2}m\upsilon_2^2 \Rightarrow \upsilon^2 = \upsilon_1^2 + \upsilon_2^2 \quad (1)$$

$$\text{Α.Δ.Ο} : \vec{p}_\Pi = \vec{p}_M \Rightarrow p = \sqrt{p_1^2 + p_2^2 + 2 \cdot p_1 \cdot p_2 \cdot \sigma\upsilon\nu\theta} \Rightarrow$$

$$\cancel{m^2} \cdot \upsilon^2 = \cancel{m^2} \cdot \upsilon_1^2 + \cancel{m^2} \cdot \upsilon_2^2 + 2 \cdot \cancel{m} \cdot \upsilon_1 \cdot \cancel{m} \cdot \upsilon_2 \cdot \sigma\upsilon\nu\theta \overset{(1)}{\Rightarrow}$$

$$\cancel{\upsilon_1^2 + \upsilon_2^2} = \cancel{\upsilon_1^2 + \upsilon_2^2} + 2 \cdot \upsilon_1 \cdot \upsilon_2 \cdot \sigma\upsilon\nu\theta \Rightarrow$$

$$2 \cdot \upsilon_1 \cdot \upsilon_2 \cdot \sigma\upsilon\nu\theta = 0 \underset{\upsilon_2 \neq 0}{\overset{\upsilon_1 \neq 0}{\Rightarrow}}$$

$$\sigma\upsilon\nu\theta = 0 \Rightarrow \theta = 90^0$$

ΘΕΜΑ Γ

Γ1. $\omega = \dfrac{\Delta\varphi}{\Delta t} \Rightarrow \omega = \dfrac{20\pi}{2} \Rightarrow \omega = 10\pi$ r/s.

$E = \dfrac{1}{2}\cdot\Delta_m\cdot\upsilon_{max}^2 \Rightarrow E = \dfrac{1}{2}\cdot\Delta_m\cdot\omega^2\cdot A^2 \Rightarrow A^2 = \dfrac{2E}{\Delta_m\cdot\omega^2} \Rightarrow$

$A^2 = \dfrac{2\cdot 16\pi^2\cdot 10^{-8}}{2\cdot 10^{-6}\cdot 10^2\pi^2} \Rightarrow A^2 = 16\cdot 10^{-4} \Rightarrow A = 4\cdot 10^{-2} = \mathbf{0,04\,m}$

Γ2. $T = \dfrac{2\pi}{\omega} \Rightarrow T = 0,2s$

$\varphi = 2\pi\left(\dfrac{t}{T} - \dfrac{x}{\lambda}\right) \Rightarrow 20\pi = 2\pi\left(\dfrac{4}{0,2} - \dfrac{1}{\lambda}\right) \Rightarrow 10 = 20 - \dfrac{1}{\lambda} \Rightarrow$

$\dfrac{1}{\lambda} = 10 \Rightarrow \lambda = 0,1$ m

$y = 0,04\eta\mu 2\pi(5t - 10x)$ (S.I.)

Γ3. $\upsilon = \dfrac{\lambda}{T} \Rightarrow \upsilon = 0,5$ m/s

$x_P = \upsilon\cdot t \Rightarrow x_P = 0,5\cdot 2 \Rightarrow x_P = 1$ m

$\Delta\varphi = \varphi_P - \varphi_1 = 2\pi(5t - 10) - 2\pi(5t - 11,5) = 3\pi$ rad

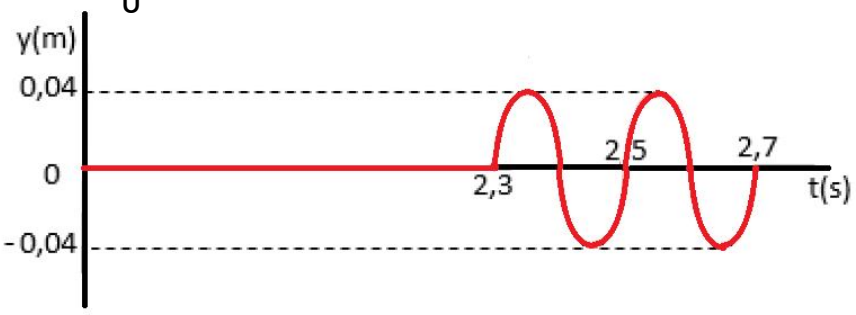
Το Σ ταλαντώνεται σε αντίθεση φάσης με το P, άρα

$\upsilon_\Sigma = -\upsilon_P \Rightarrow \upsilon_\Sigma = -\upsilon_{max} \Rightarrow \upsilon_\Sigma = -0,4\pi$ m/s

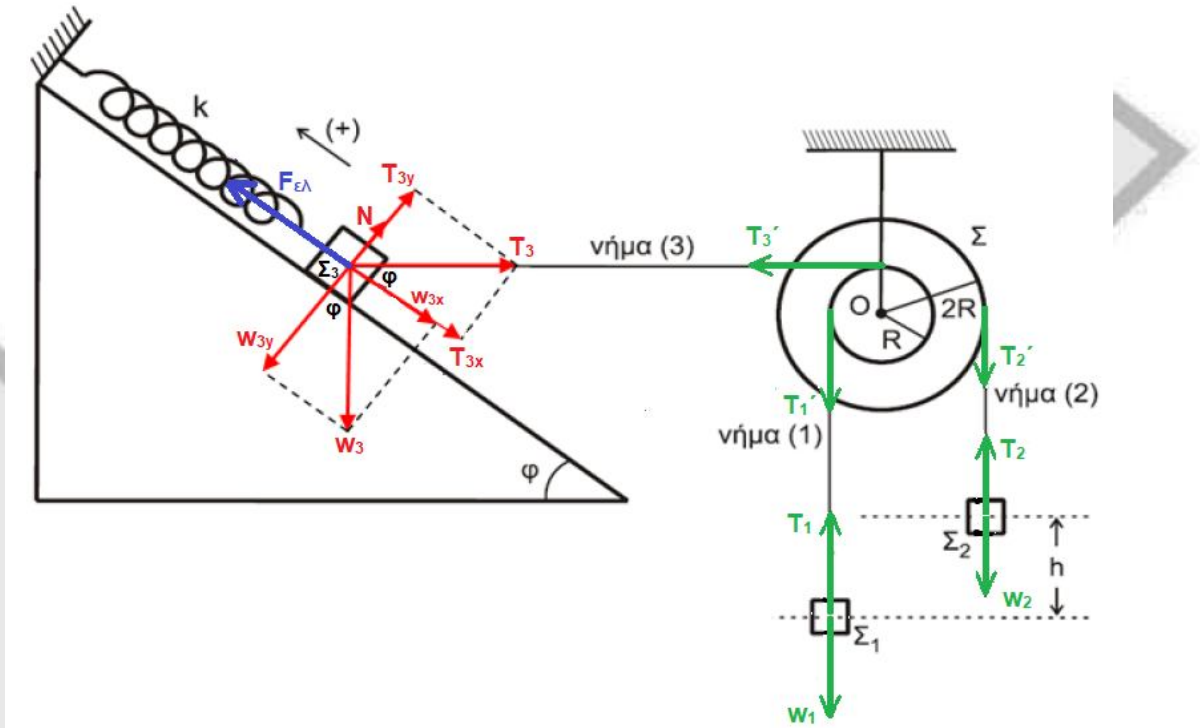
$|\upsilon_\Sigma| = 0,4\pi$ m/s, αρνητική κατεύθυνση

Γ4. $y = 0,04\eta\mu 2\pi(5t - 11,5)$ (SI) $t \geq 2,3$ s

$t_\Sigma = \dfrac{x_\Sigma}{\upsilon} \Rightarrow t_\Sigma = 2,3$ s



ΘΕΜΑ Δ



Δ1. $T_1 = T'_1 = m_1 g = 10$ N και

$T_2 = T'_2 = m_2 g = 15$ N

$$\sum \tau = 0 \Rightarrow T'_2 \cdot 2R - T'_1 \cdot R - T'_3 \cdot R = 0 \Rightarrow T'_3 = 2T'_2 - T'_1 \Rightarrow$$
$$T'_3 = 2 \cdot 15 - 10 \Rightarrow T'_3 = T_3 = 20 \text{ N}$$

$$\sum F_x = 0 \Rightarrow F_{ελ} = w_{3x} + T_{3x} \Rightarrow F_{ελ} = m_3 \cdot g \cdot ημφ + T_3 \cdot συνφ \Rightarrow$$
$$F_{ελ} = 3 \cdot 10 \cdot 0{,}8 + 20 \cdot 0{,}6 \Rightarrow F_{ελ} = 24 + 12 \Rightarrow F_{ελ} = 36 \text{ N}$$

$$\Delta \ell_1 = \frac{F_{ελ}}{k} = \frac{36}{300} = 0{,}12 \text{ m}$$

Δ2. $\sum F_x = 0 \Rightarrow F_{ελ} = w_{3x} \Rightarrow$

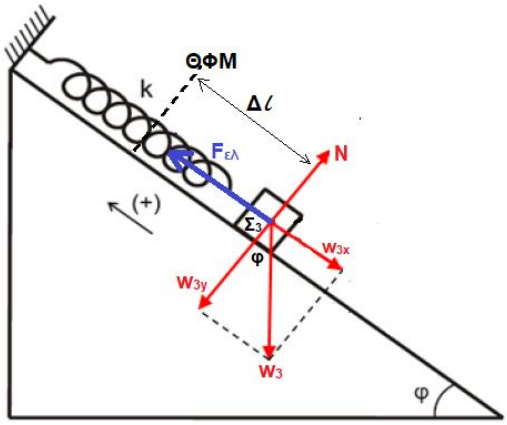
$K \cdot \Delta\ell = m_3 \cdot g \cdot ημφ \Rightarrow$

$\Delta\ell = \dfrac{m_3 \cdot g \cdot ημφ}{K} \Rightarrow$

$\Delta\ell = \dfrac{3 \cdot 10 \cdot 0,8}{300} \Rightarrow \Delta\ell = 0,08$ m

$A = \Delta\ell_1 - \Delta\ell = 0,12 - 0,08 = 0,04$ m

$\omega = \sqrt{\dfrac{k}{m_3}} = \sqrt{\dfrac{300}{3}} = 10$ rad/s



Συνθήκη : Για $t = 0$, $x = -0,04$ m και $υ = 0$

$x = 0,04 \cdot ημ\left(10t + \dfrac{3π}{2}\right)$ (SI) / $T = \dfrac{2π}{ω} = \dfrac{π}{5}$ s

$\left|\dfrac{dp}{dt}\right| = \left|\sum F\right| = k \cdot x = 300 \cdot 0,04 \cdot ημ\left(10\dfrac{π}{15} + \dfrac{3π}{2}\right)$

$= 12 \cdot ημ\left(\dfrac{2π}{3} + \dfrac{3π}{2}\right) = 12 \cdot ημ\left(\dfrac{4π}{6} + \dfrac{9π}{6}\right)$

$= 12 \cdot ημ\dfrac{13π}{6} = 12 \cdot ημ\dfrac{π}{6} = 12 \cdot \dfrac{1}{2} =$ **6 N**

Δ3. $α_γ = \dfrac{α_1}{R_1} = \dfrac{α_2}{R_2} \Rightarrow \begin{cases} α_1 = 0,1 \cdot α_γ \\ α_2 = 0,2 \cdot α_γ \end{cases}$

$\sum F_{(1)} = m_1 \cdot α_1 \Rightarrow T_1 - m_1 g = α_1 \Rightarrow T_1 = 10 + 0,1 \cdot α_γ$

$\sum F_{(2)} = m_2 \cdot α_2 \Rightarrow m_2 g - T_2 = 1,5α_2 \Rightarrow T_2 = 15 - 0,3 \cdot α_γ$

$\sum τ = I \cdot α_γ \Rightarrow T_2 \cdot 2\cancel{R} - T_1 \cdot \cancel{R} = 2MR^{\cancel{2}} \cdot α_γ \Rightarrow$

$(15 - 0,3 \cdot α_γ) \cdot 2 - (10 + 0,1 \cdot α_γ) = 2 \cdot 1,5 \cdot 0,1 \cdot α_γ \Rightarrow$

$30 - 0,6 \cdot α_γ - 10 - 0,1 \cdot α_γ = 0,3 \cdot α_γ \Rightarrow α_γ = 20$ rad/s

Δ4. $\alpha_1 = 0,1 \cdot \alpha_\gamma = 2\ m/s^2$ και

$\alpha_2 = 0,2 \cdot \alpha_\gamma = 4\ m/s^2$

$$S_1 + S_2 = h \Rightarrow \frac{1}{2} \cdot \alpha_1 \cdot \Delta t^2 + \frac{1}{2} \cdot \alpha_2 \cdot \Delta t^2 = 0,48 \Rightarrow$$

$$\frac{1}{2} \cdot 2 \cdot \Delta t^2 + \frac{1}{2} \cdot 4 \cdot \Delta t^2 = 0,48 \Rightarrow 3 \cdot \Delta t^2 = 0,48 \Rightarrow$$

$$\Delta t^2 = 0,16 \Rightarrow \Delta t = 0,4\ s$$

$$L = I \cdot \omega = 2 \cdot M \cdot R^2 \cdot \alpha_\gamma \cdot \Delta t = 2 \cdot 1,5 \cdot 0,1^2 \cdot 20 \cdot 0,4$$

$$= 0,24\ Kg \cdot m^2/s$$

Δ5. $\left. \begin{array}{l} N = \dfrac{20}{\pi} \\ \Delta\theta = N \cdot 2\pi \end{array} \right\} \Rightarrow \Delta\theta = \dfrac{20}{\pi} \cdot 2\pi \Rightarrow \Delta\theta = 40\ rad$

$$\Delta\theta = \frac{1}{2} \cdot \alpha_\gamma \cdot t_2^{\,2} \Rightarrow 40 = 10 \cdot t_2^{\,2} \Rightarrow t_2^{\,2} = 4 \Rightarrow t_2 = 2\ s$$

$$\left| \frac{dK}{dt} \right| = \left| \sum \tau \cdot \omega \right| = I \cdot \alpha_\gamma \cdot \alpha_\gamma \cdot t_2 = 2 \cdot M \cdot R^2 \cdot \alpha_\gamma^{\,2} \cdot t_2$$

$$= 2 \cdot 1,5 \cdot 0,1^2 \cdot 20^2 \cdot 2 = 24\ J/s$$