ΠΑΝΕΛΛΑΔΙΚΕΣ ΕΞΕΤΑΣΕΙΣ

ΤΡΙΤΗ 10 ΙΟΥΝΙΟΥ 2014

ΦΥΣΙΚΗ ΚΑΤΕΥΘΥΝΣΗΣ

ΑΠΑΝΤΗΣΕΙΣ

ΘΕΜΑ Α

Α1 – γ

Α2 – β

Α3 – γ

Α4 – β

Α5

α – Σ β – Σ γ – Λ δ – Λ ε – Σ

ΘΕΜΑ Β

Β1 – iii

ΑΔΟ

$$m\cdot\upsilon_{max}=2m\cdot\upsilon'_{max}\Rightarrow\omega A_1=2\omega' A_2\Rightarrow\sqrt{\frac{\kappa}{m}}A_1=2\sqrt{\frac{2\kappa}{2m}}A_2\Rightarrow\frac{A_1}{A_2}=2$$

Β2 – ii

$$T_\Delta=\frac{1}{f_1-f_2}\Rightarrow f_1-f_2=\frac{1}{2}\ (1)$$

$$f=\frac{f_1+f_2}{2}\Rightarrow\frac{N}{T_\Delta}=\frac{f_1+f_2}{2}\Rightarrow 100=\frac{f_1+f_2}{2}\Rightarrow f_1+f_2=200\ (2)$$

Από (1) και (2) σωστή επιλογή το ii

Β3 – iii

$$\upsilon'_1=-\upsilon'_2\Rightarrow\left(\frac{m_1-m_2}{m_1+m_2}\right)\upsilon_1=-\frac{2m_1}{m_1+m_2}\upsilon_1\Rightarrow m_1-m_2=-2m_1\Rightarrow 3m_1=m_2\Rightarrow\frac{m_1}{m_2}=\frac{1}{3}$$

ΘΕΜΑ Γ

Γ1

Ο χρόνος άφιξης του 1ου κύματος

$$t_1 = \frac{r_2}{\upsilon} \Rightarrow 0,2 = \frac{r_2}{5} \Rightarrow r_2 = 1m$$

Ο χρόνος άφιξης του 2ου κύματος

$$t_2 = \frac{r_1}{\upsilon} \Rightarrow 1,4 = \frac{r_1}{\upsilon} \Rightarrow r_1 = 7m$$

Γ2

$$y = \begin{cases} 0 \quad , \quad 0s \le t < 0,2s \\ A\eta\mu 2\pi\left(\frac{t}{T} - \frac{r_1}{\lambda}\right) = 5\cdot 10^{-2}\eta\mu 2\pi\left(2,5t - 0,5\right), \ 0,2s \le t < 1,4s \\ 2A\frac{\sigma\upsilon\nu 2\pi\left(r_1 - r_2\right)}{2\lambda}\eta\mu 2\pi\left(\frac{t}{T} - \frac{r_1 + r_2}{2\lambda}\right) = -10^{-2}\eta\mu 2\pi\left(2,5t - 2\right), \ 1,4s \le t < \infty \end{cases}$$

Από σχήμα

$$3T = 1,2 \Rightarrow T = 0,4 \Rightarrow f = 2,5Hz$$

$$\upsilon = \lambda f \Rightarrow \lambda = 2m$$

$$A = 5\cdot 10^{-3} m$$

Γ3

$$\upsilon = \omega\sqrt{\left(2A\right)^2 - y_1^{\ 2}} \Rightarrow \upsilon = 5\pi\sqrt{10^{-4} - 0,75\cdot 10^{-4}} \Rightarrow$$

$$\Rightarrow \upsilon = 5\pi\sqrt{0,25\cdot 10^{-4}} \Rightarrow \upsilon = 5\pi\frac{5}{10}10^{-4} = 25\pi 10^{-3} m/s$$

Γ4

$$\frac{K_1}{K_2} = \frac{\frac{1}{2}m\omega_1^{\ 2}A_1^{\ 2}}{\frac{1}{2}m\omega_2^{\ 2}A_2^{\ 2}} \Rightarrow \frac{K_1}{K_2} = \frac{\omega_1^{\ 2}A_1^{\ 2}}{\omega_2^{\ 2}A_2^{\ 2}} = \frac{4\pi^2 f_1^{\ 2}A_1^{\ 2}}{4\pi^2 f_2^{\ 2}A_2^{\ 2}} \Rightarrow \frac{K_1}{K_2} = \frac{81}{100}\cdot\frac{A_1^{\ 2}}{A_2^{\ 2}}$$

$$\upsilon_1 = \upsilon_2 \Rightarrow \ \lambda_1 f_1 = \lambda_2 f_2 \Rightarrow 2\cdot f_1 = \lambda_2\frac{10}{9}f_1 \Rightarrow \lambda_2 = 1,8m$$

$$A_1 = 10^{-2} m$$

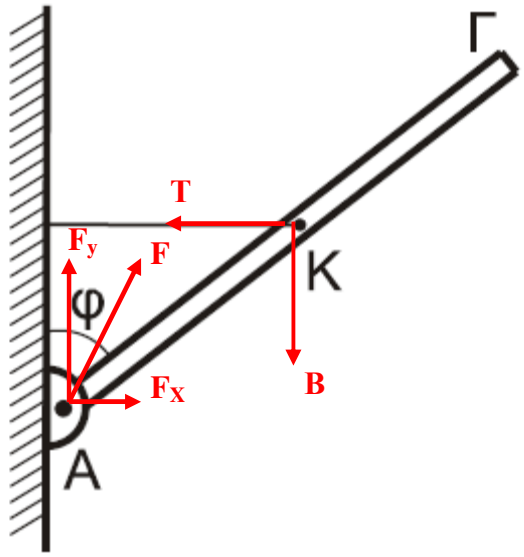
$$A_2 = 2A\sigma\upsilon\nu\frac{2\pi(r_1 - r_2)}{2\lambda_2} \Rightarrow A_2 = 10^{-2}\sigma\upsilon\nu\frac{6\pi}{1,8} = 10^{-2}\sigma\upsilon\nu\frac{60\pi}{18}$$

$$\Rightarrow A_2 = 10^{-2}\sigma\upsilon\nu\frac{10\pi}{3} = 0,5\cdot 10^{-2}\,m$$

$$\text{Άρα } \frac{K_1}{K_2} = \frac{81}{100}\cdot\frac{100}{4} = \frac{81}{4}$$

ΘΕΜΑ Δ

Δ1



$$\Sigma f\left(x\right) = 0 \Rightarrow F_x = T$$

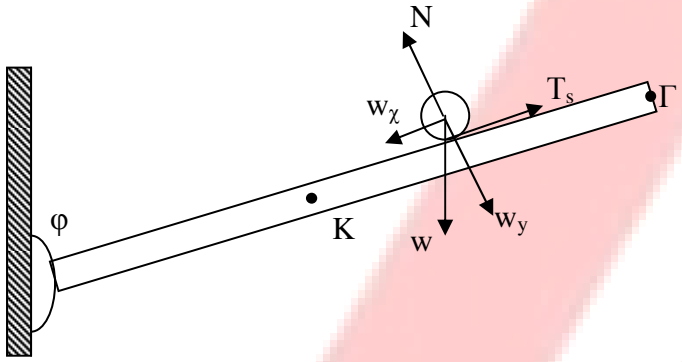
$$\Sigma f\left(y\right) = 0 \Rightarrow F_y = B = 56N$$

$$\Sigma\tau\left(A\right) = 0 \Rightarrow T\cdot\frac{\ell}{2}\sigma\upsilon\nu\varphi = B\frac{\ell}{2}\eta\mu\varphi \Rightarrow T = \frac{B\eta\mu\varphi}{\sigma\upsilon\nu\varphi} \Rightarrow T = \frac{56\cdot 0,6}{0,8} \Rightarrow T = 42N$$

$$F = \sqrt{F_x^{\,2} + F_y^{\,2}} = \sqrt{\left(7\cdot 6\right)^2 + \left(7\cdot 8\right)^2} = 7\sqrt{6^2 + 8^2} \Rightarrow F = 70N$$

$$\varepsilon\varphi\theta = \frac{F_y}{F_x} = \frac{56}{42} = \frac{4}{3}$$

Δ2



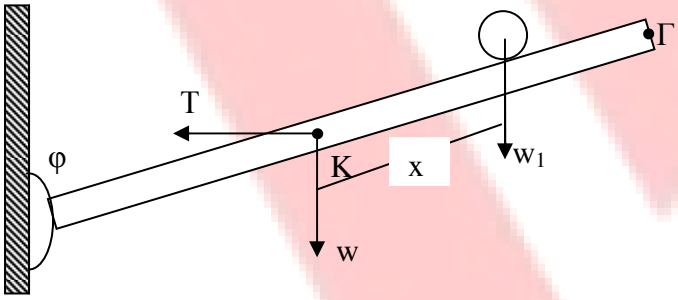
$$\Sigma f(x) = m\cdot\alpha_{cm} \Rightarrow -w_x + T = m\cdot a_{cm}$$

$$\Sigma\tau(0) = I\alpha_\gamma \Rightarrow T\cdot r = \frac{2}{5}mr^2\frac{\alpha m}{r}$$

Με πρόσθεση κατά μέλη: $-mg\sigma\upsilon\nu\varphi = \frac{7}{5}m\cdot\alpha_{cm}$

$$\alpha_{cm} = \frac{-5g\sigma\upsilon\nu\varphi}{7} \Rightarrow \alpha_{cm} = -\frac{5g\sigma\upsilon\nu\varphi}{7r} = -\frac{5\cdot 10\cdot 0,8}{7\frac{1}{70}} = -400 rad/s^2$$

Δ3

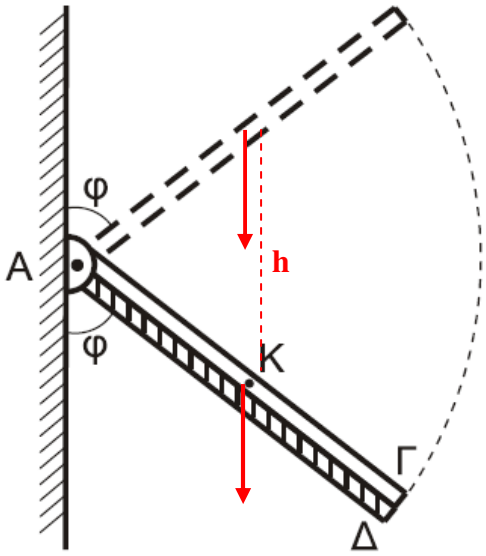


$$\Sigma\tau_{(A)} = 0 \Rightarrow T\frac{\ell}{2}\sigma\upsilon\nu\varphi - w\frac{\ell}{2}\eta\mu\varphi - w_1\left(\frac{\ell}{2}+x\right)\eta\mu\varphi \Rightarrow$$

$$T = \frac{w\frac{\ell}{2}\eta\mu\varphi + w_1\left(\frac{\ell}{2}+x\right)\eta\mu\varphi}{\frac{\ell}{2}\sigma\upsilon\nu\varphi} \Rightarrow T = \frac{56\cdot 0,6 + 4(1+x)\cdot 0,6}{0,8} \Rightarrow$$

$$\Rightarrow T = \frac{33,6 + 2,4 + 2,4x}{0,8} = 45 + 3x$$

Δ4



$$h = 2\frac{\ell}{2}\sigma\upsilon\nu\varphi$$

Θ.Μ.Κ.Ε

$$\frac{1}{2}I\omega^2 = Mg\frac{\ell}{2}\sigma\upsilon\nu\varphi\cdot 2 \Rightarrow \omega = \sqrt{\frac{2Mg\ell\sigma\upsilon\nu\varphi}{\frac{1}{3}M\ell^2}} \Rightarrow \omega = \sqrt{\frac{6g\sigma\upsilon\nu\varphi}{\ell}} \Rightarrow \omega = \sqrt{24}\ \text{rad/s}$$

$$\frac{dK}{dt} = \Sigma\tau\cdot\omega = w\cdot\frac{\ell}{2}\eta\mu\varphi\cdot\omega = 56\cdot 0,6\cdot\sqrt{24} = 33,6\cdot\sqrt{24}J/s$$

Δ5

$$\pi = \frac{K_T - K\alpha}{K\alpha}\cdot 100\% = \left(\frac{K_T}{K\alpha} - 1\right)100$$

$$\pi = \left(\frac{\frac{1}{2}\cdot\frac{L^2}{I_T}}{\frac{1}{2}\cdot\frac{L_2}{I\alpha}} - 1\right)100 = \left(\frac{I\alpha}{I_T} - 1\right)100$$

$$\pi = \left(\frac{\frac{1}{3}M\ell^2}{\frac{1}{3}4M\ell^2} - 1\right)100 = -75\%$$

$$K = \frac{1}{2}I\omega^2 = \frac{1}{2}I\frac{L^2}{I^2} = \frac{1}{2}\cdot\frac{L^2}{I}$$

ΕΠΙΜΕΛΕΙΑ ΑΠΑΝΤΗΣΕΩΝ

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