ΑΠΑΝΤΗΣΕΙΣ ΣΤΗ ΦΥΣΙΚΗ ΚΑΤΕΥΘΥΝΣΗΣ Γ΄ ΤΑΞΗΣ ΗΜΕΡΗΣΙΟΥ ΓΕΝΙΚΟΥ ΛΥΚΕΙΟΥ
ΤΡΙΤΗ 10 ΙΟΥΝΙΟΥ 2014

ΘΕΜΑ Α

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

ΘΕΜΑ Β

Β1.

$E_{T_1} = \frac{1}{2}D_1A_1^2 = \frac{1}{2}kd^2 = \frac{1}{2}mu^2$ (1)

ΑΔΟ $\Sigma f_{\varepsilon\xi} = 0 \Rightarrow P_{\alpha\rho\chi} = P_{\tau\varepsilon\lambda} \Rightarrow mu = 2mu_k \Rightarrow u_k = \frac{u}{2}$

οπότε $E_{T_2} = \frac{1}{2}2mu_k^2 = m\frac{u^2}{4} = \frac{1}{2}\frac{1}{2}mu^2 = \frac{1}{2}E_{T_1} \Rightarrow E_{T_2} = \frac{1}{2}E_{T_1} \Rightarrow \frac{1}{2}D_2A_2^2 = \frac{1}{2}\frac{1}{2}D_1A_1^2 \Rightarrow$

$\Rightarrow 2kA_2^2 = \frac{1}{2}kA_1^2 \Rightarrow A_2^2 = \frac{1}{4}A_1^2 \Rightarrow A_2 = \frac{1}{2}A_1 \Rightarrow \frac{A_1}{A_2} = 2$

Β2. $\bar{f} = \frac{N}{T_s} = \frac{200}{2}Hz \Rightarrow \frac{f_1+f_2}{2} = 100 \Rightarrow \begin{cases} f_1 + f_2 = 200Hz \\ f_d = f_1 - f_2 = \frac{1}{T_d} = 0{,}5 \end{cases} \overset{+}{\Rightarrow} 2f_1 = 200{,}5 \Rightarrow$

$f_1 = 100{,}25Hz \quad \kappa\alpha\iota \quad f_2 = 99{,}75Hz.$

Β3. $u_1' = \frac{m_1-m_2}{m_1+m_2}u_1$ (πρέπει $m_1 < m_2$ για να κινηθεί αριστερά)

$u_2' = \frac{2m_1}{m_1+m_2}u_1$ ελαστική κρούση με τοίχο της m_2

ΑΔΜΕ $\frac{1}{2}m_2u_2'^2 = \frac{1}{2}m_2u_2''^2 \Rightarrow |\vec{u}_2'| = |\vec{u}_2''|$

για να διατηρηθεί η απόσταση του ... μετά την κρούση της ... με το αντίστοιχο ... ισχύει:

$|\vec{u}_1'| = |\vec{u}_2'| \Rightarrow \frac{|m_1 - m_2|}{m_1 + m_2}|\vec{u}_1| = \frac{2m_1}{m_1+m_2}|\vec{u}_1| \Rightarrow m_2 - m_1 = 2m_1 \Rightarrow m_2 = 3m_1 \Rightarrow \frac{m_1}{m_2} = \frac{1}{3}$

ΘΕΜΑ Γ

[illegible] $\Rightarrow 3T = 1{,}2s \Rightarrow f = 0{,}4$ [illegible]

[illegible]

λ_f [illegible]

Γ1. [illegible]

Γ2. [illegible]

y [illegible] $\le 1{,}4s$ [illegible]

y [illegible] $\ge 1{,}4s$ [illegible]

[illegible]

$= 10$ [illegible] $(5\pi - 4\pi)$

$$= 10^{-2}\eta\mu(5\pi t - 4\pi + \pi) = 10^{-2}\eta\mu(5\pi t - 3\pi)$$

Γ3. $t_{11} > 1{,}4s$ *έχει ξεκινήσει η συμβολή.*

ΑΔΕΠ $K + U = U_{max} \Longrightarrow \frac{1}{2}mu^2 + \frac{1}{2}Dy^2 = \frac{1}{2}DA'^2 \Longrightarrow mu^2 = mw^2A'^2 - mw^2y^2 \Longrightarrow$

$$\Longrightarrow |\vec{u}| = w\sqrt{A'^2 - y^2} = 5\pi\sqrt{(10^2)^2 - \left(5\sqrt{3}\cdot 10^{-3}\right)^2} = 5\pi\sqrt{10^{-4} - 75\cdot 10^{-6}} = 25\pi\cdot 10^{-3} m/s$$

Γ4. $f' = \frac{10}{9}f$

$$u_\delta = \lambda f = \lambda' f' \Longrightarrow \lambda f = \lambda'\frac{10}{9}f \Longrightarrow \lambda' = \frac{9}{10}\lambda = 1{,}8$$

$$|A'_\Sigma| = 2A\left|\sigma\upsilon\nu\frac{\pi}{\lambda}(r_1 - r_2)\right| = 10^{-2}\left|\sigma\upsilon\nu\left(\frac{\pi}{1{,}8}\cdot 6\right)\right| = 10^{-2}\sigma\upsilon\nu\frac{60\pi}{18} = 10^{-2}\left|\sigma\upsilon\nu\frac{10\pi}{3}\right| =$$

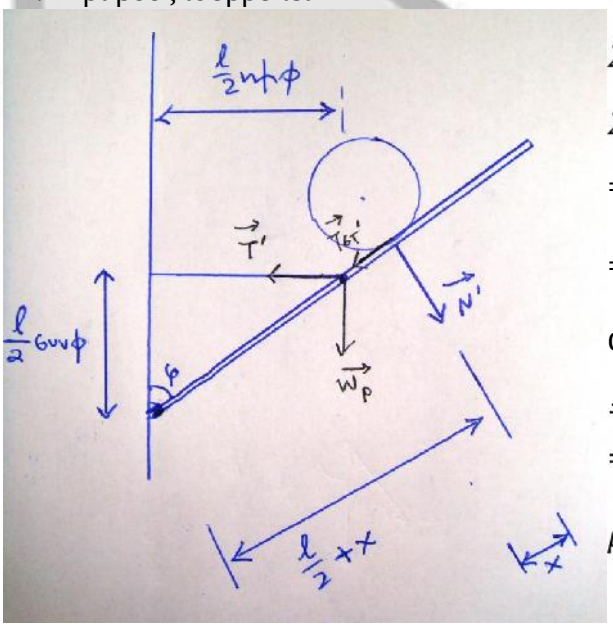
$$= 10^{-2}\left|\sigma\upsilon\nu\left(2\pi + \pi + \frac{\pi}{3}\right)\right| = 10^{-2}\left|-\sigma\upsilon\nu\frac{\pi}{3}\right| = 10^{-2}\frac{1}{2} = 5\cdot 10^{-3} m$$

$$\text{Συνεπώς } \frac{K_1}{K_2} = \frac{u_{\max 1}}{u_{max\,2}} = \frac{\frac{1}{2}D_1(A'_\Sigma)^2_{παλιό}}{\frac{1}{2}D_2(A'_\Sigma)^2_{νέο}} = \frac{mw^2(2A)^2}{mw'^2(A'_\Sigma)^2} = \frac{4\pi^2f^2(10^{-2})^2}{4\pi^2f'^2(5\cdot 10^{-3})^2} = \frac{f^2}{\frac{100}{81}f^2}\cdot\frac{10^{-4}}{25\cdot 10^{-6}} =$$

$$= \frac{81}{100}\cdot\frac{10^2}{25} = \frac{81}{25}$$

ΘΕΜΑ Δ

Δ1. Η ράβδος ισορροπεί



$$\Sigma\vec{F} = \vec{0} \Longrightarrow \begin{cases}\Sigma\vec{F_x} = \vec{0}\\ \Sigma\vec{F_y} = \vec{0}\end{cases} \Longrightarrow \begin{cases} f_{A_x} = T\\ f_{A_y} = w = 56N\end{cases}$$

$$\Sigma\tau = 0 \Longrightarrow \tau_{F(A)} + \tau_{T(A)} + \tau_{w(A)} = 0 \Longrightarrow$$

$$\Longrightarrow T\frac{\ell}{2}\sigma\upsilon\nu\varphi - w\frac{\ell}{2}\eta\mu\varphi = 0 \Longrightarrow T = \frac{w\,\eta\mu\varphi}{\sigma\upsilon\nu\varphi} \Longrightarrow$$

$$\Longrightarrow T = \frac{56\cdot 0{,}6}{0{,}8} \Longrightarrow T = 42N = F_{A_x}$$

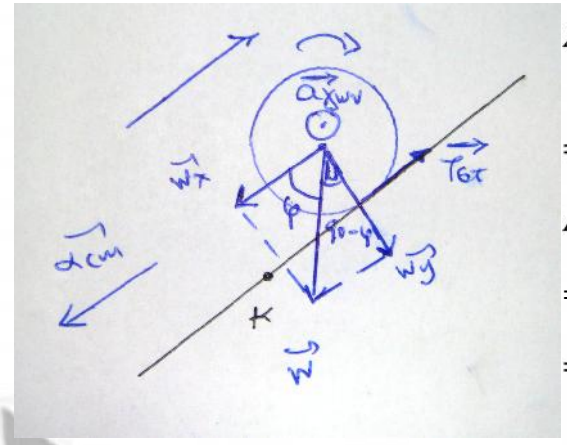
$$\text{άρα } F_A = F_{A_x} + F_{A_y} \Longrightarrow |F_A| = \sqrt{F_{A_x}^2 + F_{A_y}^2} =$$

$$= \sqrt{42^2 + 56^2} = \sqrt{(3\cdot 14)^2 + (4\cdot 14)^2} =$$

$$= \sqrt{25\cdot 14^2} = 70N$$

$$\text{με } \varepsilon\varphi\theta = \frac{|F_{A_y}|}{|F_{A_x}|} = \frac{56}{42} = \frac{4}{3}$$

Δ2.



$$\Sigma F_x = m a_{cm} \Longrightarrow mg\,\eta\mu\varphi - T_{\sigma\tau} = m a_{cm} \quad (1)$$

$$\Sigma\tau_o = I_o \cdot \alpha_{\gamma\omega\nu} \Longrightarrow T_{\sigma\tau} \cdot r = \frac{2}{5} m r^2 |\alpha_{\gamma\omega\nu}| \Longrightarrow$$

$$\Longrightarrow T_{\sigma\tau} = \frac{2}{5} m a_{cm} \quad (2)$$

$$\text{Από } (1), (2) \Longrightarrow mg\,\eta\mu\varphi - \frac{2}{5} m a_{cm} = m a_{cm}$$

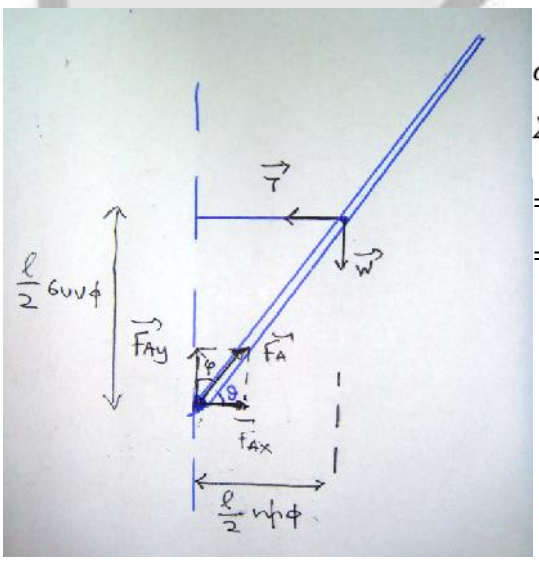
$$\Longrightarrow g\eta\mu\varphi = \frac{7}{5} a_{cm} \Longrightarrow a_{cm} = \frac{5}{7} g\,\eta\mu\varphi \Longrightarrow$$

$$\Longrightarrow a_{cm} = \frac{50}{7} \cdot \frac{6}{10} = \frac{30}{7}\ m/s^2$$

$$\text{και } |\alpha_{\gamma\omega\nu}| = \frac{a_{cm}}{r} = \frac{\frac{30}{7}}{\frac{1}{70}} = \frac{70 \cdot 30}{7} \Longrightarrow |\alpha_{\gamma\omega\nu}| = 300\ rad/s^2$$

οπότε $\alpha_{\gamma\omega\nu}$ { μέτρο $300\frac{rad}{s^2}$; διεύθ. τον αξ. περιστροφής που διέρχεται από το O κάθετο στο επ. της περισ. του κίνησης φορά απ' τη σελίδα προς τον αναγνώστη. }

Δ3.



$$0 \le x \le \frac{\ell}{2} = 1m$$

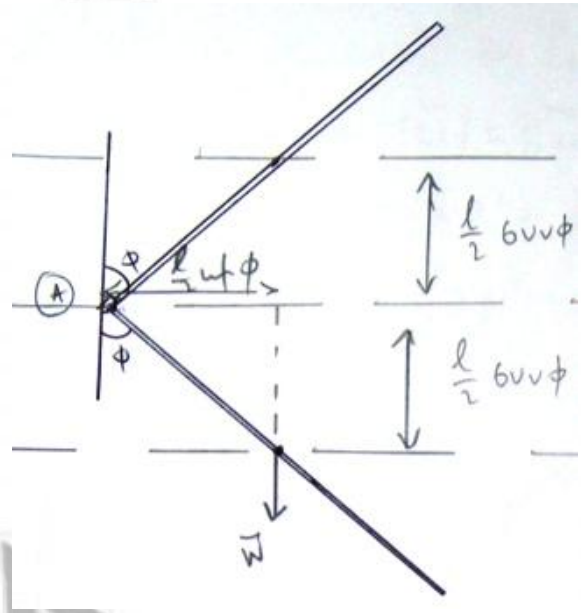
σε τ.θ. του σώματος η ράβδος ισορροπεί.

$$\Sigma\tau_A = 0 \Longrightarrow T' \frac{\ell}{2} \sigma\upsilon\nu\varphi - N' \left(\frac{\ell}{2} - x\right) - Mg \frac{\ell}{2} \eta\mu\varphi = 0$$

$$\Longrightarrow T' \frac{\ell}{2} \sigma\upsilon\nu\varphi = N' \left(\frac{\ell}{2} + x\right) + Mg \frac{\ell}{2} \eta\mu\varphi \Longrightarrow$$

$$\Longrightarrow T' = 45 + 3x$$

Δ4.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$\frac{l}{2}\eta\mu\phi$
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