ΤΕΤΑΡΤΗ 22 ΜΑΙΟΥ 2013
ΦΥΣΙΚΗ ΘΕΤΙΚΗΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΚΗΣ ΚΑΤΕΥΘΥΝΣΗΣ ΗΜΕΡΗΣΙΩΝ ΛΥΚΕΙΩΝ
ΕΝΔΕΙΚΤΙΚΕΣ ΑΠΑΝΤΗΣΕΙΣ

ΘΕΜΑ Α

Α1. γ
Α2. γ
Α3. δ
Α4. γ

Α5.
α) Σ
β) Λ
γ) Σ
δ) Λ
ε) Σ

ΘΕΜΑ Β

Β1.

$$E_{ολ_{αρχή}} = \frac{1}{2} C \cdot V_c^2 = 4 \cdot 10^{-3}\,\text{Joule}$$

$$E_{ολ_{τέλος}} = \frac{1}{2} L \cdot I_{max}^2 = 2 \cdot 10^{-3}\,\text{Joule}$$

Αφού στο τέλος έχω φορτίο q=0, άρα $i=6A=I_{max}$.

$$|\Delta E| = 2 \cdot 10^{-3}\,\text{Joule}$$

Άρα το ii ΣΩΣΤΟ.

Β2.

$$f_2 = 3f_1 \Rightarrow \frac{u}{\lambda_2} = 3\frac{u}{\lambda_1} \Rightarrow \lambda_1 = 3\lambda_2$$

Άρα $d = 6\lambda_2$

Αποσβέσεις στην ΚΛ: $\left\{ \begin{aligned} r_1 + r_2 &= d \\ r_1 - r_2 &= (2\kappa+1)\frac{\lambda_2}{2} \end{aligned} \right\} \Rightarrow 2r_1 = d + (2\kappa+1)\frac{\lambda_2}{2}$

$r_1 = \frac{d}{2} + (2\kappa+1)\frac{\lambda_2}{4} \Rightarrow r_1 = 3\lambda_2 + \frac{2\kappa+1}{4}\lambda_2$ αποστάσεις αποσβέσεων από Κ πάνω στην ευθεία ΚΛ .

Πρέπει $0 \le r_1 \le d$

$$0 \le 3\lambda_2 + \frac{(2\kappa+1)}{4}\lambda_2 \le 6\lambda_2$$

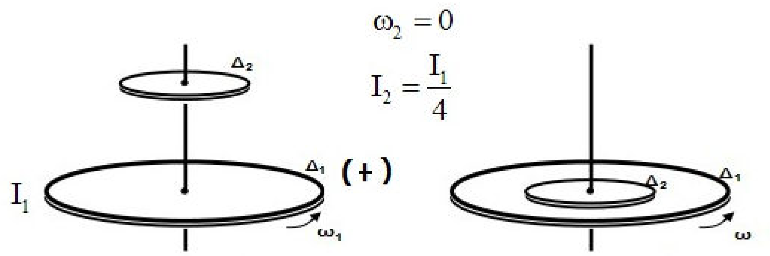
$$0 \le 3 + \frac{(2\kappa+1)}{4} \le 6$$

$$\left.\begin{array}{r} -12 \le 2\kappa+1 \le 12 \Rightarrow -6{,}5 \le \kappa \le 5{,}5 \\ \kappa \in \mathbb{Z} \end{array}\right] \text{επαληθεύεται για 12 ακέραιους } \kappa$$

Άρα 12 αποσβέσεις.

Σωστό το (iii)

B3.



ΑΔ Στρ. $I_1\omega_1 = (I_1 + I_2)\omega \Rightarrow$

$$I_1\omega_1 = \left(I_1 + \frac{I_1}{4}\right)\omega \Rightarrow$$

$$I_1\omega_1 = \frac{5}{4} I_1 \omega \Rightarrow$$

$$\omega = \frac{4}{5}\omega_1$$

$$L_{\Delta_1 \, \alpha\rho\chi} = L_1$$

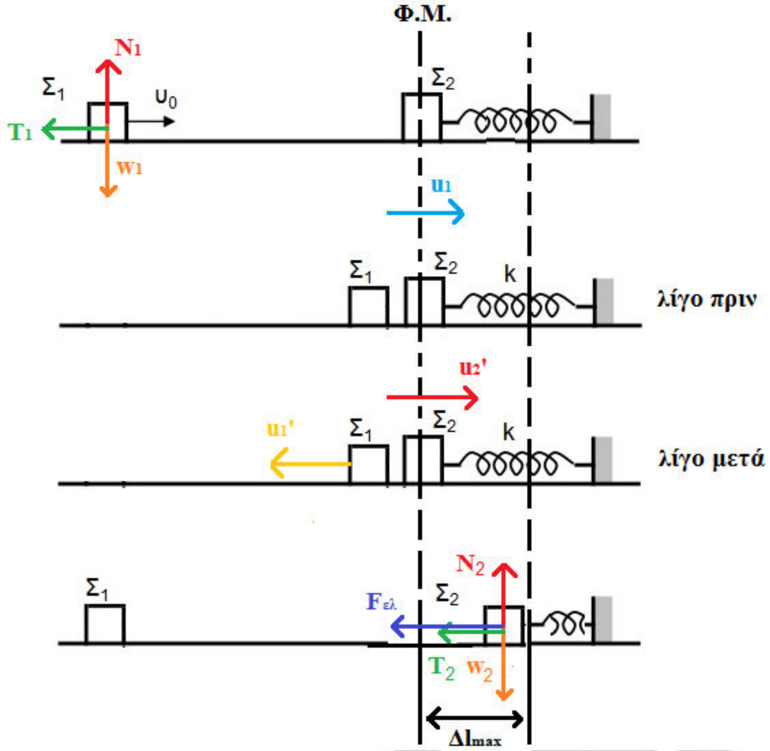
$$L_{\Delta_1 \, \tau\varepsilon\lambda} = I_1\omega = I_1 \frac{4}{5}\omega_1 = \frac{4}{5} L_1$$

$$\left|\Delta L_{\Delta_1}\right| = \left|L_{\Delta_1}^{\ \tau\varepsilon\lambda} - L_{\Delta_L}^{\ \alpha\rho\chi}\right| = \frac{1}{5} L_1$$

Άρα σωστό το (ii)

ΘΕΜΑ Γ

Γ1.



ΘΜΚΕ m1: $K_{τελ} - K_{αρχ} = W_{w_1} + W_{T_1} + W_{N_1} \Rightarrow \boxed{\frac{1}{2}u_1^2 - \frac{1}{2}u_0^2 = -5}$ (1)

$T_1 = \mu \cdot m_1 \cdot g = 5 \cdot m_1$ N

ΑΔΟ + ΑΔΚΕ

$-u_1' = \frac{m_1 - m_2}{m_1 + m_2}u_1 \Rightarrow -\sqrt{10} = \frac{m_1 - 2m_1}{m_1 + 2m_1}u_1 \Rightarrow$

$\Rightarrow u_1 = 3\sqrt{10}$ m/s

$u_2' = \frac{2m_1u_1}{m_1 + m_2}u_1 = 2\sqrt{10}$ m/s

Από σχέση (1) $\Rightarrow u_o = 10$m/s

Γ2.

$$\frac{K_2'}{K_1}100 = \frac{\frac{1}{2}m_2u_2'^2}{\frac{1}{2}m_1u_1^2} = \frac{800}{9}\%$$

Γ3.

$m_1 : \Sigma F = m_1\alpha_1 \Rightarrow \alpha_1 = -5m/s^2$

από επιβραδυνόμενη $d = u_ot_1 - \frac{1}{2}|\alpha_1|t_1^2 \Rightarrow t_1 = 0,08\sec$

κατά την επιστροφή του m_1 μέχρι να σταματήσει :

$u_1^{τελ} = u_1' - |\alpha_1| t' \Rightarrow t' = 0,64\,sec$

Άρα $t_{ολ} = 0,72\,sec$

Γ4.

$T_2 = \mu m_2 g = 5\,N$

$ΘΜΚΕ\ m_2 :\ \cancel{K_{τελ}}^{0} - K_{αρχ} = \cancel{W_{W_2}}^{0} + \cancel{W_{N_2}}^{0} + W_{T_2} + W_{Fελ} \Rightarrow$

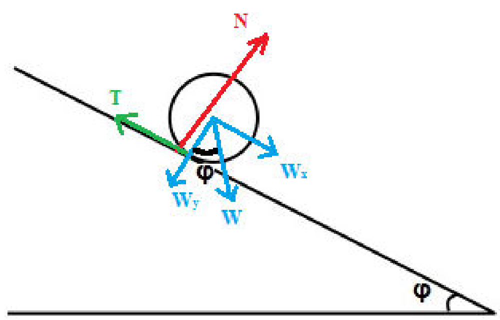
$\Rightarrow -\frac{1}{2} m_2 u_2'^2 = -T_2 \Delta l_{max} + 0 - \frac{1}{2} k \Delta l^2_{max} \Rightarrow$

$\Rightarrow \frac{105}{2} \Delta l^2_{max} + 5\Delta l_{max} - 20 = 0 \Rightarrow$

$\Delta l_{max} = \frac{60}{105} m = \frac{4}{7} m \simeq 0,57 m$

ΘΕΜΑ Δ

Δ1.



$$\left.\begin{array}{l} μετ.\ 2ος\ ΝΝ : w_x - T = m \cdot \alpha_{cm} \Rightarrow m \cdot g \cdot ημφ - T = m \cdot \alpha_{cm} \\ \left.\begin{array}{l} ΘΝΣΚ\ εκ :\ T \cdot R = \frac{1}{2} m \cdot R^2 \cdot \alpha_\gamma \\ κ.χ.ολ :\ \alpha_\gamma = \frac{\alpha_{cm}}{R} \end{array}\right\} \Rightarrow T = \frac{1}{2} m \cdot \alpha_{cm} \end{array}\right\} \Rightarrow$$

$\Rightarrow \cancel{m} \cdot g \cdot ημφ = \frac{3}{2} \cancel{m} \cdot \alpha_{cm} \Rightarrow \boxed{\alpha_{cm} = \frac{2}{3} \cdot g \cdot ημφ}$

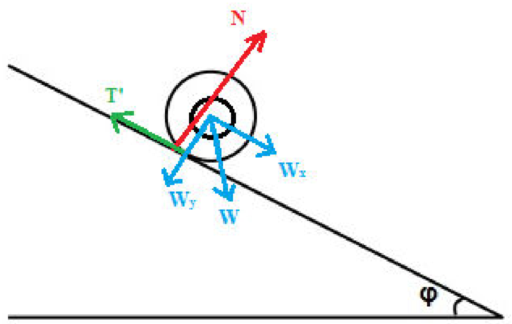
Δ2.

$$\left.\begin{array}{l}\text{σύνολο}: M = d\cdot V \Rightarrow M = d\cdot\pi\cdot R^2\cdot h \\ \text{εσωτερ. κύλινδρος}: m = d\cdot V_r \Rightarrow m = d\cdot\pi\cdot r^2\cdot h\end{array}\right\} \Rightarrow \frac{M}{m} = \frac{R^2}{r^2} \Rightarrow m = M\frac{r^2}{R^2}$$

$$I_{εσωτ} = \frac{1}{2}m\cdot r^2 = \frac{1}{2}m\cdot\frac{r^4}{R^2}$$

$$I_{κοιλ} = I_{ολ} - I_{εσωτ} = \frac{1}{2}M\cdot R^2 - \frac{1}{2}M\cdot\frac{r^4}{R^2} \Rightarrow I_{κοιλ_{κυλ}} = \frac{1}{2}M\cdot R^2\left(1-\frac{r^4}{R^4}\right)$$

Δ3.



$$\left.\begin{array}{l}\text{Μετ } 2^{ος}\text{N.N. } \Sigma F = M\alpha'_{cm} \Rightarrow Mg\eta\mu\varphi - T' = M\alpha'_{cm} \\ \text{Στρ. ΘΝΣΚ}: \Sigma\tau = I_{\substack{κοιλ.\\κυλ.}}\alpha_\gamma \Rightarrow T'\cancel{R} = \frac{1}{2}MR^{\cancel{2}}\left(1-\frac{r^4}{R^4}\right)\frac{\alpha_{cm}}{\cancel{R}} \\ \text{κ.χ.ολ.} \quad \alpha_\gamma = \frac{\alpha_{cm}}{R}\end{array}\right\} \Rightarrow$$

$$Mg\eta\mu\varphi = \left[\frac{1}{2}M\left(1-\frac{r^4}{R^4}\right)+M\right]\alpha_{cm} \Rightarrow$$

$$\alpha_{cm} = \frac{g\eta\mu\varphi}{\frac{1}{2}\left(1-\frac{r^4}{R^4}\right)+1} \Rightarrow$$

$$\alpha_{cm} = \frac{2g\eta\mu\varphi}{1-\frac{r^4}{R^4}+2} \Rightarrow \alpha_{cm} = \frac{2g\eta\mu\varphi}{3-\frac{r^4}{R^4}}$$

Δ4.

για $r = \frac{R}{2}$

$$I_{cm} = \frac{1}{2}MR^2\left(1 - \frac{1}{16}\right) = \frac{15}{32}MR^2$$

$$\left.\begin{array}{l} K_{περ} = \frac{1}{2}I_{cm}\omega^2 = \frac{15}{64}MR^2\omega^2 \\ \text{κ.χ.ολ.} \quad u_{cm} = \omega R \end{array}\right\} \Rightarrow K_{περ} = \frac{15}{64}Mu_{cm}{}^2$$

$$K_{μετ} = \frac{1}{2}Mu_{cm}{}^2$$

Άρα $\frac{K_{μετ}}{K_{περ}} = \frac{\frac{1}{2}Mu_{cm}{}^2}{\frac{15}{64}Mu_{cm}{}^2} = \frac{32}{15}$

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