ΤΕΤΑΡΤΗ 26 ΜΑΙΟΥ 2010
ΦΥΣΙΚΗ ΤΕΧΝΟΛΟΓΙΚΗΣ ΚΑΤΕΥΘΥΝΣΗΣ
ΕΝΔΕΙΚΤΙΚΕΣ ΑΠΑΝΤΗΣΕΙΣ

Θέμα Α

Α1: β

Α2: γ

Α3: β

Α4: γ

Α5: α) Λ
β) Λ
γ) Σ
δ) Λ
ε) Σ

Θέμα Β

Β1.

$|A_\Sigma| = 2A \Rightarrow$ ενίσχυση άρα $r_1 - r_2 = \kappa \cdot \lambda$

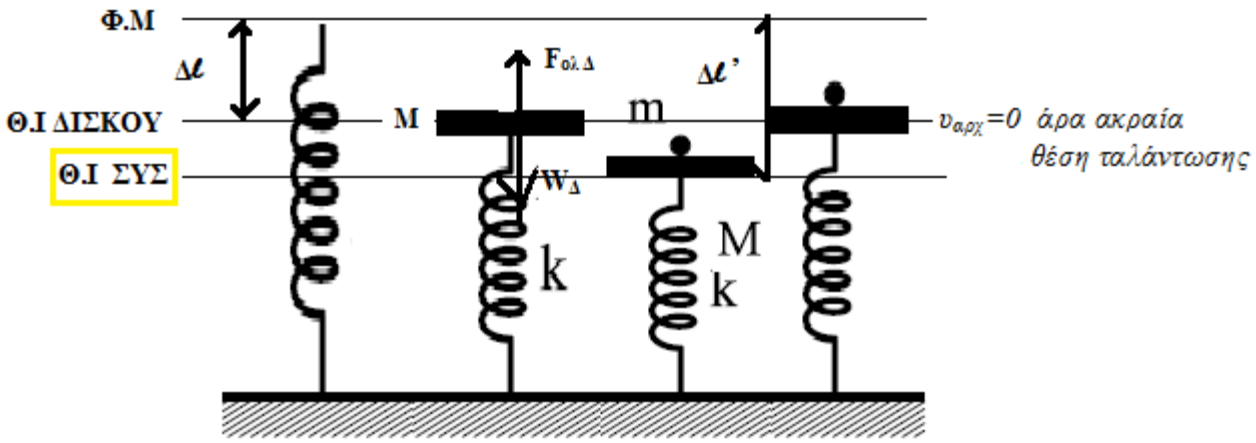
Αν $f' = 2f \Rightarrow \frac{\cancel{v}}{\lambda'} = \frac{2\cancel{v}}{\lambda} \Rightarrow \lambda' = \frac{\lambda}{2}$

άρα $\lambda = 2\lambda'$ και $r_1 - r_2 = \boxed{2\kappa} \cdot \lambda'$

Άρα $|A'_\Sigma| = \left|2A \cdot \sigma\upsilon\nu \frac{2\pi(r_1 - r_2)}{2\lambda'}\right| = \left|2A \cdot \sigma\upsilon\nu \frac{2\pi(2\kappa \cdot \cancel{\lambda'})}{\cancel{\lambda'}}\right| = |2A| = 2A$

Άρα σωστό είναι το α.

Β2.



ΔΙΣΚΟΣ: Θ.Ι $\Sigma F = 0 \Rightarrow F\varepsilon\lambda_{\Delta} = M\cdot g \Rightarrow K\cdot \Delta l_{\Delta} = M\cdot g \Rightarrow \Delta l_{\Delta} = \dfrac{M\cdot g}{K}$

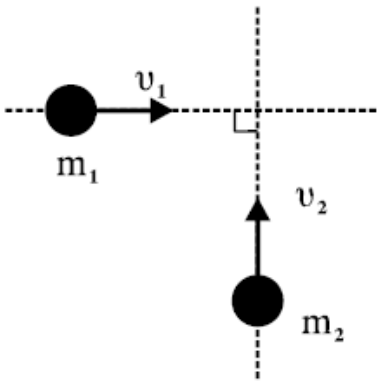
ΣΥΣΤΗΜΑ: Θ.Ι $\Sigma F = 0 \Rightarrow F\varepsilon\lambda_{\Sigma\Upsilon\Sigma} = (M+m)g \Rightarrow K\cdot \Delta l' = (M+m)g \Rightarrow \Delta l' = \dfrac{(M+m)g}{K}$

$$E = U_{max} = \frac{1}{2}D\cdot A^2 = \frac{1}{2}K\cdot(\Delta l' - \Delta l)^2 = \frac{1}{2}K\cdot\left[\frac{(M+m)g}{K} - \frac{M\cdot g}{K}\right]^2 = \frac{1}{2}K\cdot\left[\frac{M\cdot g + m\cdot g - M\cdot g}{K}\right]^2 =$$

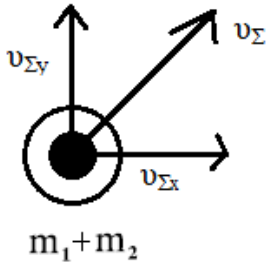
$$= \frac{1}{2}\cancel{K}\cdot\frac{m^2\cdot g^2}{K^{\cancel{2}}} \Rightarrow E = U_{max} = \frac{1}{2}\cdot\frac{m^2\cdot g^2}{K}$$

Άρα σωστό είναι το α.

Β3.



λίγο πριν



λίγο μετά

$A\Delta Ox'x \quad m_1\upsilon_1 = (M_1 + m_2)V_{\Sigma x} \Rightarrow 8 = 5 \cdot V_{\Sigma x} \Rightarrow V_{\Sigma x} = \frac{8}{5}\frac{m}{s}$

$A\Delta Oy'y \; m_2\upsilon_2 = (m_1 + m_2)V_{\Sigma y} \Rightarrow 6 = 5V_{\Sigma y} \Rightarrow V_{\Sigma y} = \frac{6}{5}\frac{m}{s}$

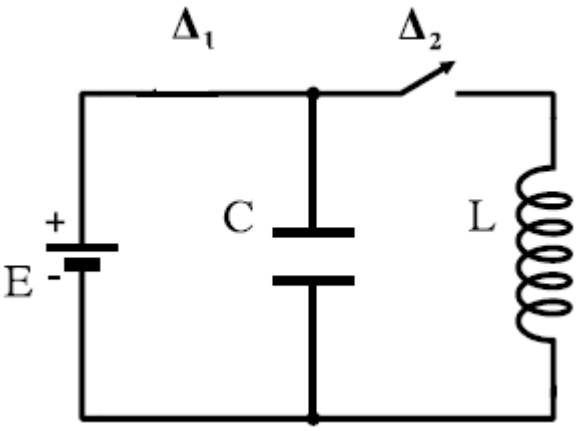
$V_\Sigma = \sqrt{V_{\Sigma x}{}^2 + V_{\Sigma y}{}^2} = 2\frac{m}{s}$

$K_{ολ_{συσσ}} = \frac{1}{2}(m_1 + m_2)V_\Sigma{}^2 = \frac{1}{2}5 \cdot 2^2 = 10J$

Άρα σωστό είναι το β.

Θέμα Γ

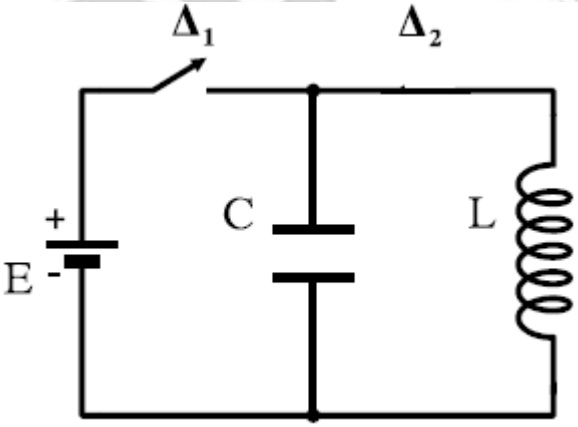
Γ1.



$V_{c_{αρχ}} = E = 5 \text{ Volt}$

$Q = C \cdot V_c = 8 \cdot 10^{-6} \cdot 5 = 40 \cdot 10^{-6} Cb = 4 \cdot 10^{-5} Cb$

Γ2.



$$T = 2\pi\sqrt{LC} = 2\pi\sqrt{2\cdot10^{-2}\cdot8\cdot10^{-6}} = 2\pi\sqrt{16\cdot10^{-8}} = 2\pi\cdot4\cdot10^{-4} = 8\pi\cdot10^{-4}\,\text{sec}$$

Γ3.

$$i = -I\cdot\eta\mu\omega t = -10^{-1}\cdot\eta\mu2500t$$

$$I = \omega\cdot Q = \frac{1}{4}\cdot10^{4}\cdot40\cdot10^{-6} = 10^{-1}\,A$$

$$\omega = \frac{2\pi}{T} = \frac{2\pi}{8\pi\cdot10^{-4}} = \frac{1}{4}\cdot10^{4}\ \text{rad/s}$$

Γ4.

$$U_B = 3U_E$$

$$U_B + U_E = U_{E_{max}} \Rightarrow$$

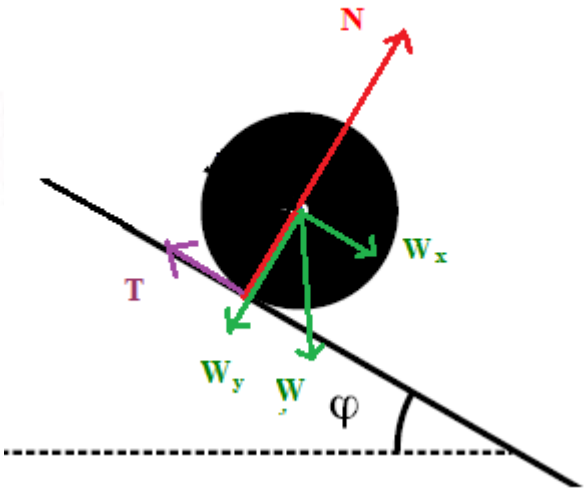
$$4U_E = U_{E_{max}} \Rightarrow 4\cdot\frac{1}{2}\cdot\frac{1}{c}\cdot q^2 = \frac{1}{2}\cdot\frac{1}{c}\cdot Q^2$$

$$q^2 = \frac{Q^2}{4} \Rightarrow q = \pm\frac{Q}{2} \Rightarrow$$

$$\Rightarrow q = \pm20\cdot10^{-6}\,Cb$$

<u>Θέμα Δ</u>

Δ1.



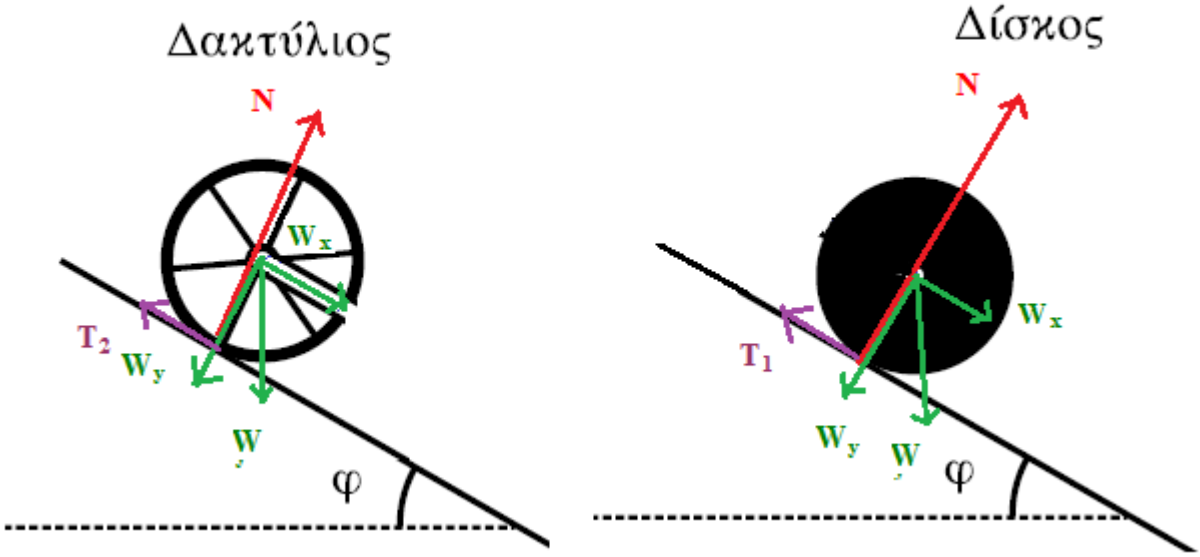
Μόνο δίσκος

$$x=\frac{1}{2}\alpha_{cm}t^2 \Rightarrow \alpha_{cm}=4\frac{m}{s^2}$$

$$2^{ος}\ NN \Rightarrow \sum F=m\cdot\alpha_{cm} \Rightarrow w_x-T=m\alpha_{cm} \Rightarrow m\cdot g\cdot\eta\mu\varphi-T=m\cdot\alpha_{cm} \Rightarrow T=2N$$

$$\left.\begin{array}{l}\Theta N\Sigma K:\ \Sigma\tau_{(cm)}=I_{cm}\cdot\alpha_\gamma \\ \text{κύλιση χωρίς ολίσθηση}:\ \alpha_{cm}=\alpha_\gamma\cdot R\end{array}\right\} \Rightarrow T\cdot R=I_{cm}=\frac{\alpha_\gamma}{R} \Rightarrow I_{cm}=\frac{T\cdot R^2}{\alpha_{cm}} \Rightarrow I_{cm}=\frac{1}{2}Kg\cdot m^2$$

Δ2.



$$\text{δίσκος}: 2ος\ N\,N\ :\ w_x-T_1=M\alpha_{cm}$$

$$\left.\begin{array}{l}\Theta N\Sigma K\ \ T_1R=I_1\alpha_{\gamma 1} \\ \text{Κύλιση Χωρίς Ολίσθηση}\ \ \alpha_{\gamma 1}=\dfrac{\alpha_{cm}}{R}\end{array}\right| \Rightarrow T_1\cancel{R}=\frac{1}{2}MR^2\frac{\alpha_{cm}}{\cancel{R}}\ \Big|^{(+)}\Rightarrow$$

$$\cancel{M}g\eta\mu\theta=\frac{3}{2}\cancel{M}\alpha_{cm1} \Rightarrow \alpha_{cm1}=\frac{10}{3}\frac{m}{\cancel{s^2}}$$

$$\text{δακτύλιος}\ \ 2ος\,NN\ \ w_x-T_2=M\alpha_{cm_2}$$

$$\left.\begin{array}{l}\Theta N\Sigma K\ \ T_2R=I_2\alpha\gamma_2 \\ K\Sigma O\Lambda\ \ \alpha\gamma_2=\dfrac{\alpha_{cm2}}{R}\end{array}\right| \Rightarrow T_2\cancel{R}=M\cancel{R^2}\frac{\alpha_{cm}}{\cancel{R}}\ \Big|^{(+)}\Rightarrow$$

$\cancel{M}g\eta\mu\theta = 2\cancel{M}\alpha_{cm2} \Rightarrow \alpha_{cm2} = \frac{5}{2}\,m/s^2$

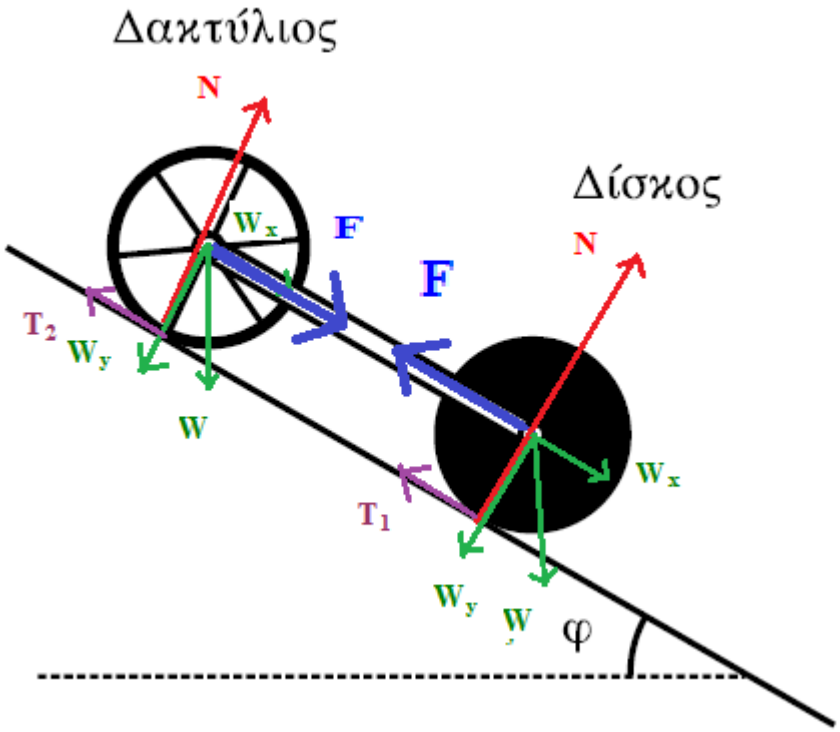
άρα $\alpha_{cm1} \rangle \alpha_{cm2}$ και $\alpha_{\gamma 1} \rangle \alpha_{\gamma 2}$

Δ3.

$$\frac{K_1}{K_2} = \frac{\frac{1}{2}\cdot M\upsilon^2 + \frac{1}{2}\cdot I_1\omega^2}{\frac{1}{2}\cdot M\upsilon^2 + \frac{1}{2}\cdot I_2\omega^2} = \frac{\frac{1}{2}M\upsilon^2 + \frac{1}{2}\cdot\frac{1}{2}\cdot MR^2\omega^2}{\frac{1}{2}M\upsilon^2 + \frac{1}{2}\cdot MR^2\omega^2} = \frac{\frac{3}{4}M\upsilon^2}{M\upsilon^2} = \frac{3}{4}$$

τα σώματα κινούνται με ίδια $\upsilon = \omega R$

Δ4.



Σύστημα δίσκου-δακτυλίου-ράβδου

Δακτύλιος : 2ος ΝΝ $\quad w_x + F - T_2 = M\alpha_{cm}$

ΘΝΣΚ : $T_2 \cdot R = I_2\frac{\alpha_{cm}}{R} \Rightarrow T_2 \cdot \cancel{R} = M \cdot \cancel{R}^2\frac{\alpha_{cm}}{\cancel{R}} \Rightarrow T_2 = M \cdot \alpha_{cm}$ $\Big\}\overset{(+)}{\Rightarrow}$

κυλ.χωρίς ολισθ: $\alpha_\gamma = \frac{\alpha_{cm}}{R}$

$M \cdot g \cdot \eta\mu\theta + F = 2M \cdot \alpha_{cm} \Rightarrow 7 + F = 2{,}8\alpha_{cm} \quad (I)$

Δίσκος : $\left.\begin{array}{l} 2ος\,ΝΝ\;\; w_x - F - T = M\cdot\alpha_{cm} \\ ΘΝΣΚ : T_1\cdot R = I_1\dfrac{\alpha_{cm}}{R} \Rightarrow T_1\cdot \not{R} = \dfrac{1}{2}M\cdot \not{R}^{\not{2}}\dfrac{\alpha_{cm}}{\not{R}} \end{array}\right\}^{(+)}\Rightarrow$

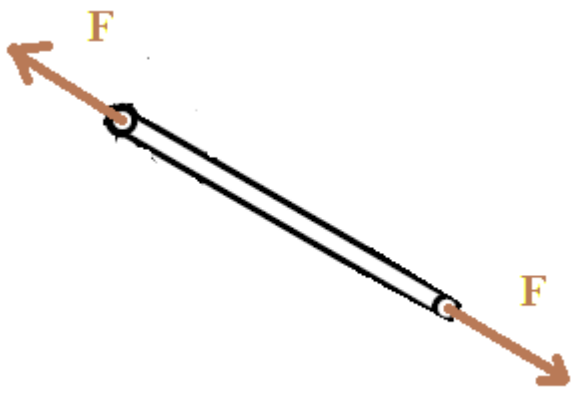
Κυλ.χ.ολ. $\alpha_\gamma = \dfrac{\alpha_{cm}}{R}$

$M\cdot g\cdot ημθ - F = \dfrac{1}{2}M\cdot\alpha_{cm} \Rightarrow 7 - F = 2{,}1\alpha_{cm} \quad (II)$

Τα σώματα έχουν ίδια α_{cm}

(I) κ (II) $\Rightarrow \dfrac{7+F}{7-F} = \dfrac{2{,}8}{2{,}1} \Rightarrow \dfrac{7+F}{7-F} = \dfrac{4}{3} \Rightarrow F = 1N$

Σχόλιο: Η ράβδος δέχεται δυνάμεις όπως στο σχήμα παρακάτω



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