Κελάφας
ΦΡΟΝΤΙΣΤΗΡΙΑ

ΕΠΑΝΑΛΗΠΤΙΚΕΣ ΠΑΝΕΛΛΗΝΙΕΣ ΕΞΕΤΑΣΕΙΣ
Γ΄ ΤΑΞΗΣ ΗΜΕΡΗΣΙΟΥ ΓΕΝΙΚΟΥ ΛΥΚΕΙΟΥ
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ΑΠΑΝΤΗΣΕΙΣ ΣΤΗ ΦΥΣΙΚΗ ΚΑΤΕΥΘΥΝΣΗΣ

ΘΕΜΑ Α

Α1. δ
Α2. β
Α3. β
Α4. γ
Α5. **α.** Σωστό, **β.** Λάθος, **γ.** Λάθος, **δ.** Σωστό, **ε.** Σωστό.

ΘΕΜΑ Β

Β1. α

Αιτιολόγηση :

Ακίνητη πηγή , κινούμενος παρατηρητής πλησιάζει την πηγή

$$f_A = \frac{u + u_A}{u} \cdot f_1 \quad \textbf{(1)}$$

Ο ήχος ανακλάται στο αυτοκίνητο.

Κινούμενη πηγή πλησιάζει τον ακίνητο παρατηρητή

$$f_2 = \frac{u}{u - u_A} \cdot f_A \quad \textbf{(2)}$$

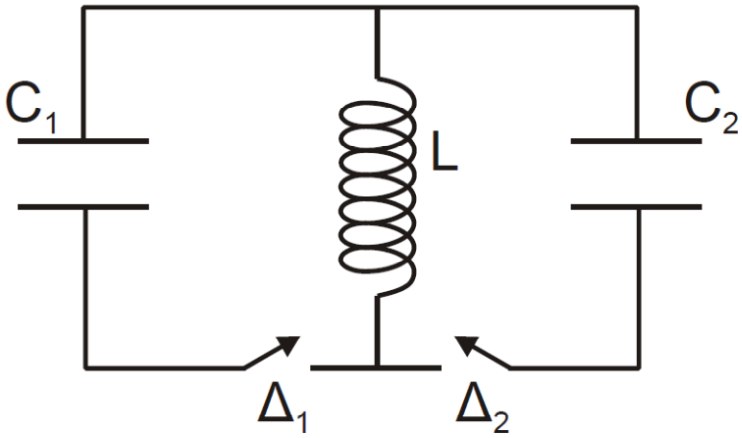
Από τις (1) και (2) έχουμε :

$$f_2 = \frac{\cancel{u}}{u - u_A} \cdot \frac{u + u_A}{\cancel{u}} f_1 \Rightarrow \frac{f_2}{f_1} = \frac{u + u_A}{u - u_A} \Rightarrow$$

$$\frac{f_2}{f_1} = \frac{\frac{11}{10}u}{\frac{9}{10}u} \Rightarrow \frac{f_2}{f_1} = \frac{11}{9}$$

B2. γ

Αιτιολόγηση :



Δ1 κλειστός, Δ2 ανοιχτός

$t_0 = 0 : Q_{1_{max}} = Q, \; i = 0$

$$t_1 = \frac{7T_1}{4} : i = -I \cdot ημω_1 t_1 = -I \cdot ημ\left(\frac{2π}{T_1} \cdot \frac{7T_1}{4}\right) = -I \cdot ημ\frac{7π}{2} = I$$

Δ1 ανοιχτός, Δ2 κλειστός

$t_0 = 0 : q = Q, \; i = I$

Α.Δ.Ε.

$$\frac{1}{2}Li^2 + \frac{1}{2} \cdot \frac{q^2}{C_2} = \frac{1}{2} \cdot \frac{Q_{2_{max}}{}^2}{C_2} \Rightarrow \frac{\cancel{1}}{\cancel{2}}LI^2 + \frac{\cancel{1}}{\cancel{2}} \cdot \frac{Q^2}{C_2} = \frac{\cancel{1}}{\cancel{2}} \cdot \frac{Q_{2_{max}}{}^2}{C_2} \overset{I = ω_1 Q}{\Rightarrow}$$

$$Lω_1{}^2Q^2 + \frac{Q^2}{C_2} = \frac{Q_{2_{max}}{}^2}{C_2} \overset{ω_1 = \frac{1}{\sqrt{LC_1}}}{\Rightarrow} \cancel{L}\frac{1}{\cancel{L}C_1}Q^2 + \frac{Q^2}{C_2} = \frac{Q_{2_{max}}{}^2}{C_2} \overset{C_2 = 2C_1}{\Rightarrow}$$

$$\frac{Q^2}{C_1} + \frac{Q^2}{2C_1} = \frac{Q_{2_{max}}{}^2}{2C_1} \Rightarrow Q_{2_{max}}{}^2 = 3Q^2 \Rightarrow Q_{2_{max}} = \sqrt{3}Q$$

Β3. β

Αιτιολόγηση :

$$y_1 = A \cdot \eta\mu\left(\omega t + \frac{\pi}{3}\right), \quad y_2 = \sqrt{3}A \cdot \eta\mu\left(\omega t - \frac{\pi}{6}\right)$$

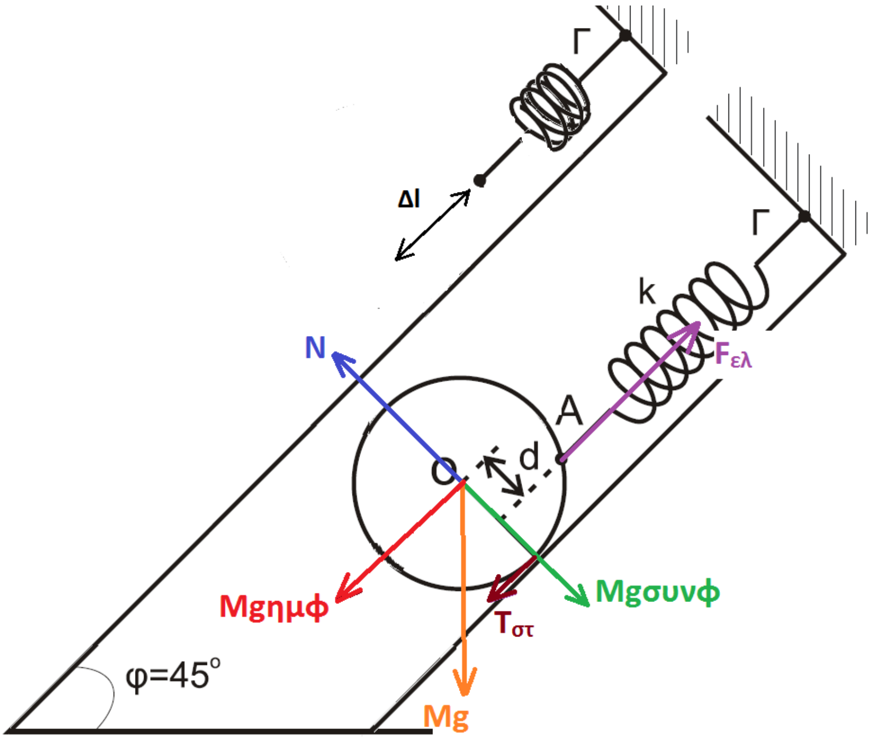
$$A' = \sqrt{A_1^{\,2} + A_2^{\,2} + 2A_1A_2 \cdot \sigma\upsilon\nu(\varphi_{02} - \varphi_{01})}$$

$$= \sqrt{A^2 + \left(\sqrt{3}A\right)^2 + 2A \cdot \sqrt{3}A \cdot \sigma\upsilon\nu\left(-\frac{\pi}{6} - \frac{\pi}{3}\right)}$$

$$= \sqrt{A^2 + 3A^2 + \cancel{2\sqrt{3}A^2 \cdot \sigma\upsilon\nu\left(-\frac{\pi}{2}\right)}} = \sqrt{4A^2} = 2A$$

$$\left.\begin{aligned} E_1 &= \frac{1}{2}DA^2 \\ E_2 &= \frac{1}{2}D\left(\sqrt{3}A\right)^2 = 3\,\frac{1}{2}DA^2 \\ E_{o\lambda} &= \frac{1}{2}DA'^2 = \frac{1}{2}D\,(2A)^2 = 4\,\frac{1}{2}DA^2 \end{aligned}\right\} \Rightarrow E_{o\lambda} = E_1 + E_2$$

ΘΕΜΑ Γ



Γ1. Ο δίσκος ισορροπεί

$$\sum F_x = 0 \;\Rightarrow\; Mg\eta\mu\varphi + T_{\sigma\tau} = F_{\varepsilon\lambda} \quad (1)$$

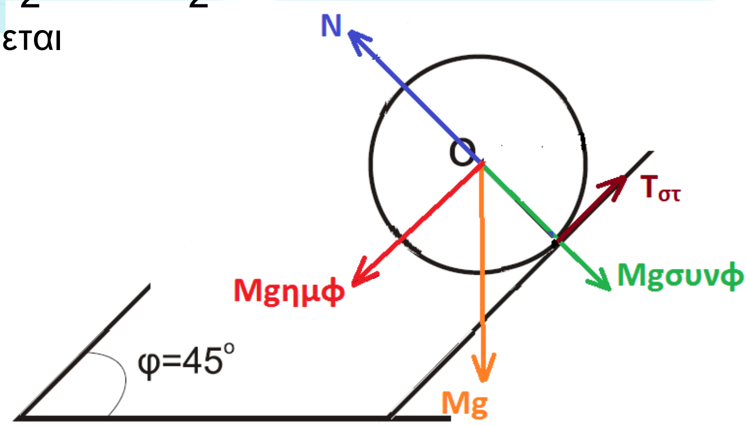
$$\sum \tau_{(O)} = 0 \;\Rightarrow\; F_{\varepsilon\lambda}\cdot\frac{\cancel{R}}{2} - T_{\sigma\tau}\cdot\cancel{R} = 0 \;\Rightarrow\; T_{\sigma\tau} = \frac{F_{\varepsilon\lambda}}{2} \quad (2)$$

$$(1),(2) \overset{F_{\varepsilon\lambda}=k\cdot\Delta l}{\Rightarrow} Mg\eta\mu\varphi + \frac{k\cdot\Delta l}{2} = k\cdot\Delta l \;\Rightarrow\; Mg\eta\mu\varphi = \frac{k\cdot\Delta l}{2} \;\Rightarrow$$

$$\Delta l = \frac{2Mg\eta\mu\varphi}{k} = \frac{2\cdot 2\cancel{\sqrt{2}}\cdot 1\cancel{0}\cdot\frac{\cancel{\sqrt{2}}}{\cancel{2}}}{10\cancel{0}} = \mathbf{0{,}4\,m}$$

Γ2. $(2) \;\Rightarrow\; T_{\sigma\tau} = \frac{k\cdot\Delta l}{2} = \frac{100\cdot 0{,}4}{2} = \mathbf{20\,N}$

Γ3. Το ελατήριο κόβεται



Κύλιση χωρίς ολίσθηση, άρα $\alpha_{cm} = \alpha_{\gamma\omega\nu}\cdot R$ (1)

$$\sum F_x = M\cdot\alpha_{cm} \;\Rightarrow\; Mg\eta\mu\varphi - T_{\sigma\tau} = M\cdot\alpha_{cm} \quad (2)$$

$$\sum \tau_{(O)} = I\cdot\alpha_{\gamma\omega\nu} \overset{(1)}{\Rightarrow} T_{\sigma\tau}\cdot\cancel{R} = \frac{1}{2}M\cancel{R^2}\cdot\frac{\alpha_{cm}}{\cancel{R}} \;\Rightarrow\; T_{\sigma\tau} = \frac{1}{2}M\alpha_{cm} \quad (3)$$

$$(2) \overset{(3)}{\Rightarrow} \cancel{M}g\eta\mu\varphi - \frac{1}{2}\cancel{M}\alpha_{cm} = \cancel{M}\alpha_{cm} \;\Rightarrow\; g\eta\mu\varphi = \frac{3}{2}\alpha_{cm} \;\Rightarrow$$

$$\alpha_{cm} = \frac{2g\eta\mu\varphi}{3} = \frac{2\cdot 10\cdot\frac{\sqrt{2}}{2}}{3} = \mathbf{\frac{10\sqrt{2}}{3}\,m/s^2}$$

Γ4. Λόγω μεταφορικής κίνησης

$$S = \frac{1}{2}\alpha_{cm}t^2 \Rightarrow t = \sqrt{\frac{2S}{\alpha_{cm}}} = \sqrt{\frac{2 \cdot 0,3\sqrt{2}}{\frac{10\sqrt{2}}{3}}} = \sqrt{\frac{18}{100}} = \frac{3\sqrt{2}}{10}\ \text{s}$$

Λόγω στροφικής κίνησης

$$\omega = \alpha_{\gamma\omega\nu}t \overset{(1)}{\Rightarrow} \omega = \frac{\alpha_{cm}}{R}t \Rightarrow \omega = \frac{10\sqrt{2}\cdot \cancel{10}}{\cancel{3}} \cdot \frac{\cancel{3}\sqrt{2}}{\cancel{10}} = 20\ \text{rad/s}$$

$$L = I\cdot\omega = \frac{1}{2}MR^2\cdot\omega = \frac{1}{\cancel{2}}\cancel{2}\sqrt{2}\cdot 0,01\cdot 20 = \mathbf{0,2\sqrt{2}\ Kg\frac{m^2}{s}}$$

ΘΕΜΑ Δ

Δ1. Πριν : $P_{\pi\rho\iota\nu} = m\cdot u$ (1)

Μετά : $P_{\mu\varepsilon\tau\acute{\alpha}} = \sqrt{P'^2_1 + P'^2_2 + 2P'_1P'_2\sigma\upsilon\nu\varphi}$

$= \sqrt{m^2u_1^2 + m^2u_2^2 + 2m^2u_1u_2\sigma\upsilon\nu\varphi}$ (2)

Από Α.Δ.Ο. και τις (1), (2) $\Rightarrow$

$$m\cdot u = \sqrt{m^2u_1^2 + m^2u_2^2 + 2m^2u_1u_2\sigma\upsilon\nu\varphi} \Rightarrow$$

$$\cancel{m^2}u^2 = \cancel{m^2}u_1^2 + \cancel{m^2}u_2^2 + 2\cancel{m^2}u_1u_2\sigma\upsilon\nu\varphi \Rightarrow$$

$$u^2 = u_1^2 + u_2^2 + 2u_1u_2\sigma\upsilon\nu\varphi \quad (3)$$

Από Α.Δ.Κ.Ε. $\cancel{m}u^2 = \cancel{m}u_1^2 + \cancel{m}u_2^2 \Rightarrow u^2 = u_1^2 + u_2^2$ (4)

Από (3) και (4) έχουμε $2u_1u_2\sigma\upsilon\nu\varphi = 0 \Rightarrow$

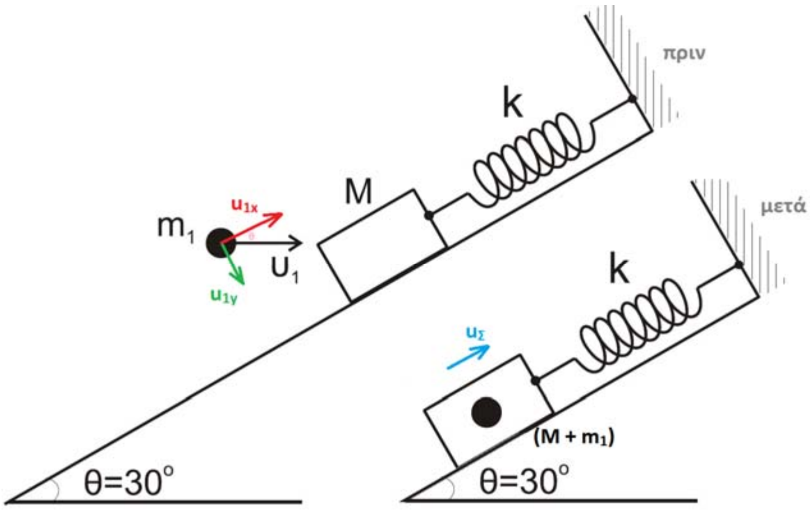
$\sigma\upsilon\nu\varphi = 0 \Rightarrow$ $\boldsymbol{\varphi = \frac{\pi}{2}}$ **rad**

Δ2. $u^2 = u_1^2 + u_2^2 \overset{u_2 = \frac{u_1}{\sqrt{3}}}{\Rightarrow} \frac{16}{9} = u_1^2 + \frac{u_1^2}{3} \Rightarrow \frac{16}{9} = \frac{4u_1^2}{3} \Rightarrow$

$u_1^2 = \frac{12}{9} \Rightarrow \mathbf{u_1 = \frac{2\sqrt{3}}{3}\ m/s}$

$u_2 = \frac{u_1}{\sqrt{3}} \Rightarrow u_2 = \frac{\frac{2\sqrt{3}}{3}}{\sqrt{3}} \Rightarrow \mathbf{u_2 = \frac{2}{3}\ m/s}$

Δ3.



Από Α.Δ.Ο. $\vec{P}_{πριν} = \vec{P}_{μετά} \Rightarrow m_1 \cdot u_{1x} = (M + m_1) \cdot u_\Sigma \Rightarrow$

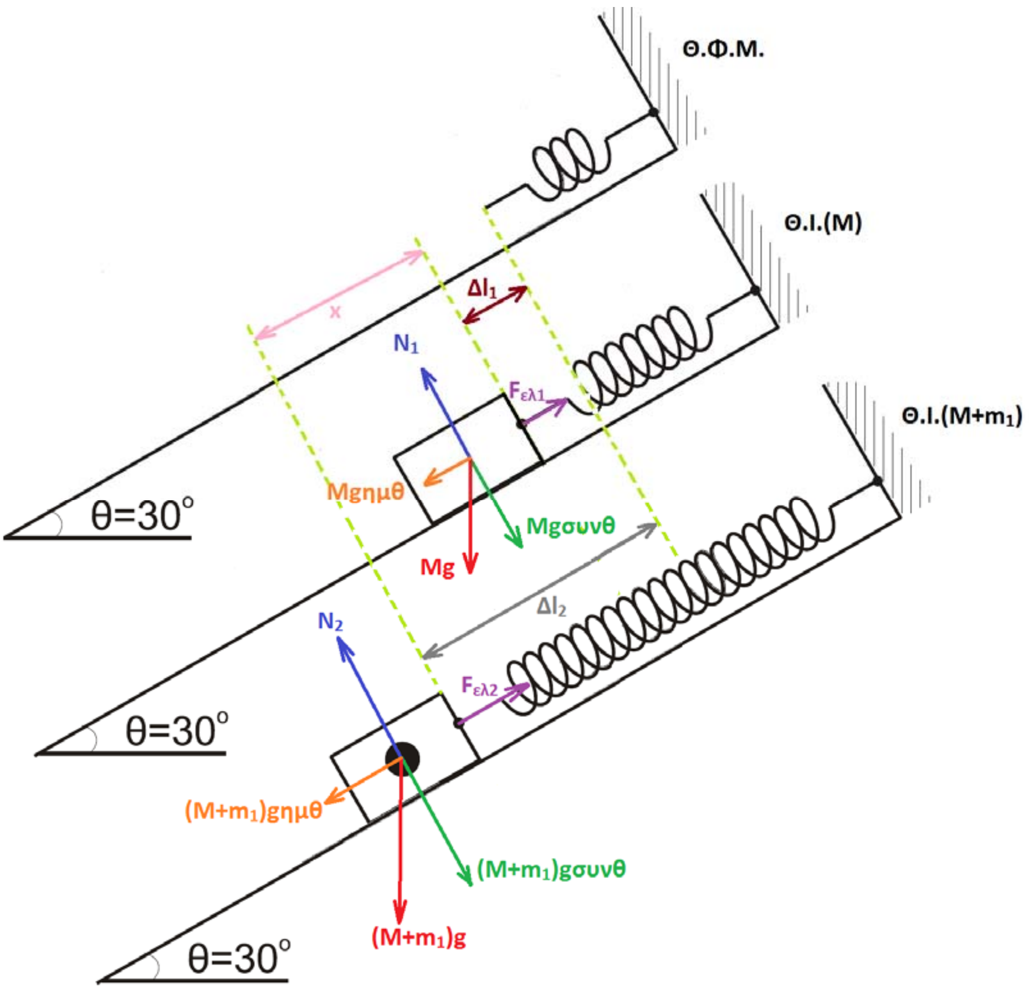
$m_1 \cdot u_1 \cdot συν30^0 = (M + m_1) \cdot u_\Sigma \Rightarrow u_\Sigma = \frac{m_1 \cdot u_1 \cdot συν30^0}{M + m_1} \Rightarrow$

$u_\Sigma = \frac{1 \cdot \frac{2\sqrt{3}}{3} \cdot \frac{\sqrt{3}}{2}}{3 + 1} = \frac{1}{4}\ m/s$

$\Delta K = K_{τελ} - K_{αρχ} = \frac{1}{2}(M + m_1)u_\Sigma^2 - \frac{1}{2}m_1 u_1^2$

$= \frac{1}{2}(3 + 1) \cdot \left(\frac{1}{4}\right)^2 - \frac{1}{2}1 \cdot \left(\frac{2\sqrt{3}}{3}\right)^2 = \frac{1}{8} - \frac{2}{3} = \mathbf{-\frac{13}{24}\ Joule}$

Δ4.



Θ.Ι. (M) : $k \cdot \Delta l_1 = Mg \cdot ημθ \;\Rightarrow\; \Delta l_1 = \dfrac{Mg \cdot ημθ}{k} = \dfrac{3 \cdot 10 \cdot \frac{1}{2}}{100} = 0{,}15\ m$

Θ.Ι. (M+m) : $k \cdot \Delta l_2 = (M + m_1)g \cdot ημθ \;\Rightarrow\; \Delta l_2 = \dfrac{(M + m_1)g \cdot ημθ}{k} = 0{,}2\ m$

Η αρχική Θ.Ι. του M είναι τώρα τυχαία θέση για το συσσωμάτωμα $(M + m_1)$

Στη θέση αυτή εφαρμόζουμε Α.Δ.Ε.Τ. $\cancel{\frac{1}{2}}kA^2 = \cancel{\frac{1}{2}}(M + m_1)u_Σ^{\,2} + \cancel{\frac{1}{2}}kx^2 \;\xRightarrow{x = \Delta l_2 - \Delta l_1}$

$A^2 = \dfrac{(M + m_1)}{k}u_Σ^{\,2} + \left(\Delta l_2 - \Delta l_1\right)^2 = \dfrac{4}{100} \cdot \dfrac{1}{16} + (0{,}05)^2 = 2 \cdot (0{,}05)^2$

άρα $\mathbf{A = 0,05\sqrt{2}\ m}$