



Κελάφας

ΦΡΟΝΤΙΣΤΗΡΙΑ

**ΕΠΑΝΑΛΗΠΤΙΚΕΣ ΠΑΝΕΛΛΗΝΙΕΣ ΕΞΕΤΑΣΕΙΣ  
Δ' ΤΑΞΗΣ ΕΣΠΕΡΙΝΟΥ ΓΕΝΙΚΟΥ ΛΥΚΕΙΟΥ  
ΤΕΤΑΡΤΗ 13 ΙΟΥΝΙΟΥ 2012  
ΑΠΑΝΤΗΣΕΙΣ ΣΤΗ ΦΥΣΙΚΗ ΚΑΤΕΥΘΥΝΣΗΣ**

**ΘΕΜΑ Α**

**A1.** δ

**A2.** α

**A3.** β

**A4.** γ

**A5.** α. Σωστό, β. Λάθος, γ. Λάθος, δ. Σωστό, ε. Σωστό.

**ΘΕΜΑ Β**

**B1.** γ

Αιτιολόγηση :

$$|A| = 2A \cdot \sigma\upsilon\nu\left(\pi \cdot \frac{x_1 - x_2}{\lambda}\right) = 2A \cdot \sigma\upsilon\nu\frac{\pi}{4} = \sqrt{2}A$$

**B2.** γ

Αιτιολόγηση :

Δ1 κλειστός, Δ2 ανοιχτός

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

$$t_1 = \frac{7T_1}{4} : i = -I \cdot \eta\mu\omega_1 t_1 = -I \cdot \eta\mu\left(\frac{2\pi}{T_1} \cdot \frac{7T_1}{4}\right) = -I \cdot \eta\mu\frac{7\pi}{2} = I$$

Δ1 ανοιχτός, Δ2 κλειστός

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

Α.Δ.Ε.

$$\frac{1}{2}Li^2 + \frac{1}{2} \cdot \frac{q^2}{C_2} = \frac{1}{2} \cdot \frac{Q_{2\max}^2}{C_2} \Rightarrow \frac{1}{2}Li^2 + \frac{1}{2} \cdot \frac{Q^2}{C_2} = \frac{1}{2} \cdot \frac{Q_{2\max}^2}{C_2} \quad I = \omega_1 Q \Rightarrow$$

$$L\omega_1^2 Q^2 + \frac{Q^2}{C_2} = \frac{Q_{2\max}^2}{C_2} \quad \omega_1 = \frac{1}{\sqrt{LC_1}} \Rightarrow \frac{1}{LC_1} Q^2 + \frac{Q^2}{C_2} = \frac{Q_{2\max}^2}{C_2} \quad C_2 = 2C_1 \Rightarrow$$

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

**B3. β**

Αιτιολόγηση :

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

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

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

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

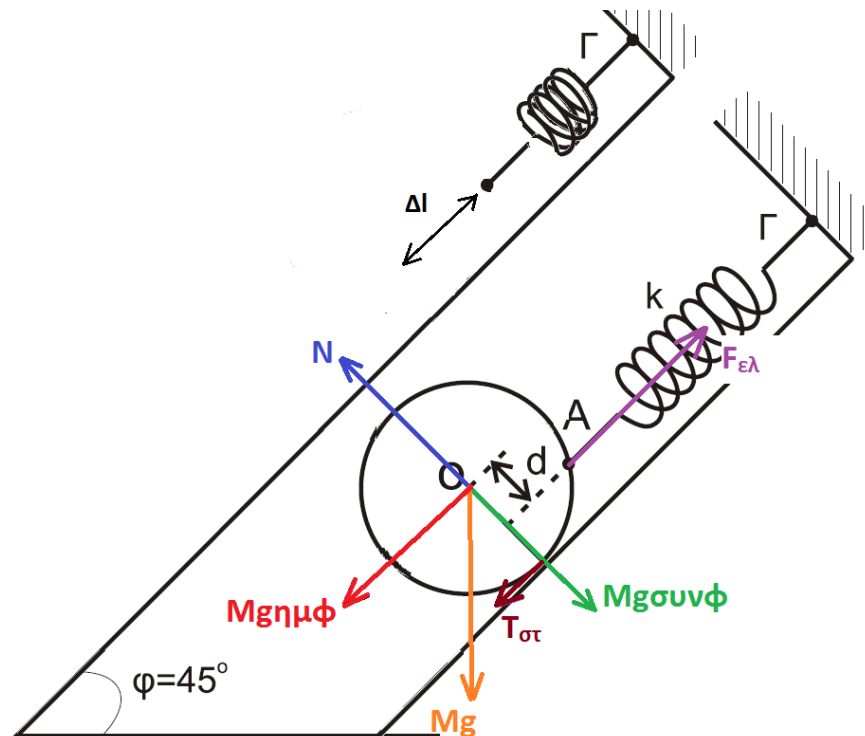
$$E_1 = \frac{1}{2} DA^2$$

$$E_2 = \frac{1}{2} D (\sqrt{3}A)^2 = 3 \frac{1}{2} DA^2 \quad \Rightarrow \quad E_{\text{ολ}} = E_1 + E_2$$

$$E_{\text{ολ}} = \frac{1}{2} DA'^2 = \frac{1}{2} D (2A)^2 = 4 \frac{1}{2} DA^2$$

**Κ Ε Λ Α Φ Α Σ Φ Ρ Ο Ν Τ Ι Σ Τ Η Ρ Ι Α**

**ΘΕΜΑ Γ**



Γ1. Ο δίσκος ισορροπεί

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

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

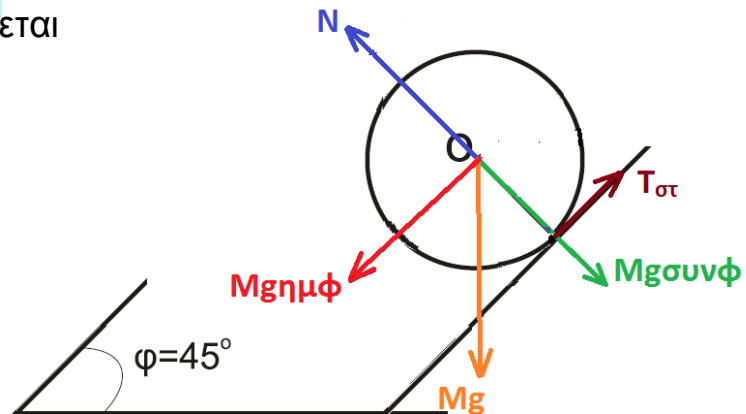
$$(1), (2) \stackrel{F_{\varepsilon\lambda} = k \cdot \Delta l}{\Rightarrow} Mg\eta\mu\phi + \frac{k \cdot \Delta l}{2} = k \cdot \Delta l \Rightarrow Mg\eta\mu\phi = \frac{k \cdot \Delta l}{2} \Rightarrow$$

$$\Delta l = \frac{2Mg\eta\mu\phi}{k} = \frac{2 \cdot 2 \cdot \sqrt{2} \cdot 10 \cdot \frac{\sqrt{2}}{2}}{100} = 0,4 \text{ m}$$

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

### Κ Ε Λ Α Φ Α Σ ΦΡΟΝΤΙΣΤΗΡΙΑ

Γ3. Το ελατήριο κόβεται



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

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

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

$$(2) \stackrel{(3)}{\Rightarrow} Mg\eta\mu\phi - \frac{1}{2} M\alpha_{cm} = M\alpha_{cm} \Rightarrow g\eta\mu\phi = \frac{3}{2} \alpha_{cm} \Rightarrow$$

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

Γ4. Λόγω μεταφορικής κίνησης

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

Λόγω στροφικής κίνησης

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

$$L = I \cdot \omega = \frac{1}{2} MR^2 \cdot \omega = \frac{1}{2} \cancel{3}\sqrt{2} \cdot 0,01 \cdot 20 = 0,2\sqrt{2} \text{ Kg} \frac{\text{m}^2}{\text{s}}$$

## Κ Ε Λ Α Φ Α Σ ΦΡΟΝΤΙΣΤΗΡΙΑ

### ΘΕΜΑ Δ

Δ1. Πριν :  $P_{\text{πριν}} = m \cdot u$  (1)

$$\begin{aligned} \text{Μετά : } P_{\text{μετά}} &= \sqrt{P_1'^2 + P_2'^2 + 2P_1'P_2' \cos\varphi} \\ &= \sqrt{m^2 u_1^2 + m^2 u_2^2 + 2m^2 u_1 u_2 \cos\varphi} \end{aligned} \quad (2)$$

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

$$\begin{aligned} m \cdot u &= \sqrt{m^2 u_1^2 + m^2 u_2^2 + 2m^2 u_1 u_2 \cos\varphi} \Rightarrow \\ \cancel{m} u^2 &= \cancel{m} u_1^2 + \cancel{m} u_2^2 + 2\cancel{m} u_1 u_2 \cos\varphi \Rightarrow \\ u^2 &= u_1^2 + u_2^2 + 2u_1 u_2 \cos\varphi \quad (3) \end{aligned}$$

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  $2u_1 u_2 \cos\varphi = 0 \Rightarrow$

$$\cos\varphi = 0 \Rightarrow \varphi = \frac{\pi}{2} \text{ rad}$$

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

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

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

### Κ Ε Λ Α Φ Α Σ Φ Ρ Ο Ν Τ Ι Σ Τ Η Ρ Ι Α

$$\Delta 3. \text{ΑΠΌ Α.Δ.Ο. } \vec{P}_{\text{πριν}} = \vec{P}_{\text{μετά}} \Rightarrow m_1 \cdot u_1 = (M + m_1) \cdot u_{\Sigma} \Rightarrow$$

$$u_{\Sigma} = \frac{m_1 \cdot u_1}{M + m_1} \Rightarrow u_{\Sigma} = \frac{1 \cdot \frac{2\sqrt{3}}{3}}{3 + 1} = \frac{\sqrt{3}}{6} \text{ m/s}$$

$$\begin{aligned} \Delta K &= K_{\text{τελ}} - K_{\text{αρχ}} = \frac{1}{2}(M + m_1)u_{\Sigma}^2 - \frac{1}{2}m_1u_1^2 \\ &= \frac{1}{2}(3 + 1) \cdot \left(\frac{\sqrt{3}}{6}\right)^2 - \frac{1}{2} \cdot 1 \cdot \left(\frac{2\sqrt{3}}{3}\right)^2 = \frac{1}{6} - \frac{2}{3} = -\frac{1}{2} \text{ Joule} \end{aligned}$$

### Κ Ε Λ Α Φ Α Σ Φ Ρ Ο Ν Τ Ι Σ Τ Η Ρ Ι Α

$$\Delta 4. \Theta.Μ.Κ.Ε. K_{\text{τελ}} - K_{\text{αρχ}} = W_{\text{τρ}} + W_{\text{Fελ}} \Rightarrow$$

$$-\frac{1}{2}(M + m_1)u_{\Sigma}^2 = -\mu \cdot N \cdot x_{\text{max}} - \frac{1}{2}kx_{\text{max}}^2 \quad N=(M+m_1)g \Rightarrow$$

$$-\frac{1}{2}(M + m_1)u_{\Sigma}^2 = -\mu \cdot (M + m_1)g \cdot x_{\text{max}} - \frac{1}{2}kx_{\text{max}}^2 \Rightarrow$$

$$-\frac{1}{2}4\left(\frac{\sqrt{3}}{6}\right)^2 = -\frac{1}{12} \cdot 4 \cdot 10 \cdot 2 \cdot 10^{-2} - \frac{1}{2}k \cdot 4 \cdot 10^{-4} \Rightarrow$$

$$-\frac{1}{6} = -\frac{1}{15} - \frac{k}{5000} \Rightarrow \frac{k}{5000} = \frac{1}{10} \Rightarrow k = 500 \text{ N/m}$$