

ΦΥΣΙΚΗ ΚΑΤΕΥΘΥΝΣΗΣ
ΘΕΤΙΚΗΣ - ΤΕΧΝΟΛΟΓΙΚΗΣ ΚΑΤΕΥΘΥΝΣΗΣ
ΑΠΑΝΤΗΣΕΙΣ

ΘΕΜΑ Α

A1. β A2. γ A3. β A4. γ A5. α Λ β Λ γ Σ δ Λ ε Σ

ΘΕΜΑ Β

B1. Αρχικά: $A' = 2A \mu\epsilon \lambda = \frac{v}{f}$ $x_1 - x_2 = \kappa\lambda$

Τελικά: $\lambda' = \frac{v}{2f} \Rightarrow \lambda' = \frac{\lambda}{2}$

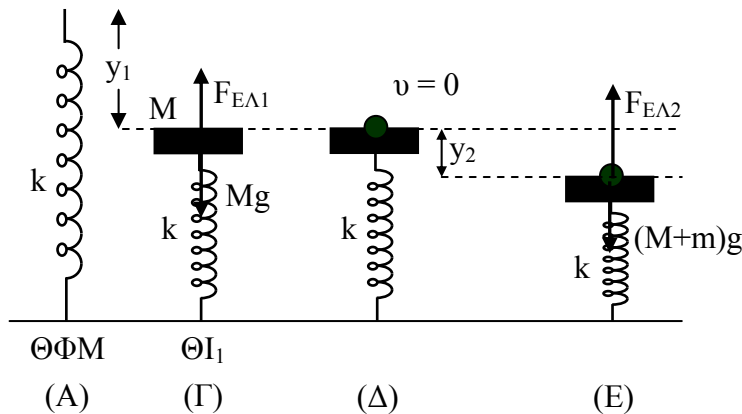
Οπότε

$$A' = \left| 2A \sigma\upsilon\nu 2\pi \frac{x_1 - x_2}{2\lambda'} \right| \Rightarrow A' = \left| 2A \sigma\upsilon\nu 2\pi \frac{x_1 - x_2}{2 \frac{\lambda}{2}} \right|$$

$$\xrightarrow{x_1 - x_2 = \kappa\lambda} A' = \left| 2A \sigma\upsilon\nu 2\pi \frac{\kappa\lambda}{2 \frac{\lambda}{2}} \right| = |2A \sigma\upsilon\nu 2\kappa\pi| = 2A$$

Σωστό το α.

B2.



Σωστό το α.

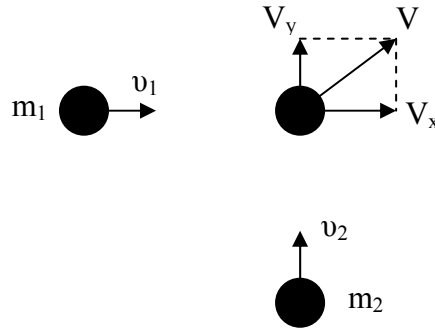
$\theta I_1 : \overline{\Sigma F} = 0 \Rightarrow Mg = \kappa y_1$ (1)

$\theta I_2 : \overline{\Sigma F} = 0 \Rightarrow (M + m)g = \kappa(y_1 + y_2) \Rightarrow Mg + mg = \kappa y_1 + \kappa y_2 \xrightarrow{(1)} y_2 = \frac{mg}{\kappa}$

Στο Δ ξεκινά ταλάντωση με $v = 0$ άρα είναι ακραία θέση άρα $A = y_2 = \frac{mg}{\kappa}$

Άρα $E = \frac{1}{2} \kappa A^2 \Rightarrow E = \frac{1}{2} \frac{m^2 g^2}{\kappa}$

B3.



Α.Δ.Ο. σε άξονες

Άξονας xx': $\vec{P}_{αρχ} = \vec{P}_{τελ} \Rightarrow m_1 v_1 = (m_1 + m_2) V_x \Rightarrow V_x = \frac{m_1 v_1}{m_1 + m_2} \Rightarrow V_x = \frac{8}{5} m/s$

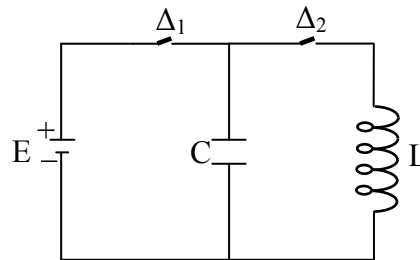
Άξονας yy': $\vec{P}_{αρχ} = \vec{P}_{τελ} \Rightarrow m_2 v_2 = (m_1 + m_2) V_y \Rightarrow V_y = \frac{m_2 v_2}{m_1 + m_2} \Rightarrow V_y = \frac{6}{5} m/s$

$$V = \sqrt{V_x^2 + V_y^2} = \sqrt{\left(\frac{8}{5}\right)^2 + \left(\frac{6}{5}\right)^2} \Rightarrow V = \sqrt{\frac{64}{25} + \frac{36}{25}} = \sqrt{4} \Rightarrow V = 2 m/s$$

Άρα $K_{συσσ.} = \frac{1}{2} (m_1 + m_2) V^2 \Rightarrow K_{συσσ.} = 10 J$

Σωστό το β.

ΘΕΜΑ Γ



Γ1.

Δ₁: κλειστός, Δ₂: ανοικτός

$$c = \frac{Q}{V} \xrightarrow{V=E} Q = c \cdot E \Rightarrow Q = 40 \cdot 10^{-6} C$$

Γ2.

Δ₁: ανοικτός, Δ₂: κλειστός

$$T = 2\pi\sqrt{LC} = 2\pi\sqrt{16 \cdot 10^{-8}} \Rightarrow T = 8\pi \cdot 10^{-4} s$$

Γ3.

$$\omega = \frac{2\pi}{T} = \frac{2\pi}{8\pi \cdot 10^{-4}} = 2500 r/s$$

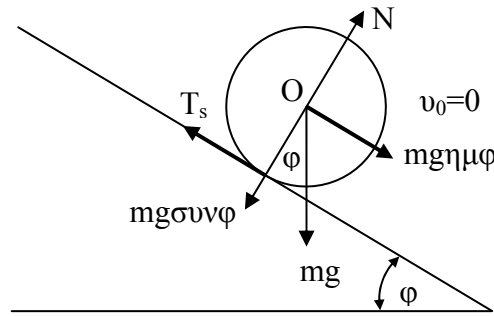
$$I = Q \cdot \omega \Rightarrow I = 4 \cdot 10^{-5} \cdot 25 \cdot 10^2 \Rightarrow I = 0,1 A$$

οπότε $i = -0,1 \eta\mu(2500t + \phi_0) \xrightarrow[t=0]{i=0} i = -0,1 \eta\mu 2500t$

Γ4.

$$\left. \begin{aligned} U_B &= 3U_E \\ E &= U_B + U_E \end{aligned} \right\} \Rightarrow E = 4U_E \Rightarrow U_E = \frac{E}{4} \Rightarrow \frac{1}{2} \frac{q^2}{c} = \frac{2}{4} \frac{c}{4} \Rightarrow q^2 = \frac{Q^2}{4} \Rightarrow q = \pm \frac{Q}{2} \Rightarrow q = \pm 20 \cdot 10^{-6} \text{ C}$$

ΘΕΜΑ Δ



Δ1.

$$\left. \begin{aligned} \Sigma \vec{F} &= m \vec{a}_{cm} \Rightarrow mg \eta \mu \phi - T_s = m a_{cm} \\ \Sigma \vec{\tau} &= I \cdot \vec{\alpha} \Rightarrow T_s \cdot r = I \cdot a \gamma \\ \alpha_{cm} &= a \gamma \cdot r \end{aligned} \right\} \Rightarrow T_s = I \frac{a_{cm}}{r^2} \left\{ \begin{aligned} mg \eta \mu \phi - I \frac{a_{cm}}{r^2} &= m a_{cm} \xrightarrow{(1a)} I = \frac{(mg \eta \mu \phi - m a_{cm}) r^2}{a_{cm}} \end{aligned} \right. \quad (1)$$

$$x = \frac{1}{2} a_{cm} t^2 \Rightarrow a_{cm} = \frac{2x}{t^2} = 4 \text{ m/sec}^2$$

$$(1) \Rightarrow I = \frac{(2 \cdot 10 \cdot \frac{1}{2} - 2 \cdot 4) 1^2}{4} \Rightarrow I = 0,5 \text{ kg m}^2$$

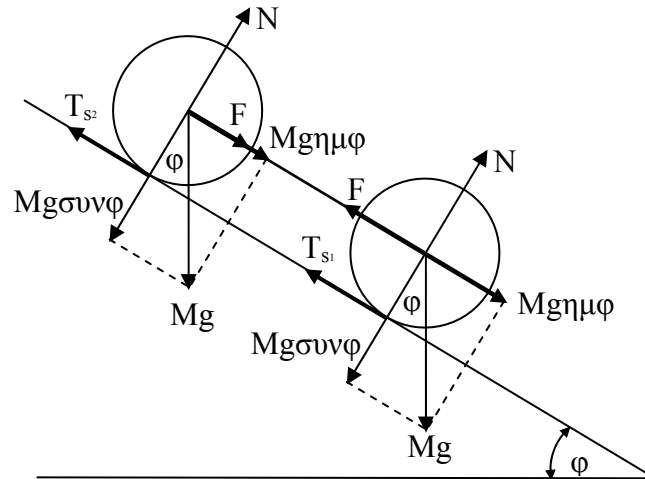
Δ2.

$$\text{Από (1a)} \Rightarrow mg \eta \mu \phi = \left(\frac{I}{r^2} + m \right) a_{cm} \Rightarrow a_{cm} = \frac{mg \eta \mu \phi}{\frac{I}{r^2} + m}$$

$$\left\{ \begin{aligned} \text{δίσκος} \quad \alpha_{cm1} &= \frac{Mg \eta \mu \phi}{\frac{1/2 m R^2}{R^2} + M} = \frac{2}{3} g \eta \mu \phi = \frac{10}{3} \text{ m/sec}^2 \\ \text{δακτύλιος} \quad \alpha_{cm2} &= \frac{Mg \eta \mu \phi}{\frac{m R^2}{R^2} + M} = \frac{g \eta \mu \phi}{2} = \frac{5}{2} \text{ m/sec}^2 \end{aligned} \right.$$

Άρα $\alpha_{cm1} > \alpha_{cm2}$

Δ3.



$$\frac{K_1}{K_2} = \frac{\frac{1}{2}Mv_{cm}^2 + \frac{1}{2}I_1\omega^2}{\frac{1}{2}Mv_{cm}^2 + \frac{1}{2}I_1\omega^2} = \frac{Mv_{cm}^2 + \frac{1}{2}MR^2\frac{v_{cm}^2}{R^2}}{Mv_{cm}^2 + MR^2\frac{v_{cm}^2}{R^2}} = \frac{\frac{3}{2}Mv_{cm}^2}{2Mv_{cm}^2} = \frac{3}{4}$$

Δ4.

Δίσκος: $\Sigma \vec{F}_x = M\vec{a}_{cm} = Mg\eta\mu\phi - T_{S1} - F = Ma_{cm}$ (1)

$T_{S1} \cdot R = I_{\pi} \cdot \alpha\gamma \Rightarrow T_{S1} = \frac{1}{2}MR^2\frac{a_{cm}}{R^2} \Rightarrow T_{S1} = \frac{1}{2}Ma_{cm}$ (2)

Δακτύλιος: $F + Mg\eta\mu\phi - T_{S2} = Ma_{cm}$ (3)

$T_{S2} \cdot R = I_2 \cdot \frac{a_{cm}}{R} \Rightarrow T_{S2} = MR^2\frac{a_{cm}}{R^2} \Rightarrow T_{S2} = Ma_{cm}$ (4)

(1) $\xrightarrow{(2)}$ $Mg\eta\mu\phi - \frac{1}{2}Ma_{cm} - F = Ma_{cm} \Rightarrow Mg\eta\mu\phi - F = \frac{3}{2}Ma_{cm}$ (5)

(3) $\xrightarrow{(4)}$ $F + Mg\eta\mu\phi - Ma_{cm} = Ma_{cm} \Rightarrow F + Mg\eta\mu\phi = 2Ma_{cm}$ (6)

(5) $\Rightarrow \frac{Mg\eta\mu\phi - F}{F + Mg\eta\mu\phi} = \frac{\frac{3}{2}Ma_{cm}}{2Ma_{cm}} \Rightarrow 4Mg\eta\mu\phi - 4F = 3F + 3Mg\eta\mu\phi \Rightarrow Mg\eta\mu\phi = 7F \Rightarrow F = \frac{Mg\eta\mu\phi}{7} \Rightarrow$

$F = \frac{1,4 \cdot 10 \cdot \frac{1}{2}}{7} \Rightarrow F = 1N$