ΦΥΣΙΚΗ ΚΑΤΕΥΘΥΝΣΗΣ
ΘΕΤΙΚΗΣ - ΤΕΧΝΟΛΟΓΙΚΗΣ ΚΑΤΕΥΘΥΝΣΗΣ
ΑΠΑΝΤΗΣΕΙΣ

ΘΕΜΑ Α

Α1. β **Α2.**γ **Α3.**β **Α4.**γ **Α5.** α Λ β Λ γ Σ δ Λ ε Σ

ΘΕΜΑ Β

Β1. Αρχικά: $A' = 2A \;\mu\varepsilon\; \lambda = \frac{\upsilon}{f}$ x_1-x_2=κλ

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

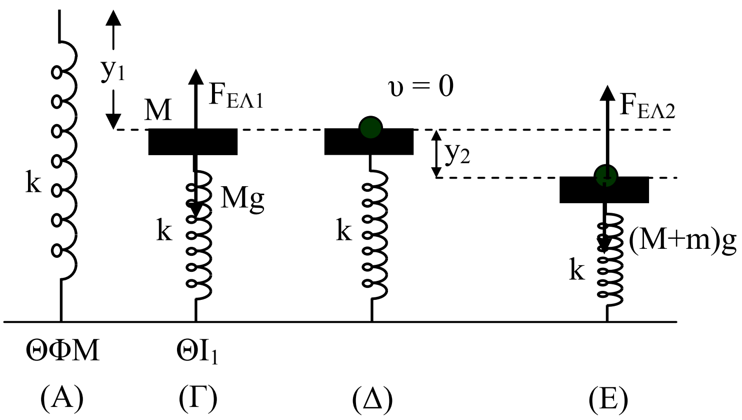
Οπότε

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

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

Σωστό το α.

Β2.



Σωστό το α.

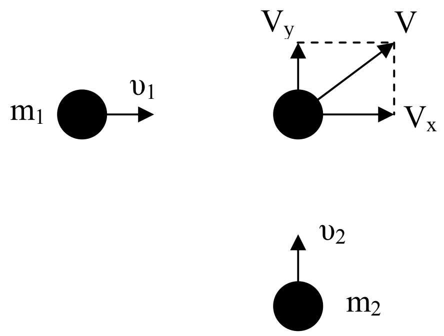
$\theta I_1 : \overrightarrow{\Sigma F} = 0 \Rightarrow Mg = \kappa y_1$ (1)

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

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

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

Β3.



<u>Α.Δ.Ο. σε άξονες</u>

Άξονας xx΄: $\vec{P}_{αρχ} = \vec{P}_{τελ} \Rightarrow m_1 υ_1 = (m_1 + m_2) V_x \Rightarrow V_x = \dfrac{m_1 υ_1}{m_1 + m_2} \Rightarrow V_x = \dfrac{8}{5} m/s$

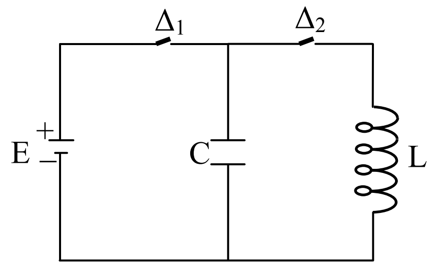
Άξονας yy΄: $\vec{P}_{αρχ} = \vec{P}_{τελ} \Rightarrow m_2 υ_2 = (m_1 + m_2) V_y \Rightarrow V_y = \dfrac{m_2 υ_2}{m_1 + m_2} \Rightarrow V_y = \dfrac{6}{5} m/s$

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

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

Σωστό το β.

ΘΕΜΑ Γ



Γ1.

$Δ_1$:κλειστός, $Δ_2$: ανοικτός

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

Γ2.

$Δ_1$: ανοικτός, $Δ_2$: κλειστός

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

Γ3.

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

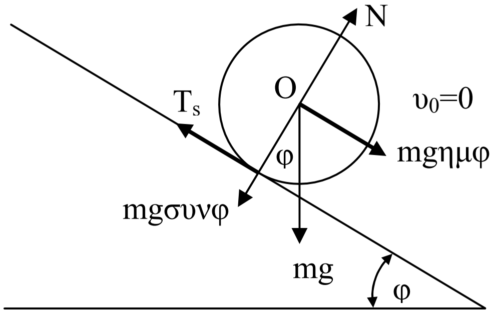
$$I = Q \cdot \omega \Rightarrow I = 4 \cdot 10^{-5} \cdot 25 \cdot 10^{2} \Rightarrow I = 0{,}1A$$

οπότε i=-0,1ημ(2500t+$φ_o$) $\xrightarrow[i=0]{t=0}$ $i = -0{,}1 ημ 2500t$

Γ4.

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

ΘΕΜΑ Δ



Δ1.

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

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

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

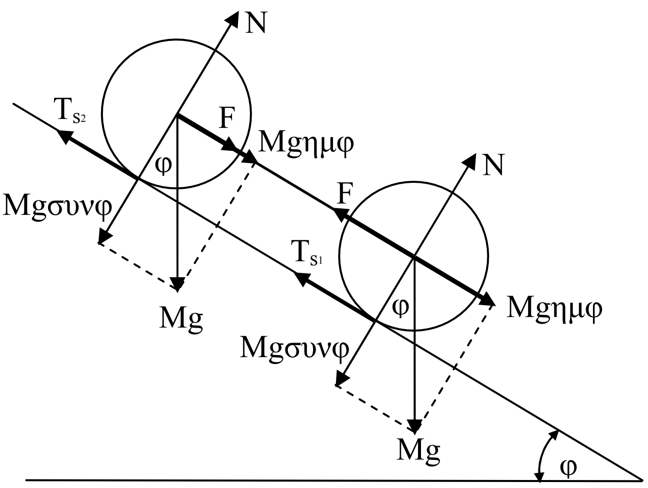
Δ2.

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

$$\begin{cases} \delta\acute{\iota}\sigma\kappa o\varsigma \quad \alpha_{cm1} = \dfrac{Mg\eta\mu\varphi}{\dfrac{\frac{1}{2}mR^2}{R^2} + M} = \dfrac{2}{3}g\eta\mu\varphi = \dfrac{10}{3}m/\sec^2 \\ \delta\alpha\kappa\tau\acute{\upsilon}\lambda\iota o\varsigma \quad \alpha_{cm2} = \dfrac{Mg\eta\mu\varphi}{\dfrac{mR^2}{R^2} + M} = \dfrac{g\eta\mu\varphi}{2} = \dfrac{5}{2}m/\sec^2 \end{cases}$$

Άρα $\alpha_{cm1} > \alpha_{cm2}$

Δ3.



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

Δ4.

<u>Δίσκος:</u> $\overrightarrow{\Sigma F_x}=M\overrightarrow{\alpha_{cm}}$ = Mgημφ-T_{S1}-F=Mα_{cm} (1)

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

<u>Δακτύλιος:</u> F+Mgημφ – T_{S2}=Mα_{cm} (3)

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

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

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

$$\frac{(5)}{(6)}\Rightarrow\frac{Mg\eta\mu\varphi-F}{F+Mg\eta\mu\varphi}=\frac{\frac{3}{2}M\alpha_{cm}}{2Ma_{cm}}\Rightarrow 4Mg\eta\mu\varphi-4F=3F+3Mg\eta\mu\varphi\Rightarrow Mg\eta\mu\varphi=7F\Rightarrow F=\frac{Mg\eta\mu\varphi}{7}\Rightarrow$$

$$F=\frac{1,4\cdot10\cdot\frac{1}{2}}{7}\Rightarrow F=1N$$