Απαντήσεις στα θέματα φυσικής θετικής κατεύθυνσης

Θέμα Α

Α1. α

Α2. β

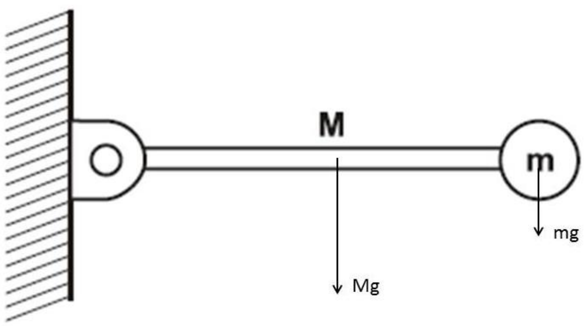
Α3. α

Α4. δ

Α5. α) Λ β) Σ γ) Σ δ) Λ ε) Σ

Θέμα Β

Β1. iii)



$$I_{ολ} = I_ρ + ml^2$$

$$I_{ολ} = \frac{1}{3}ML^2 + \frac{1}{2}ML^2 = \frac{5}{6}ML^2$$

$$\left.\begin{array}{r} Στ = I_{ολ} \cdot a_γ \\ Σ_τ = Mg\frac{L}{2} + mgL \end{array}\right\} \Rightarrow$$

$$I_{ολ} \cdot a_γ = Mg\frac{L}{2} + \frac{Mg}{2}L$$

$$I_{ολ} \cdot a_γ = MgL$$

$$\frac{5}{6}ML^2 \cdot a_γ = MgL$$

$$a_γ = \frac{6g}{5L}$$

$$\frac{\Delta L_\rho}{\Delta t} = I_\rho \cdot a_\gamma = \frac{1}{3} M L^2 \cdot \frac{6g}{5L} = \frac{2}{5}\, MgL$$

B2. iii)

$$y = 2A\sigma\upsilon\nu(\frac{2\pi\chi}{\lambda})\eta\mu(\frac{2\pi t}{T})$$

Από την εξίσωση του στάσιμου παρατηρούμε ότι έχουμε κοιλία στο Ο.

Επομένως: $X_\Delta = (2\kappa + 1)\frac{\lambda}{4} \overset{\kappa=2}{\Longrightarrow} X_{\Delta 3} = \frac{5\lambda}{4}$

$$X_M = X_{\Delta 3} + \frac{\lambda}{12} = \frac{5\lambda}{4} + \frac{\lambda}{12} = \frac{4\lambda}{3}$$

$$A'_M = 2A\left|\sigma\upsilon\nu\frac{2\pi\chi_M}{\lambda}\right| \Rightarrow$$

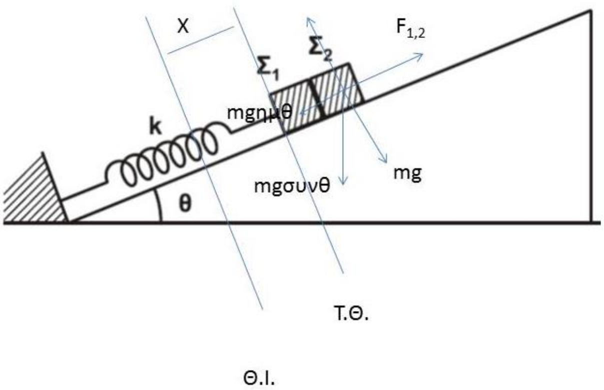
$$A'_M = 2A\left|\sigma\upsilon\nu(\frac{2\pi\frac{4\lambda}{3}}{\lambda})\right| \Rightarrow$$

$$A'_M = 2A\left|\sigma\upsilon\nu(\frac{8\pi}{3})\right| \Rightarrow$$

$$A'_M = 2A\left|\sigma\upsilon\nu(\frac{2\pi}{3})\right| \Rightarrow$$

$$A'_M = A$$

B3. i)



Για λείο κεκλιμένο επίπεδο

$$\kappa = D_{o\lambda} = (m_1 + m_2)\omega^2$$

$$\omega = \sqrt{\frac{\kappa}{m_1 + m_2}}$$

$$D_2 = m_2\omega^2$$

Η πιθανή αποκόλληση θα συμβεί πάνω από τη θέση ισορροπίας .

Για μια τυχαία θέση πάνω από τη ΘΙ ισχύει :

$$\left.\begin{matrix} \Sigma F_2 = D_2\chi \\ \Sigma F_2 = m_2 g\eta\mu\theta - F_{1,2} \end{matrix}\right\} \Rightarrow$$

$$D_2\chi = m_2 g\eta\mu\theta - F_{1,2}$$

$$F_{1,2} = m_2 g\eta\mu\theta - D_2\chi$$

$$F_{1,2} = m_2 g\eta\mu\theta - m_2\frac{\kappa}{m_1 + m_2}x \xrightarrow[F_{1,2}=F_{1,2\,\min}\ \kappa\alpha\iota\ X=A]{}$$

$$F_{1,2min} = m_2 g\eta\mu\theta - m_2\frac{\kappa}{m_1+m_2}A$$

$$\theta\acute{\varepsilon}\lambda\omega\ F_{1,2min} > 0$$

$$m_2 g\eta\mu\theta - m_2\frac{\kappa}{m_1+m_2}A > 0$$

$$(m_1 + m_2)g\eta\mu\theta > KA$$

$$KA < (m_1 + m_2)g\eta\mu\theta$$

Θέμα Γ

Γ1.

Α.Δ.Ε.Τ.

$$U_E + U_B = E_T$$

$$U_E = \frac{1}{2}L(I^2 - i^2)(1)$$

$$U_E = 8\bullet 10^{-2}(I^2 - i^2)(2)$$

$$\alpha\pi ό(1),(2)\frac{1}{2}L = 8\bullet 10^{-2} \Rightarrow$$

$$L = 16\bullet 10^{-2}H$$

$$I^2 = 1 \Rightarrow I = 1A$$

$$U_{E\max} = U_{B\max} = \frac{1}{2}LI^2 = 8\bullet 10^{-2}J$$

$$E_T = U_{E\max} = \frac{1}{2}CV_C^2 \Rightarrow C = \frac{2E_T}{V_C^2} = 10^{-4}F$$

$$T = 2\pi\sqrt{LC} = 8\pi 10^{-3}s$$

Γ2.

$$E_T = \frac{1}{2}LI^2 = 8\bullet 10^{-2}J$$

$$U_E = E_T\sigma\upsilon\nu^2(\omega t) \Rightarrow$$

$$U_E = E_T\sigma\upsilon\nu^2(\frac{2\pi}{T}\bullet\frac{T}{12}) \Rightarrow$$

$$U_E = E_T\sigma\upsilon\nu^2(\frac{\pi}{6}) \Rightarrow$$

$$U_E = 6\bullet 10^{-2}J$$

Γ3.

$E_T = U_E + U_B (1)$

$U_E = 3U_B \Rightarrow U_B = \frac{U_E}{3} (2)$

$\alpha\pi ó (1),(2)$

$E_T = U_E + \frac{U_E}{3} \Rightarrow$

$E_T = \frac{4}{3} U_E \Rightarrow$

$E_T = \frac{4}{3}\frac{1}{2}\frac{q^2}{C} \Rightarrow q = \sqrt{\frac{3E_T C}{2}} \Rightarrow$

$q = \pm 2\sqrt{3} 10^{-3} C$

$$\left|\frac{di}{dt}\right| = \left|-\frac{E_{AYT}}{L}\right| = \left|-\frac{V_C}{L}\right| = \left|-\frac{q}{LC}\right| = \frac{\sqrt{3}}{8} 10^3 \frac{A}{s}$$

Γ4.

$\omega = \frac{2\pi}{T} \Rightarrow \omega^2 = \frac{4\pi^2}{T^2} \Rightarrow \omega^2 = \frac{1}{16 \cdot 10^{-6}}\ (S.I)$

$\omega = \frac{1}{\sqrt{LC}} \Rightarrow LC = \frac{1}{\omega^2} \Rightarrow LC = 16 \cdot 10^{-6}\ (S.I)$

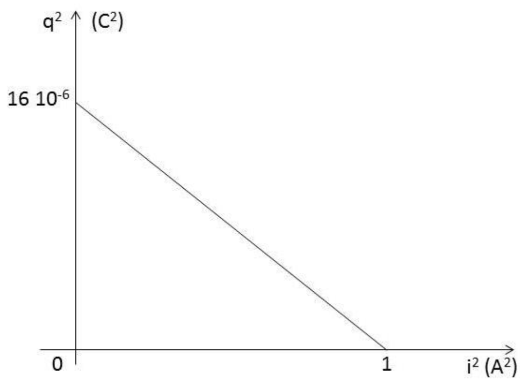
$E_T = U_E + U_B \Rightarrow U_E = E_T - U_B \Rightarrow$

$\frac{1q^2}{2c} = \frac{1}{2}LI^2 - \frac{1}{2}Li^2 \Rightarrow$

$q^2 = LCI^2 - LCi^2 \Rightarrow$

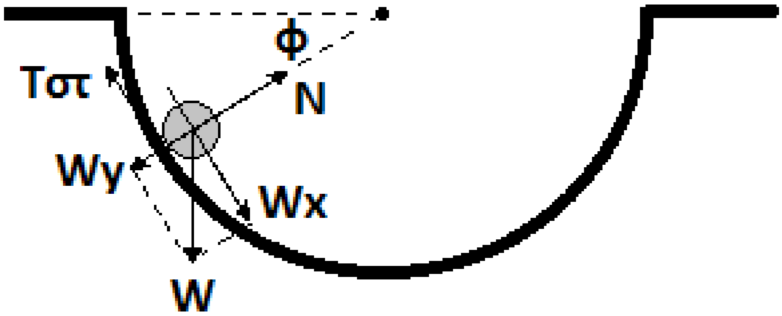
$q^2 = 16 \cdot 10^{-6} - 16 \cdot 10^{-6} i^2\ (S.I)$

$(\mu\varepsilon -1 \leq i \leq +1 \Rightarrow 0 \leq i^2 \leq +1)$



Θέμα Δ

Δ1.



$$\left.\begin{cases}\Sigma F = mg\sigma\upsilon\nu\varphi - T_S \\ \Sigma F = ma_{cm}\end{cases}\right\} \Rightarrow T_S = mg\sigma\upsilon\nu\varphi - ma_{cm} (1)$$

$$\left.\begin{cases}\Sigma\tau = I\alpha_\gamma \\ \Sigma\tau = T_S r\end{cases}\right\} \Rightarrow$$

$$I\alpha_\gamma = T_S r \Rightarrow$$

$$\frac{2}{5}mr^2\alpha_\gamma = T_S r \Rightarrow$$

$$\frac{2}{5}m\alpha_{cm} = T_S \Rightarrow$$

$$a_{cm} = \frac{5T_S}{2m} (2)$$

$$\alpha\pi\acute{o}(1),(2) T_S = mg\sigma\upsilon\nu\varphi - \frac{5}{2}T_s \Rightarrow$$

$$\frac{7}{2}T_s = mg\sigma\upsilon\nu\varphi \Rightarrow T_s = \frac{2}{7}mg\sigma\upsilon\nu\varphi \Rightarrow$$

$$T_s = 4\sigma\upsilon\nu\varphi (S.I)$$

Δ2.

$$\left.\begin{array}{r} \Sigma F_y = \frac{mu_{cm}^2}{(R-r)} \\ \Sigma F_y = N - mg\eta\mu\varphi \end{array}\right\} \Rightarrow$$

$$\frac{mu_{cm}^2}{(R-r)} = N - mg\eta\mu\varphi \Rightarrow$$

$$N = mg\eta\mu\varphi + \frac{mu_{cm}^2}{(R-r)} \quad (3) \qquad \eta\mu\varphi = \frac{h}{R-r}$$

Α.Δ.Μ.Ε. Α→Γ

$$E_A = E_\Gamma$$

$$mgh = \frac{1}{2}mu_{cm}^2 + \frac{1}{2}I\omega^2$$

$$mg(R-r)\eta\mu\varphi = \frac{1}{2}mu_{cm}^2 + \frac{1}{2}\frac{2}{5}mr^2\omega^2$$

$$g(R-r)\eta\mu\varphi = \frac{1}{2}u_{cm}^2 + \frac{1}{5}u_{cm}^2$$

$$g(R-r)\eta\mu\varphi = \frac{7}{10}u_{cm}^2$$

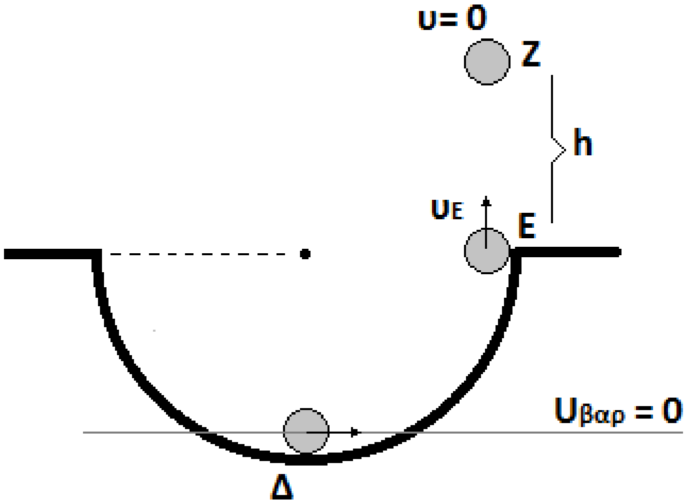
$$u_{cm}^2 = \frac{10}{7}\, g(R-r)\eta\mu\varphi \ (4)$$

$$(3) \overset{(4)}{\Rightarrow} N = mg\eta\mu\varphi + \frac{10}{7}\frac{m}{(R-r)}g(R-r)\eta\mu\varphi$$

$$N = \frac{17}{7}mg\eta\mu\varphi$$

N=17N

Δ3.



Α.Δ.Μ.Ε. (Δ)→ (Ε)

$$\mathrm{E}_{\Delta} = \mathrm{E}_{\mathrm{E}} \Rightarrow$$

$$\frac{1}{2}mu_{\Delta}^2 + \frac{1}{2}\mathrm{I}\omega_{\Delta}^2 = mg(R-r) + \frac{1}{2}mu_{\mathrm{E}}^2 + \frac{1}{2}\mathrm{I}\omega_{\mathrm{E}}^2 \Rightarrow$$

$$mu_{\Delta}^2 + \frac{2}{5}mr^2\omega_{\Delta}^2 = 2mg\frac{7}{8}R + mu_{\mathrm{E}}^2 + \frac{2}{5}mr^2\omega_E^2$$

$$\xrightarrow[u_E=\omega_E r]{u_{\Delta}=\omega_{\Delta} r} \frac{7}{5}u_{\Delta}^2 = \frac{7}{4}gR + \frac{7}{5}u_E^2 \Rightarrow$$

$$u_{\Delta}^2 - \frac{5}{4}gR = u_E^2 \Rightarrow u_E^2 = 36 - \frac{5}{4}\cdot 10\cdot 1.6$$

$$u_E^2 = 36 - 20 \Rightarrow u_E^2 = 16 \Rightarrow$$

$$u_E = 4m/s$$

Α.Δ.Μ.Ε. (Ε)→ h_{max} (θέση z)

$$\mathrm{E}_E = \mathrm{E}_Z \Rightarrow$$

$$\frac{1}{2}mu_E^2 + \frac{1}{2}\mathrm{I}\omega_{\mathrm{E}}^2 = mgh_{\max} + \frac{1}{2}\mathrm{I}\omega_{\mathrm{E}}^2 \Rightarrow$$

$$h_{\max} = \frac{u_E^2}{2g} \Rightarrow h_{\max} = \frac{16}{20} \Rightarrow$$

$$h_{\max} = 0.8m$$

Δ4.

Αμέσως μετά την απώλεια επαφής στο Ε :

Στ=0

$\frac{dK}{dt} = \frac{dw}{dt} = \Sigma F \cdot \upsilon + \Sigma\tau \cdot \omega = -mgu_E + 0 = -$*1,4·10·4=- 56 J/s*

$\frac{dL}{dt} = \Sigma\tau = 0$ (Η ροπή του βάρους είναι μηδέν)

ΟΡΟΣΗΜΟ ΠΕΙΡΑΙΑ

ΠΑΓΚΑΛΗΣ ΔΗΜΗΤΡΙΟΣ

ΛΑΜΠΡΟΠΟΥΛΟΣ ΓΙΩΡΓΟΣ

ΚΩΝΣΤΑΝΤΕΛΟΣ ΧΡΗΣΤΟΣ

ΛΙΒΑΔΑ ΜΑΡΙΑ

ΟΡΟΣΗΜΟ ΡΑΦΗΝΑ

ΠΛΑΣΚΟΒΙΤΗΣ ΣΠΥΡΟΣ

ΤΣΙΤΟΥΡΑΣ ΜΑΝΟΣ

ΓΑΛΑΖΟΥΛΑΣ ΝΙΚΟΣ