ΑΠΟΛΥΤΗΡΙΕΣ ΕΞΕΤΑΣΕΙΣ ΤΗΣ Γ' ΛΥΚΕΙΟΥ
ΦΥΣΙΚΗ ΘΕΤΙΚΗΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΚΗΣ ΚΑΤΕΥΘΥΝΣΗΣ

ΟΙ ΑΠΑΝΤΗΣΕΙΣ ΤΩΝ ΘΕΜΑΤΩΝ ΑΠΟ ΚΑΘΗΓΗΤΕΣ

του ΦΡΟΝΤΙΣΤΗΡΙΟΥ

Γιάννης Κυριακίδης

Όριον φροντιστήριο μέσης εκπαίδευσης

www.orion.edu.gr

ΘΕΜΑ Α

Α1. α

Α2. β

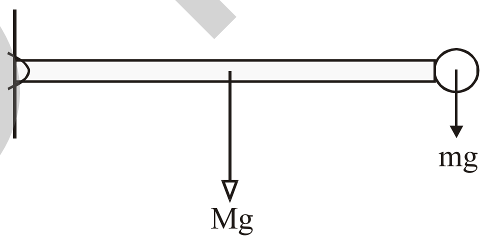
Α3. α

Α4. δ

Α5. α – Λ , β – Σ , γ – Σ , δ – Λ , ε – Σ

ΘΕΜΑ Β

Β1. Θ. Steiner: $I_{ολ} = I_p + mL^2 \Rightarrow I_{ολ} = \frac{5}{6}ML^2$ (1)



Θ.Ν.Σ.: $\Sigma\tau = I_{ολ} \cdot α_γ \Rightarrow mgL + \frac{MgL}{2} = I_{ολ} \cdot α_γ \Rightarrow$

$\Rightarrow α_γ = \frac{6g}{5L}$ (2)

$$\left(\frac{\Delta L_p}{\Delta t}\right) = \Sigma\tau_p = I_p \cdot α_γ \overset{(1)}{\underset{(2)}{\Rightarrow}} \left(\frac{\Delta L_p}{\Delta t}\right) = \frac{1}{3}ML^{\cancel{2}} \cdot \frac{6g}{5\cancel{L}} \Rightarrow \boxed{\frac{\Delta L_p}{\Delta t} = \frac{2}{5}MgL}$$

σωστό το (iii)

B2. $x_M = x_\Delta + \frac{\lambda}{12} = \frac{5\lambda}{5} + \frac{\lambda}{12} \Rightarrow x_M = \frac{4\lambda}{3}$

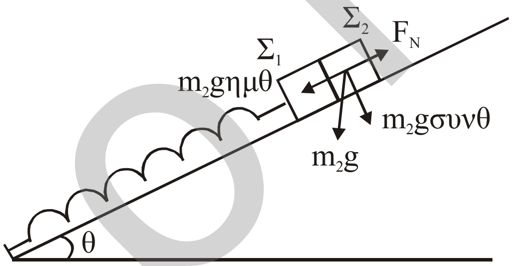
$A' = \left| 2A \cdot \sigma\upsilon\nu \frac{2\pi x_M}{\lambda} \right| = \left| 2A\sigma\upsilon\nu \frac{8\pi}{3} \right| \Rightarrow \boxed{A' = A}$

σωστό το (iii)

B3. Για να μην χαθεί η επαφή πρέπει: $F_N > 0$ (1)

$\Sigma_2 = \Sigma F_2 = F_{\varepsilon\pi} \Leftrightarrow F_N - m_2 g\eta\mu\theta = -D_2 x \Leftrightarrow$

$F_N = m_2 g\eta\mu\theta - m_2\omega^2 x$ (2)



$(2) \overset{(1)}{\Rightarrow} \cancel{m_2} g\eta\mu\theta > \cancel{m_2}\omega^2 x \Rightarrow x < \frac{g\eta\mu\theta}{\omega^2} \Rightarrow$

$\Rightarrow x < \frac{g\eta\mu\theta(m_1 + m_2)}{K} \Rightarrow Kx < (m_1 + m_2) g\eta\mu\theta$

Επειδή $x_{max} = A$ έχω $\boxed{KA < (m_1 + m_2) g\eta\mu\theta}$

σωστό το (i)

ΘΕΜΑ Γ

Γ1. $U_E = 8\cdot10^{-2} - 8\cdot10^{-2}\cdot i^2 \quad (1)$

$ΑΔΕΤ: U_E + U_B = E_{ΟΛ} \Rightarrow U_E = E_{ΟΛ} - \frac{1}{2}L\cdot i^2 \quad (2)$

$\overset{(1),(2)}{\Rightarrow} \boxed{E_{ΟΛ} = 8\cdot10^{-2}\,J}$ και $\frac{1}{2}L = 8\cdot10^{-2} \Rightarrow \underline{L = 16\cdot10^{-2}\,H}$

$E_{ΟΛ} = \frac{1}{2}LI^2 \Rightarrow \underline{I = 1\,A}$

$E_{ΟΛ} = \frac{1}{2}\frac{Q^2}{c} = \frac{1}{2}CV^2 \Rightarrow C = \frac{2E_{ΟΛ}}{V^2} \Rightarrow \underline{C = 10^{-4}\,F}$

$T = 2\pi\sqrt{LC} \Rightarrow \boxed{T = 8\pi\cdot10^{-3}\,s}$

Γ2. $t = \frac{T}{12}$: $i = -I\cdot ημ\frac{2\pi}{T}\frac{T}{12} = -I\cdot ημ\frac{\pi}{6} \Rightarrow \underline{i = -0,5\ A}$

$U_E = 8\cdot10^{-2}(1-0,25) \Rightarrow \boxed{U_E = 6\cdot10^{-2}\,J}$

Γ3. ΑΔΕΤ: $U_E + U_B = E_{ΟΛ} \Leftrightarrow 4U_B = E_{ΟΛ} \Rightarrow i = \pm\frac{I}{2}$

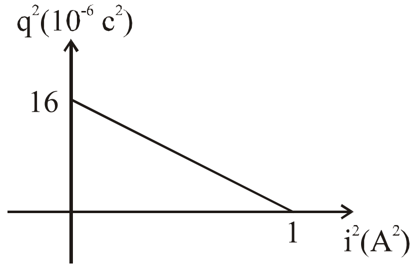
$U_E = 3U_B \Rightarrow \frac{1}{2}\cdot\frac{q^2}{C} = 3\frac{1}{2}Li^2 \Rightarrow q = \frac{I\sqrt{3LC}}{2}$

$\left|\frac{di}{dt}\right| = \left|\frac{V_L}{L}\right| = \left|\frac{-V_C}{L}\right| = \left|\frac{-q}{LC}\right| = \left|\frac{I\sqrt{3}}{2\sqrt{LC}}\right| = \boxed{125\sqrt{3}\ A/s}$

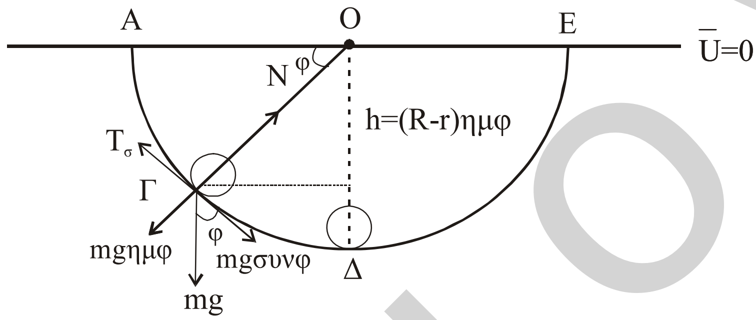
Γ4. ΑΔΕΤ: $\frac{1}{2}Li^2 + \frac{1}{2}\cdot\frac{q^2}{C} = E_{ΟΛ} \overset{SI}{\Rightarrow} 8\cdot10^{-2}i^2 + 5000q^2 = 8\cdot10^{-2}$

$\Rightarrow \boxed{q^2 = 16\cdot10^{-6} - 16\cdot10^{-6}\cdot i^2}$ SI,

όπου: $0 \le i^2 \le 1$



ΘΕΜΑ Δ



Δ1. ΘΝΣ: $\Sigma\tau = I \cdot \alpha_\gamma \Rightarrow T_\sigma \cdot \cancel{r} = \frac{2}{5} m r^{\cancel{2}} \alpha_\gamma \Rightarrow$

$$\Rightarrow T_\sigma = \frac{2}{5} m\alpha_{cm} \quad (1)$$

ΘΝΜ: $\Sigma F_x = m\alpha_{cm} \Rightarrow mg\sigma\upsilon\nu\varphi - T_\sigma = m\alpha_{cm} \quad (2)$

$$\overset{(1)+(2)}{\Rightarrow} \cancel{m} g\sigma\upsilon\nu\varphi = \frac{7}{5}\cancel{m}\alpha_{cm} \Rightarrow \alpha_{cm} = \frac{5g\sigma\upsilon\nu\varphi}{7} \overset{(1)}{\Rightarrow}$$

$$\Rightarrow T_\sigma = \frac{2}{\cancel{5}} m \frac{\cancel{5} g\sigma\upsilon\nu\varphi}{7} \Rightarrow \boxed{T_\sigma = 4\sigma\upsilon\nu\varphi} \quad (SI)$$

Δ2. $\Sigma F_y = F_{KEN} \Leftrightarrow N - mg\eta\mu\varphi = m\frac{\upsilon_\Gamma^2}{R-r} \Rightarrow \underline{N = mg\eta\mu\varphi + m\frac{\upsilon_\Gamma^2}{R-r}} \quad (3)$

$$\underset{(A)\to(\Gamma)}{\text{ΑΔΜΕ}}: E_{MHX}^{(A)} = E_{MHX}^{(\Gamma)} \Leftrightarrow 0+0+0 = -mg\left(R-r\right)\eta\mu\varphi + \frac{1}{2}m\upsilon_\Gamma^2 + \frac{1}{2}I\omega^2$$

$$\Leftrightarrow \cancel{m}g(R-r)\eta\mu\varphi = \frac{7}{10}\cancel{m}\upsilon_\Gamma^2 \Rightarrow U_\Gamma = \sqrt{\frac{10g(R-r)\eta\mu\varphi}{7}} \overset{SI}{\Rightarrow}$$

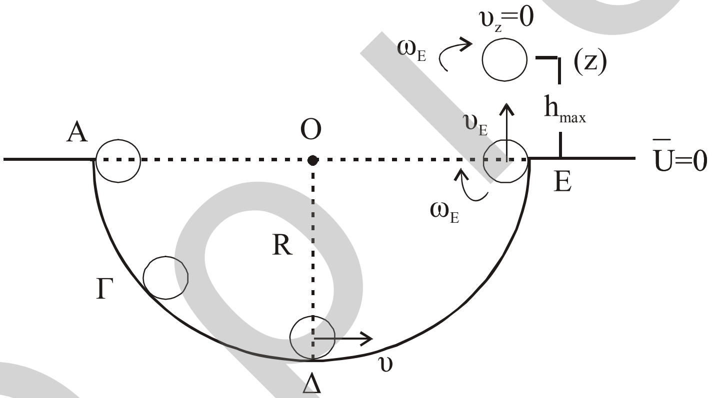
$$\Rightarrow \upsilon_\Gamma = \sqrt{10}\ {}^{m}\!/_{s} \overset{(3)}{\Rightarrow} N = 1,4\cdot 10\cdot\frac{1}{2} + 1,4\cdot\frac{10}{1,6-0,2} \Rightarrow \boxed{N = 17\ N}$$

Δ3. $$\underset{(\Delta)\to(E)}{A\Delta ME}:\ \frac{1}{2}m\upsilon^2 + \frac{1}{2}I\omega^2 - mg(R-r) =$$

$$= \frac{1}{2}m\upsilon_E^2 + \frac{1}{2}I\omega_E^2 + 0 \Leftrightarrow$$

$$\Leftrightarrow \frac{7}{10}\cancel{m}\upsilon^2 - \cancel{m}g(R-r) = \frac{7}{10}m\upsilon_E^2$$

$$\Leftrightarrow \upsilon_E = \sqrt{\upsilon^2 - \frac{10g}{7}(R-r)} \Rightarrow \underline{\upsilon_E = 4\ {}^{m}\!/_{s}}$$



Μόλις η σφαίρα χάσει επαφή με το δάπεδο στο (Ε) δεν ασκείται πάνω της καμία ροπή, οπότε συνεχίζει να στρέφεται με την ίδια γωνιακή ταχύτητα:

$$\omega_E = \frac{\upsilon_E}{r} = 20\ {}^{r}\!/_{s}$$

$$\underset{(\Delta)\to(E)}{A\Delta ME}:\ 0 + \frac{1}{2}m\upsilon_E^2 + \frac{1}{2}\cancel{I\omega_E^2} = mgh_{max} + 0 + \frac{1}{2}\cancel{I\omega_E^2}$$

$$\Rightarrow h_{max} = \frac{\upsilon_E^2}{2g} \Rightarrow \boxed{h_{max} = 0,8\ m}$$

Δ4. $\left(\frac{dK}{dt}\right)_E = \left(\frac{dW}{dt}\right)_E = \Sigma F \cdot \upsilon_E = -mg\upsilon_E \Rightarrow \boxed{\left(\frac{dk}{dt}\right)_E = -56\ ^{j}/_{s}}$

$$\left(\frac{dL}{dt}\right)_E = \Sigma\tau = 0 \Rightarrow \boxed{\left(\frac{dL}{dt}\right)_E = 0}$$