$\boxed{\text{Θέμα Α}}$

Α1 α

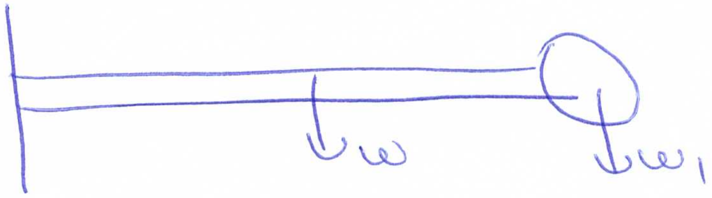
Α2 β.

Α3 α

Α4 δ

Α5 α) Λ
β) Σ
γ) Σ
δ) Λ
ε) Σ

$\boxed{B1}$



$$\Sigma \tau = w \frac{L}{2} + mgL$$

$$\Sigma \tau = Mg\frac{L}{2} + \frac{M}{2}gL.$$

$$\Sigma \tau = MgL \quad (1).$$

$$I_{ox} = \frac{M\ell^2}{3} + m\ell^2 \Rightarrow I_{ox} = \frac{5}{6} m\ell^2.$$

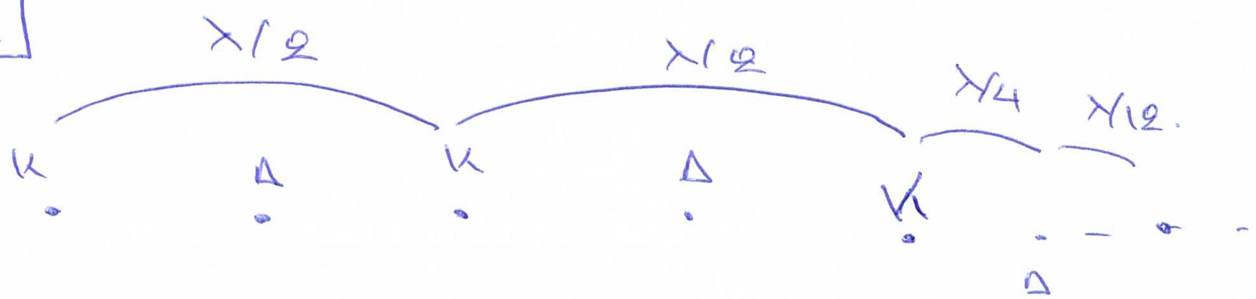
$$\Sigma \tau = I_{ox}\, a_\gamma.$$

$$\cancel{Mg\ell} = \frac{5}{6} ML^2 a_\gamma \Rightarrow a_\gamma = \frac{6g}{5L}.$$

$$\frac{\Delta L_p}{\Delta t} = I_p\, a_\gamma = \frac{ML^2}{3}\,\frac{6g}{5L} = \frac{2}{5} MLg.$$

<u>σωστό το iii</u>

$\boxed{B2}$



$$x = \frac{\lambda}{2} + \frac{\lambda}{2} + \frac{\lambda}{4} + \frac{\lambda}{12} = \frac{12\lambda}{12} + \frac{3\lambda}{12} + \frac{\lambda}{12} =$$

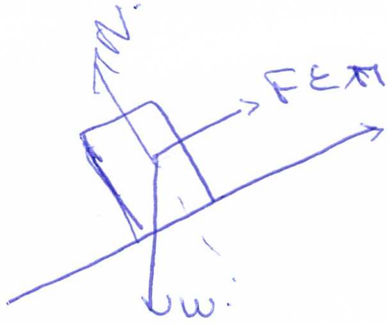
$$= \frac{16\lambda}{12} \Rightarrow x = \frac{4\lambda}{3}$$

$$A' = 2A \text{ συν } \frac{2\pi x}{\lambda} = 2A \text{ συν } \frac{2\pi 4\cancel{\lambda}}{3\cancel{\lambda}} =$$

$$= \left| 2A \text{ συν } \frac{8\pi}{3} \right| = A' = 2A \frac{1}{2} \Rightarrow$$

$$A' = A$$ σωστο το!!!

B3



$$\vec{\Sigma F_2} = \vec{F_{επ}} + \vec{w_{2x}} \Rightarrow \vec{F_{επ}} = \vec{\Sigma F_2} - \vec{w_{2x}}$$

$$\Rightarrow F_{επ} = -D_2\vec{x} + m_2 g\, ημφ. \quad (1)$$

$$F_{επ} = 0 \Rightarrow D_2 x = m_2 g\, ημφ \Rightarrow$$

$$\frac{D_2}{D} = \frac{m_2 \cdot \cancel{ω^2}}{(m_1+m_2)\cancel{ω^2}} \Rightarrow \frac{D_2}{K} = \frac{m_2}{m_1+m_2} \Rightarrow D_2 = \frac{m_2}{m_1+m_2}$$

$$\frac{\cancel{m_2}}{m_1+m_2} Kx = \cancel{m_2} g\, ημφ \Rightarrow$$

$$Kx = (m_1+m_2) g\, ημφ.$$

Για να μην χαθεί η επαφή

$$KA < (m_1+m_2) g\, ημφ. \quad (1)$$

$\boxed{\text{ΘΕΜΑ Γ}}$

$\boxed{\Gamma_1}$ $V = 40V$

$U_E = 8 \cdot 10^{-2}(1 - i^2)$

$E_{o\lambda} = U_E + U_B \Rightarrow U_E = E_{o\lambda} - U_B \Rightarrow$

$U_E = 8 \cdot 10^{-2} - 8 \cdot 10^{-2} i^2$

Δηλαδή $U_E = E_{o\lambda} - \frac{1}{2} L i^2$

Άρα $\frac{1}{2} L i^2 = 8 \cdot 10^{-2} i^2 \Rightarrow L = 16 \cdot 10^{-2} H$

$E_{o\lambda} = 8 \cdot 10^{-2} = \frac{1}{2} L I^2 \Rightarrow I = 1A$

$I = \omega Q \Rightarrow I = \frac{1}{\sqrt{LC}} CV \Rightarrow I^2 = \frac{1}{LC}$

$C = \frac{LI^2}{V^2} \Rightarrow C = \frac{16 \cdot 10^{-2} \cdot 1}{40 \cdot 40} \Rightarrow C = 10^{-4} F$

$T = 2\pi\sqrt{LC} = 2\pi\sqrt{16 \cdot 10^{-2} \cdot 10^{-4}} = 2\pi\sqrt{16 \cdot 10^{-6}}$

$\Rightarrow \boxed{T = 8\pi \cdot 10^{-3} sec}$

$\boxed{\Gamma_2}$ $U_E = E\,\sigma\upsilon\nu^2(\omega t) = E\,\sigma\upsilon\nu^2\left(\frac{2\pi}{T} \cdot \frac{T}{12}\right) = E\,\sigma\upsilon\nu^2\frac{\pi}{6}$

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

$\boxed{\Gamma_3}$ $U_E + U_B = E$ $\quad U_E = 3U_B$ ή $U_B = \frac{U_E}{3}$

$$U_E + \frac{U_E}{3} = E \;\acute{\eta}\; \frac{4U_E}{3} = E \Rightarrow 4U_E = 3E \Rightarrow$$

$$\Rightarrow 4\frac{q^2}{2C} = 3E \Rightarrow q = \pm\sqrt{\frac{6CE}{4}} = \pm 2\sqrt{3}\cdot 10^{-3} C$$

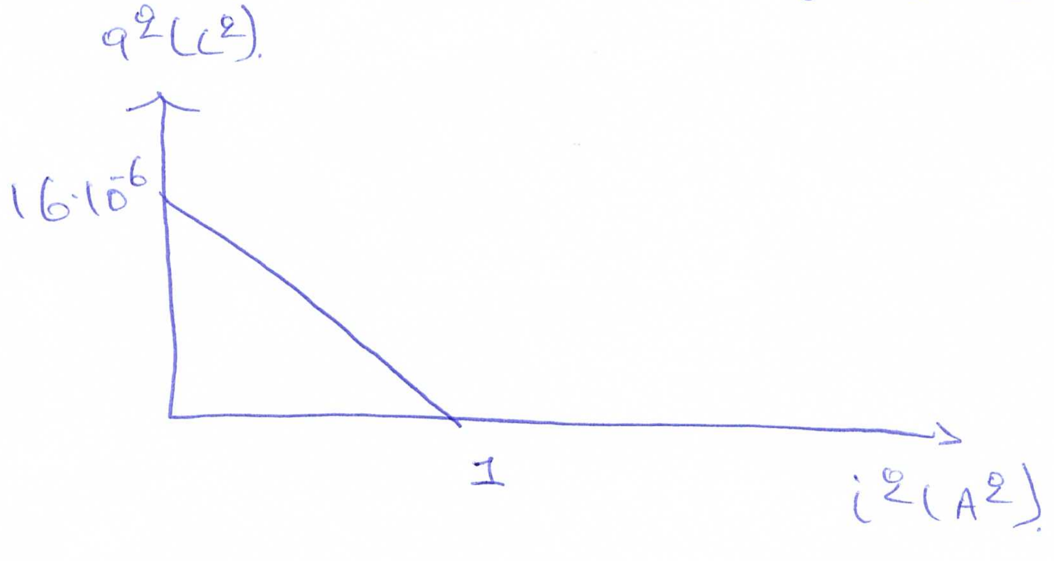
$$V_L = V_C \Rightarrow -L\frac{di}{dt} = \frac{q}{C} \Rightarrow \left|\frac{di}{dt}\right| = \frac{|q|}{LC}$$

$$\left|\frac{di}{dt}\right| = 125\sqrt{3}\ A/s.$$

$\boxed{\Gamma 4.}$ $$E = \frac{q^2}{2C} + \frac{1}{2}Li^2 \Rightarrow \frac{q^2}{2C} = E - \frac{Li^2}{2}.$$

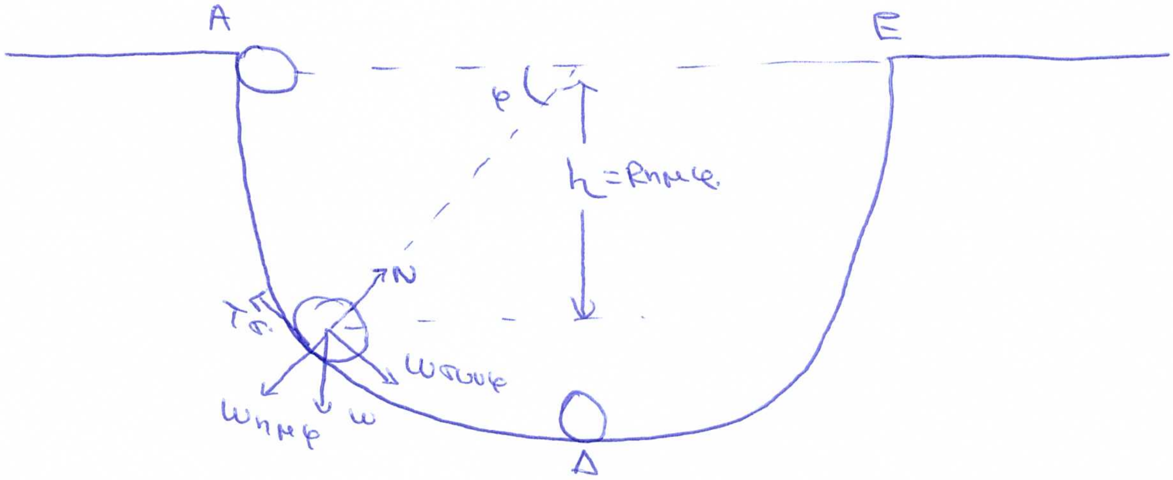
$$q^2 = 2CE - CLi^2.$$

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



ΘΕΜΑ Δ

Δ1



Θέση Γ

$\Sigma\tau = I\alpha_\gamma \Rightarrow T_s \cdot r = \frac{2}{5} m r^2 \alpha_\gamma \Rightarrow T_\sigma = \frac{2}{5} m \alpha_{cm}$ (1)

$\Sigma F_x = m\alpha_{cm} \Rightarrow w\,\sigma\upsilon\nu\varphi - T_\sigma = m\alpha_{cm}$ (2)

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

$\alpha_{cm} = \frac{5g\,\sigma\upsilon\nu\varphi}{7}$ (3)

$(1) \xrightarrow{(3)} T_s = \frac{2}{5} m \frac{5g\,\sigma\upsilon\nu\varphi}{7} \Rightarrow T_\sigma = \frac{2mg\,\sigma\upsilon\nu\varphi}{7}$ (4) $\Rightarrow$

$\Rightarrow T_\sigma = \frac{2 \cdot 1{,}4 \cdot 10 \cdot \sigma\upsilon\nu\varphi}{7} \Rightarrow \boxed{T_\sigma = 4\,\sigma\upsilon\nu\varphi}$ S.I

Δ2

$\Sigma F_\varphi = F_{\kappa\varepsilon\nu} \Rightarrow N - mg\,\eta\mu\varphi = m\frac{\upsilon_\Gamma^2}{R} \Rightarrow N = mg\,\eta\mu\varphi + \frac{m\upsilon_\Gamma^2}{R}$ (5)

ΑΔΜΕ: $E^{(A)}_{\mu\eta\chi} = E^{(\Gamma)}_{\mu\eta\chi} \Rightarrow 0 = -mgh + \frac{1}{2} m \upsilon_\Gamma^2 + \frac{1}{2} I \omega_\Gamma^2 \Rightarrow$
(Α)→(Γ)

$\Rightarrow 0 = -mgR\,\eta\mu\varphi + \frac{1}{2} m \upsilon_\Gamma^2 + \frac{1}{2} \frac{2}{5} m r^2 \omega_\Gamma^2 \Rightarrow$

$\Rightarrow 0 = -mgR\,\eta\mu\varphi + \frac{7}{10} m \upsilon_\Gamma^2$

$\Rightarrow \upsilon_\Gamma = \sqrt{\frac{10gR\,\eta\mu\varphi}{7}} \Rightarrow \upsilon_\Gamma = \sqrt{\frac{80}{7}}$ m/s

$(5) \Rightarrow N = 7 + 10 \Rightarrow \boxed{N = 17\,N}$

Δ3. ΑΔΜΕ: $E^{(A)}_{\mu\eta\chi} = E^{(E)}_{\mu\eta\chi} \Rightarrow$

$\Rightarrow \frac{1}{2} m u^2 + \frac{1}{2} I \omega^2 - mg(R-r) = \frac{1}{2} m u_E^2 + \frac{1}{2} I \omega^2 + 0$

$\Rightarrow \frac{1}{2} m u^2 + \frac{1}{2}\frac{2}{5} m r^2 \omega^2 - mg(R-r) = \frac{1}{2} m u_E^2 + \frac{1}{2}\frac{2}{5} m r^2 \omega_E^2$

$\Rightarrow \frac{7}{10} \cancel{m} u^2 - \cancel{m} g(R-r) = \frac{7}{10} \cancel{m} u_E^2$

$\Rightarrow u^2 - \frac{10 g (R-r)}{7} = u_E^2 \Rightarrow$

$\Rightarrow u_E = \sqrt{u^2 - \frac{10 g (R-r)}{7}} = \sqrt{36 - \frac{10 \cdot 10 (1{,}6 - 0{,}2)}{7}} = \sqrt{16} = 4\,m/s$

$\omega_E = \frac{u_r}{r} = \frac{4}{0{,}2} \Rightarrow \omega_E = 20\,r/s$

ΑΔΜΕ (Ε)→(Ζ) $E^{E}_{\mu\eta\chi} = E^{Z}_{\mu\eta\chi} \Rightarrow 0 + \frac{1}{2} m u_E^2 + \cancel{\frac{1}{2} I \omega_E^2} =$

$= mgh_{max} + 0 + \cancel{\frac{1}{2} I \omega_E^2}$

$\Rightarrow h_{max} = \frac{u_E^2}{2g} = \frac{16}{20} \Rightarrow \boxed{h_{max} = 0{,}8\,m}$

Δ4 $\left(\frac{dK}{dt}\right)_E = \left(\frac{dW}{dt}\right)_E = \Sigma F \cdot u_E \Rightarrow \left(\frac{dK}{dt}\right)_E = -mg u_E \Rightarrow$

$\Rightarrow \left(\frac{dK}{dt}\right)_E = -1{,}4 \cdot 10 \cdot 4 \Rightarrow \frac{dK}{dt} = -56\,J/s$

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