Απαντήσεις - Λύσεις
Θεμάτων
Φυσικής
2026

Θέμα Α

Α1. δ

Α2. β

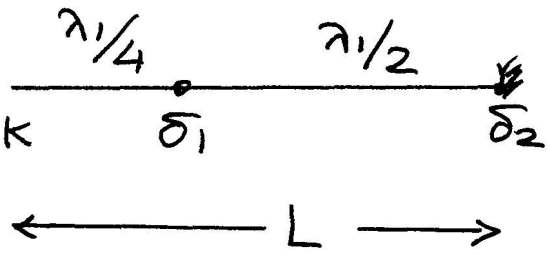
Α3. α

Α4. γ

Α5. α) Σ
β) Σ
γ) Λ
δ) Λ
ε) Σ

Θέμα Β

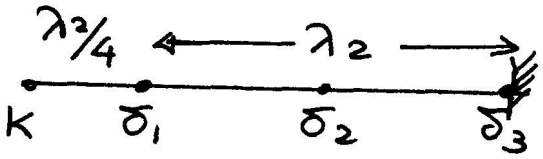
Β1)(iii) Αρχικά



$$L = \frac{\lambda_1}{4} + \frac{\lambda_1}{2} \Rightarrow$$

$$\Longrightarrow L = \frac{3\lambda_1}{4} \quad (1)$$

Τελικά



$$L = \frac{\lambda_2}{4} + \lambda_2 =$$

$$= \frac{5\lambda_2}{4} \quad (2)$$

$$(1),\ (2) \Longrightarrow \frac{3\lambda_1}{4} = \frac{5\lambda_2}{4} \longrightarrow \frac{\lambda_2}{\lambda_1} = \frac{3}{5} \longrightarrow$$

$$\longrightarrow \frac{v \cdot T_2}{v \cdot T_1} = \frac{3}{5} \quad \eta \quad \underline{\frac{T_1}{T_2} = \frac{5}{3}} \ (iii)$$

Β2)(i) Αρχικά,

$$F_1 = \frac{\mu_0}{4\pi} \frac{2 \cdot I \cdot 2I}{r} \cdot \ell \Rightarrow F_1 = \frac{\mu_0}{4\pi} \frac{4I^2\ell}{r} \quad (1)$$

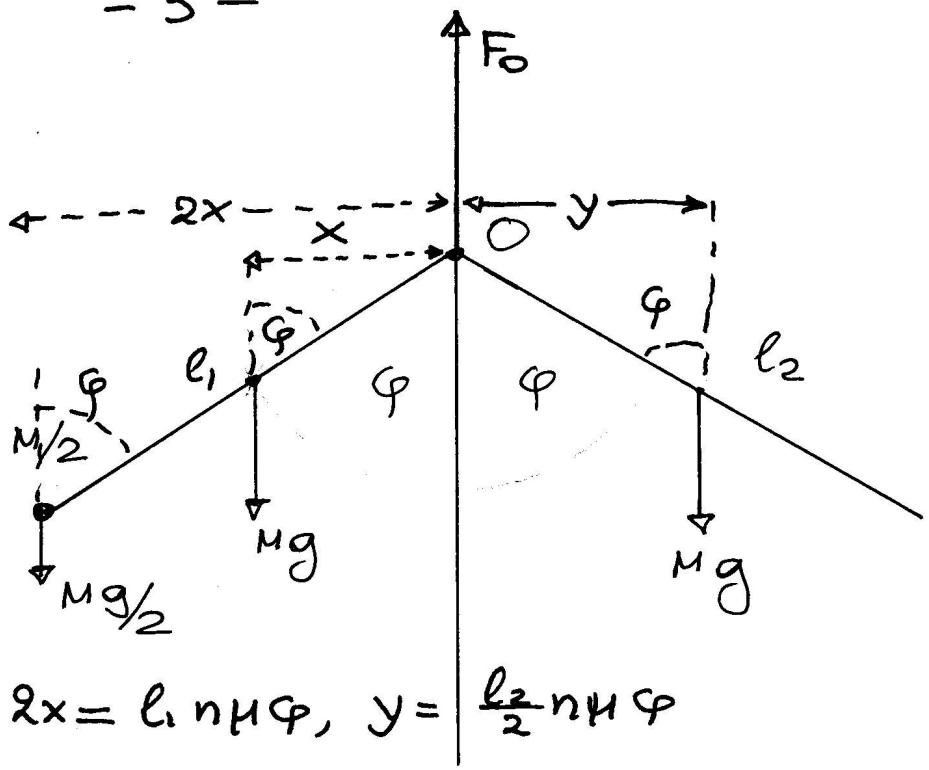
Τελικά

$$F_2 = \frac{\mu_0}{4\pi} \frac{2 \cdot I \cdot 4I}{r + r/2} \ell \Longrightarrow F_2 = \frac{\mu_0}{4\pi} \frac{8I^2\ell}{3r/2} \longrightarrow$$

$$\longrightarrow F_2 = \frac{\mu_0}{4\pi} \frac{16I^2\ell}{3r} \quad (2)$$

$$(1) \div (2) \Longrightarrow \underline{\frac{F_1}{F_2} = \frac{3}{4}} \ (i)$$

B3) (ii)



Σύστημα ισορροπεί,

$\Sigma\tau_O = 0$

Μοχλοβραχίονες:

$x = \frac{l_1}{2}\eta\mu\varphi$, $2x = l_1\eta\mu\varphi$, $y = \frac{l_2}{2}\eta\mu\varphi$

$\Sigma\tau_O = 0 \overset{(+)}{\Longrightarrow} \frac{Mg}{2}\cdot l_1\eta\mu\varphi + Mg\frac{l_1}{2}\eta\mu\varphi -$

$- Mg\frac{l_2}{2}\eta\mu\varphi = 0 \Longrightarrow Mgl_1\eta\mu\varphi = Mg\frac{l_2}{2}\eta\mu\varphi$

$\eta\mu\varphi \neq 0 \Longrightarrow \frac{l_1}{l_2} = \frac{1}{2}$ (ii)

Θέμα Γ

$\lambda = 8\lambda_c$, $\lambda_c = \frac{h}{mc}$

Γ1) $\lambda' - \lambda = \lambda_c (1 - (-1)) \Rightarrow \lambda' = 8\lambda_c + 2\lambda_c \Rightarrow$

$\Rightarrow \lambda' = 10\lambda_c \Rightarrow \lambda' = 10 \frac{h}{m_e c} \Rightarrow \lambda' = 10 \frac{hc}{m_e c^2} \Rightarrow$

$\Rightarrow \lambda' = 10 \cdot \frac{1200\, eV \cdot nm}{5 \cdot 10^5 eV} \Rightarrow \lambda' = 240 \cdot 10^{-4} nm \Rightarrow$

$\Rightarrow \underline{\lambda' = 24 \cdot 10^{-12} m \text{ ή } 24\, pm} \quad (1)$

Γ2) $E = \frac{hc}{\lambda} \Rightarrow E = \frac{hc}{8\lambda_c} \Rightarrow E = \frac{hc}{8\, h/mc} \Rightarrow E = \frac{mc^2}{8}$ (2)

Και $E' = \frac{hc}{\lambda'} \Rightarrow E' = \frac{hc}{10\lambda_c} \Rightarrow E' = \frac{mc^2}{10}$ (3)

Α.Δ.Ενέργειας, Compton, $K = E - E' \Rightarrow$

$\Rightarrow K = \frac{mc^2}{8} - \frac{mc^2}{10} \Rightarrow K = \frac{2mc^2}{80} = \frac{mc^2}{40} \Rightarrow$

$\Rightarrow K = \frac{5 \cdot 10^5 eV}{40} \Rightarrow \underline{K = \frac{1}{8} \cdot 10^5 eV} \quad (4) \Rightarrow$

$\Rightarrow K = \frac{1}{8} \cdot 1,6 \cdot 10^{-19} J \cdot 10^5 \Rightarrow K = 0,2 \cdot 10^{-14} \Rightarrow$

$\Rightarrow \underline{K = 2 \cdot 10^{-15} J} \quad (5)$

Γ3) Πρέπει $K_{max} \geq 0 \Rightarrow hf - \varphi \geq 0 \Rightarrow f \geq \frac{\varphi}{h}$

άρα $f_0 = \frac{\varphi}{h} \Rightarrow f_0 = \frac{1,4 \cdot 1,6 \cdot 10^{-19}}{6,4 \cdot 10^{-34}} \Rightarrow f_0 = 0,35 \cdot 10^{15}$

ή $\underline{f_0 = 3,5 \cdot 10^{14} Hz} \quad (6)$

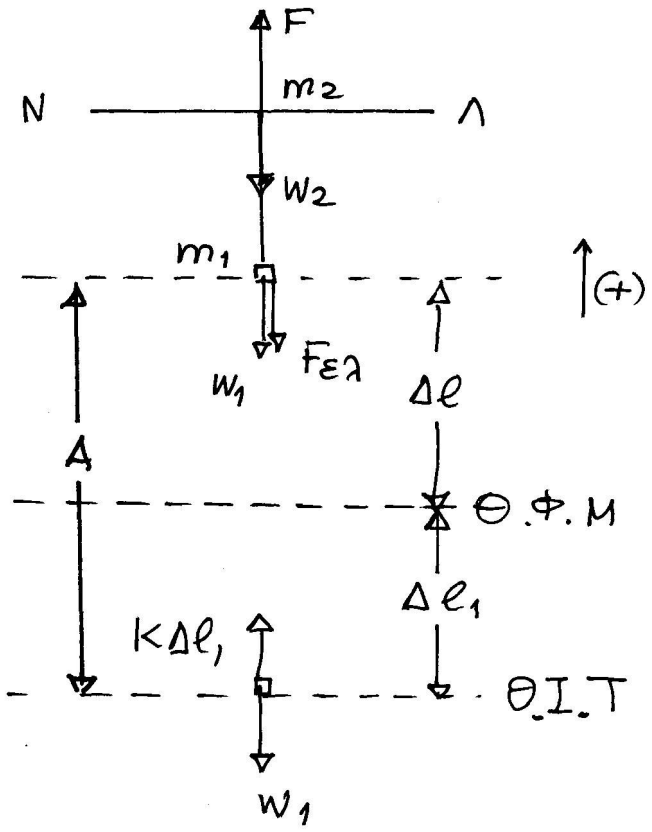
Γ4) $\left.\begin{array}{l} K_{max} = h\frac{c}{\lambda_1} - \varphi \\ \text{και } K_{max} = eV_0 \end{array}\right\} V_0 = \frac{hc}{e\lambda_1} - \frac{\varphi}{e} \Rightarrow$

$$\Longrightarrow V_o = \frac{1200\,eV.nm}{e.400nm} - \frac{1,4eV}{e} \Longrightarrow V_o = 3 - 1,4 \Longrightarrow$$

$$\Longrightarrow \underline{V_o = 1,6\ Volt} \quad (7)$$

Θέμα Δ

Δ1. Σύστημα αγωγός + Σ,



$\Sigma F_y = 0 \xrightarrow{\uparrow +} F-(m_1+m_2)g - K\Delta\ell = 0 \Rightarrow$

$\Rightarrow \Delta\ell = \frac{F-(m_1+m_2)g}{K} \Rightarrow$

$\Rightarrow \Delta\ell = \frac{3-2}{10} \Rightarrow$

$\Rightarrow \underline{\Delta\ell = 0,1m}$ (1)

Μελέτη Θ.Ι.Τ. $\Sigma F = 0 \Rightarrow \Delta\ell_1 = \frac{m_1 g}{K} \Rightarrow \underline{\Delta\ell_1 = 0,1m}$ (2)

Επειδή $v_0 = 0$, $\underline{A = \Delta\ell + \Delta\ell_1 = 0,2m}$ (3)

$\omega_0 = \sqrt{\frac{K}{m}} = 10 rad/s$ (4), $t_0 = 0$, $x = +A \Rightarrow \varphi_0 = \pi/2$ (rad)

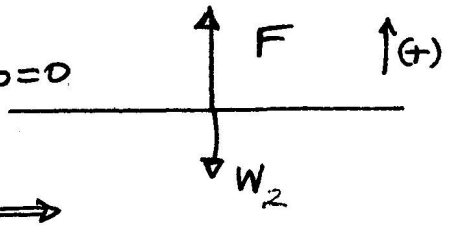
$\underline{x(t) = 0,2\eta\mu(10t + \pi/2)\ (S.I)}$

Δ2) $K = \frac{3}{4}E \Rightarrow$ Α.Δ.Ε.Τ. $U = \frac{E}{4} \Rightarrow$

$\Rightarrow |x| = \frac{A}{2} \Rightarrow |x| = 0,1m$ (6)

$|a| = |-\omega^2 x| \Rightarrow |a| = 10\ m/s^2$ (Θ.Φ.Μ. η μια θέση, η $x = +0,1m$)

Δ3) $t_0=0$,



$\Sigma F = m_2 a_0 \rightarrow a_0 = \frac{F - m_2 g}{m_2} \Rightarrow$

$\Rightarrow a_0 = \frac{3-1}{0,1} = 20 m/s^2 (\nearrow)$ ο αγωγός αρχίζει να επιταχύνεται προς τα πάνω:

Τυχαία t,

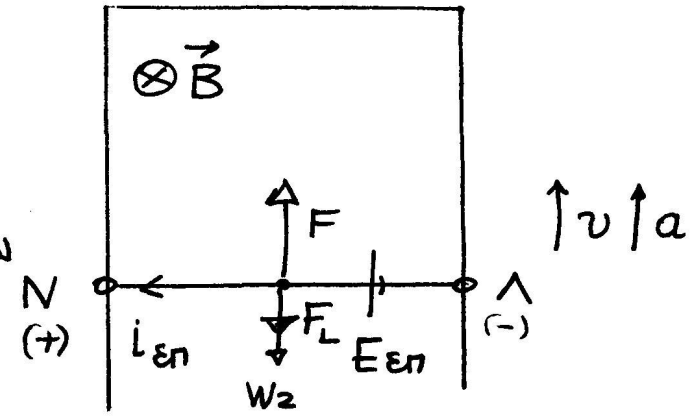
$\Sigma F = ma \Rightarrow$

$F - F_L - m_2 g = m_2 a$

$F_L = B i_{επ} \ell$

$i_{επ} = \frac{B v \ell}{R_{ολ}}$

$\Rightarrow$



$\Rightarrow F - \frac{B^2 \ell^2 v}{R_{ολ}} - mg = ma \Rightarrow a = \frac{F - m_2 g}{m_2} - \frac{B^2 \ell^2}{m_2 R_{ολ}} v$

$\Rightarrow a(v) = 20 - \frac{1}{0,2} v \Rightarrow \underline{a(v) = 20 - 5v \ (S.I) \ (8)}$

Αγωγός επιταχύνεται $\Rightarrow v \uparrow \Rightarrow a \downarrow$, μη ομαλά επιταχυνόμενη με φθίνουσα α μέχρι τη στιγμή που $a=0 \Rightarrow \underline{v_{op} = 4 m/s \ (9)}$

Δ4) $h = v_{op} \cdot \Delta t \Rightarrow h = 4 \cdot \frac{1}{8} \Rightarrow \underline{h = \frac{1}{2} m \ (10)}$

$Q_J = I_{επ}^2 R_{ολ} \Delta t$ με $I_{επ} = σταθ = \frac{B v_{op} \ell}{R_{ολ}} = \frac{4}{2} = 2A$

οπότε, $\underline{Q_J = 4 \cdot 2 \cdot \frac{1}{8} = 1 J \ (11)}$

$$\Pi = \frac{Q_J}{W_F} \cdot 100 = \frac{Q_J}{F \cdot h} \cdot 100 = \frac{1}{3 \cdot 1/2} \cdot 100 \Rightarrow$$

$$\Longrightarrow \underline{\Pi = \frac{200}{3}\%} \quad (12)$$

(Εναλλακτικά, $Q_J = |W_{FL}|$ με απόδειξη,

$$Q_J = |-F_L \cdot h| = \frac{B^2 \ell^2}{R_{ολ}} v_{ορ} \cdot h =$$

$$= \frac{1^2 \cdot 1^2}{2} \cdot 4 \cdot \frac{1}{2} = 1\,J)$$