ΘΕΜΑ Α

Α1 δ Α2 γ Α3 γ Α4 β Α5 ΣΛΣΣΛ

ΘΕΜ Β

Β1. $\lambda_{2\,max} = \frac{\lambda_{1\,max}}{2}$ $\quad \lambda_{1\,max} = 3\cdot10^{-7}\ m$

$f_1 = 10^{15}\ Hz.$

$U_1 = U_2 \Rightarrow \lambda_{1\,max} f_1 = \lambda_{2\,max} f_2 \Rightarrow f_2 = 2\cdot10^{15}\ Hz.$

$$\varphi_2 = 2\pi\left(2\cdot10^{15}t - \frac{x}{\frac{3}{2}\cdot10^{-7}}\right)$$

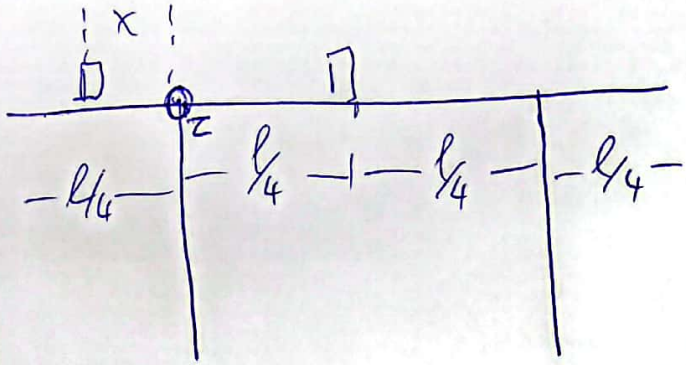
Β2. $L_2 = 5L_1 \Rightarrow mU_2\frac{mU_2}{B|q|} = 5mU_1\frac{mU_1}{B|q|} \Rightarrow U_2 = \sqrt{5}\,U_1$

$$K_2 = \frac{hc}{\lambda_2} - \phi$$
$$K_1 = \frac{hc}{\lambda_1} - \phi$$
$$\Rightarrow \frac{\frac{1}{2}mU_2^2}{\frac{1}{2}mU_1^2} = \frac{\frac{hc}{\lambda_2} - \phi}{\frac{hc}{\lambda_1} - \phi} \Rightarrow 5\frac{hc}{\lambda_1} - 5\phi = \frac{2hc}{\lambda_1} - \phi$$

$$\frac{3hc}{\lambda_1} = 4\phi \Rightarrow \phi = \frac{3hc}{4\lambda_1} = \frac{3\cdot1250}{4\cdot375}\,eV = \frac{3\cdot1250\,eV}{1500} = 2{,}5\,eV$$

Άρα Βαρίο

Β3.



$\Sigma\tau_{(z)} = 0 \Rightarrow mgx = Mg\frac{l}{4} \Rightarrow$

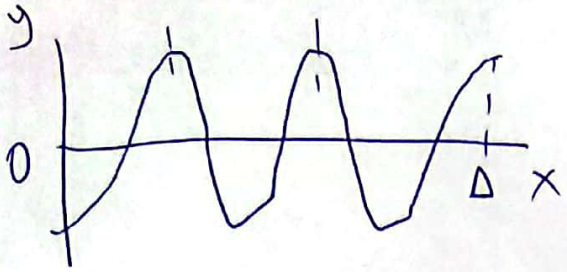
$mx = \frac{m}{2}\frac{l}{4} \Rightarrow x = \frac{l}{8}$

Άρα $S_\Sigma = \frac{l}{4} + \frac{l}{8} = \frac{3l}{8}$

$$\frac{x_{cm}}{S_\Sigma} = \frac{U_{cm}\,t}{U_\Sigma\cdot t} = \frac{U_{cm}}{2U_{cm}} = \frac{1}{2} \Rightarrow x_{cm} = \frac{3l}{16}$$

ΘΕΜΑ Γ

Γ1. $f = \frac{N}{\Delta t} = \frac{1}{2}\,Hz \rightarrow T = 2\,s$



$x_\Delta = 2{,}5\lambda \Rightarrow \lambda = 1\,m$

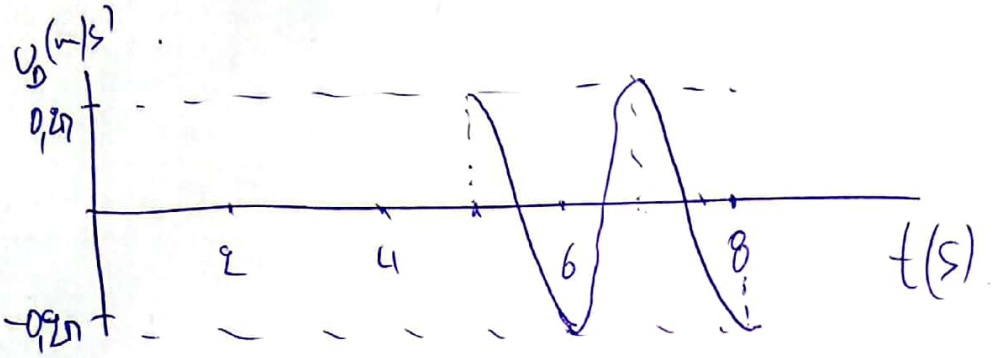
$v = \lambda f = \frac{1}{2}\,m/s$

$S = 10A \Rightarrow A = 0{,}2\,m$

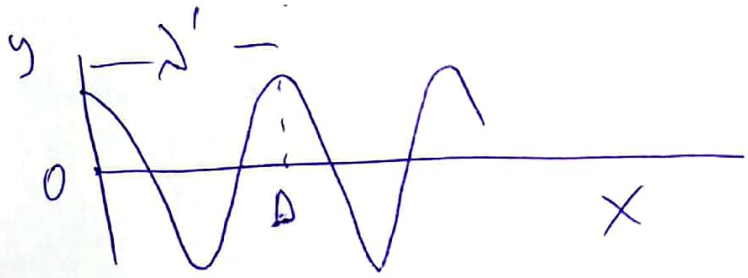
Γ2. $y_\Delta = A\eta\mu\omega(t - t_\Delta) = A\eta\mu\frac{2\pi}{T}\left(t - \frac{x_\Delta}{v}\right) = A\eta\mu 2\pi\left(\frac{t}{T} - \frac{x_\Delta}{\lambda}\right)$

Γ3. $y_\Delta = 0{,}2\eta\mu 2\pi\left(\frac{t}{2} - 2{,}5\right)$ SI

$v_\Delta = 0{,}2\pi\,\sigma\upsilon\nu 2\pi\left(\frac{t}{2} - 2{,}5\right)$ SI. για $t \geq 5\,s$



Γ4



Θα έχουμε $\lambda' = x_\Delta = 2{,}5\,m \Rightarrow \frac{v}{f'} = 2{,}5\,m \Rightarrow$

$f' = 0{,}2\,Hz \quad \Delta f = f' - f = -0{,}3\,Hz$

Μείωση $|\Delta f| = 0{,}3\,Hz.$

ΘΕΜΑ Δ

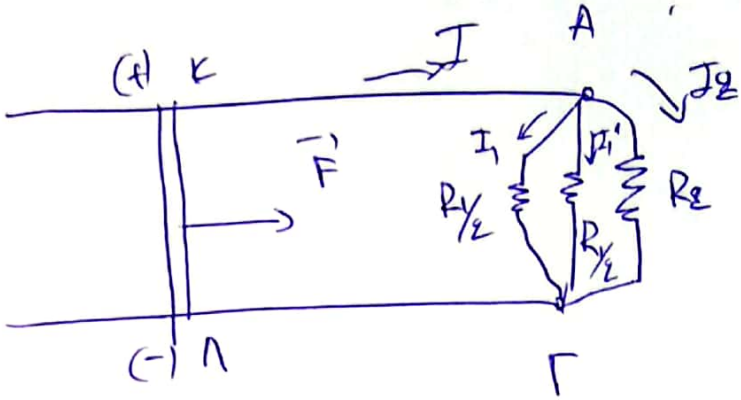
Δ1. α. $\Sigma F_\varepsilon = M_\varepsilon a \Rightarrow F_\varepsilon = M_\varepsilon \cdot (-\omega^2 x) \xrightarrow{F_\varepsilon = 0} x = 0$

Άρα στη Θ.Φ.Μ.

β. Ισχύει $U_{max(1)} = U_{max(2)} \Rightarrow A\sqrt{\frac{k}{M_\varepsilon + m}} = \sqrt{\frac{k}{m}} A'$

$A' = \sqrt{\frac{m}{M_\varepsilon + m}} \cdot A \Rightarrow A' = \frac{A}{2} = 0,2\,m$ $\quad (A = \Delta\ell = 0,4\,m)$

Δ2.



Κ(+) Λ(−)

Δ3. $a = \frac{F}{M_\varepsilon} = 2,5\ m/s^2$ $\quad U = U_{max} + a\Delta t = 1 + 5 = 6\ m/s$

Δ4. α. $I = \frac{BU\ell}{R_{\Sigma}} = 3A$ $\quad \frac{1}{R_\Sigma} = \frac{1}{R_1/2} + \frac{1}{R_1/2} + \frac{1}{R_2} \Rightarrow R_\Sigma = 2\Omega$

$F_L = BI\ell = 3N$

Άρα $\Sigma F = 0$ οπότε $U = \sigma\tau\alpha\theta$

β. $I_1 = I_1'$ $\quad V_{R_2} = V_{R_1} \Rightarrow I_2 R_2 = I_1 \cdot \frac{R_1}{2} \Rightarrow I_1 = 2I_2$

$I = I_1 + I_1' + I_2 = I_1 + I_1 + \frac{I_1}{2} \Rightarrow 3 = 2,5 I_1 \Rightarrow I_1 = 1,2\,A$

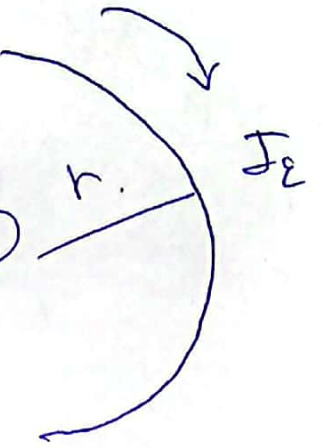
Άρα $I_1 = I_1' = 1,2\,A$ και $I_2 = 0,6\,A$

Δ6 α.

$$B_2 = \Sigma \frac{\mu_0}{4\pi} \frac{I_2 \eta\mu 90}{r^2} \Delta l =$$

$$= \frac{\mu_0}{4\pi} \cdot \frac{I_2 \cdot 1}{r^2} \cdot \pi r = \frac{\mu_0 I_2}{4 \frac{1}{2}} =$$

$$= \frac{\mu_0 I_2}{2L} = 1{,}2\pi \cdot 10^{-7}\ T$$



β. Στον κυκλικό αγωγό λόγω συμμετρίας

$B_1 = 0$

Άρα $B_{ολ} = B_2 = 1{,}2\pi \cdot 10^{-7}\ T$ ⊗