ΘΕΜΑ Α

Α1 δ

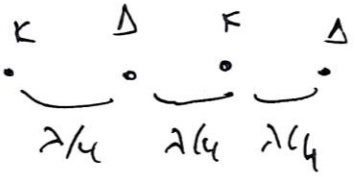
Α2 β

Α3 α

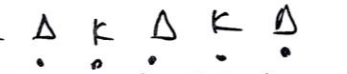
Α4 γ

Α5 Σ, Σ, Λ, Λ, Σ

ΘΕΜΑ Β

Β1 : με περίοδο T_1 έχω 

$L = \frac{3\lambda}{4}$

με περίοδο T_2 έχω 

$L = \frac{5\lambda'}{4}$

αφού το L παραμένει σταθερό $\frac{3\lambda}{4} = \frac{5\lambda'}{4} \Rightarrow$

$$\frac{3\beta \cdot T_1}{4} = \frac{5\beta T_2}{4} \Rightarrow \frac{T_1}{T_2} = \frac{5}{3} \quad (iii)$$

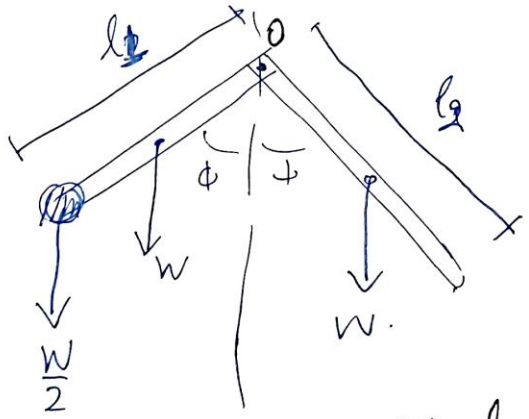
(B2) $\frac{F_1}{\ell} = \frac{\mu_0}{4\pi} \frac{2I_1 I_2}{r}$

$\frac{F_2}{\ell} = \frac{\mu_0}{4\pi} \frac{2I_1 I_2'}{r'}$

$\Rightarrow \frac{F_1/\ell}{F_2/\ell} = \frac{r' \cdot I_2}{r \cdot I_2'} \Rightarrow$

$\Rightarrow \frac{F_1/\ell}{F_2/\ell} = \frac{(r+\frac{r}{2}) \cdot I_2}{r\, 2I_2} \Rightarrow \frac{F_1/\ell}{F_2/\ell} = \frac{3}{4}$ (i)

(B3)



Αφού η ράβδος ισορροπεί $\Sigma\tau_O = 0$.

$W\frac{l_2}{2}\eta\mu\phi = W\frac{l_1}{2}\eta\mu\phi + \frac{W}{2} l_1 \eta\mu\phi \Rightarrow$

$\Rightarrow l_2 = 2l_1 \Rightarrow \frac{l_1}{l_2} = \frac{1}{2}$ (ii)

ΘΕΜΑ Γ

Γ1) $\lambda' - \lambda = \lambda_c (1 - \sigma\upsilon\nu\theta) \Rightarrow \lambda' = \lambda + \lambda_c (1 - \sigma\upsilon\nu 180)$

$\Rightarrow \lambda' = 8\lambda_c + 2\lambda_c \Rightarrow \lambda' = 10\lambda_c \Rightarrow \lambda' = 10 \frac{h}{m_e c}$

Γ2) $E_\phi = hf = \frac{hc}{\lambda} = \frac{hc}{8\lambda_c} = \frac{\cancel{h}c\, m_e c}{8\cancel{h}} \Rightarrow$

$E_\phi = \frac{m_e c^2}{8}$

$E_\phi' = hf' = \frac{hc}{\lambda'} = \frac{hc}{10\lambda_c} = \frac{\cancel{h}c\, m_e c}{10\cancel{h}} \Rightarrow$

$E_\phi' = \frac{m_e c^2}{10}$

$K_e = E_\phi - E_\phi' = \frac{m_e c^2}{8} - \frac{m_e c^2}{10} = \frac{m_e c^2}{40} \Rightarrow$

$K_e = \frac{5 \cdot 10^5}{40} \Rightarrow K_e = 12500\, eV$

Γ3 Από την εξίσωση του Einstein

$$E_\phi = K_e + \phi \xrightarrow[\text{για } K_e=0]{f_0} hf_0 = \phi \Rightarrow$$

$$f_0 = \frac{\phi}{h} \quad \text{και εδώ} \quad f_0 = \frac{1,4 \cdot 1,6 \cdot 10^{-19}}{6,4 \cdot 10^{-34}}$$

$$f_0 = 3,5 \cdot 10^{14} \text{ Hz}$$

Γ4 $$E_\phi = \frac{hc}{\lambda_1} = \frac{1200}{400} = 3\text{eV} \quad . \text{Άρα}$$

$$K_e = E_\phi - \phi = 3 - 1,4 = 1,6\text{eV} \quad .$$

Για τον υπολογισμό της V_0 δουλεύω με θεώρημα

$$\underbrace{K_{τελ}}_{0} - K_{αρχ} = W_{ολ} \Rightarrow -1,6 = e V_0 \Rightarrow V_0 = 1,6\text{ V} \quad .$$

[$V_0 = -1,6$ V στην πραγματικότητα].

Δ1

$x = A\eta\mu(\omega t + \varphi_0)$ $\quad \varphi_0 = \frac{\pi}{2}$ $\quad \omega = \sqrt{\frac{k}{0,1}} = 10\,r/s$.

Fλ.

$\Sigma F = 0 \Rightarrow T_v = w_1 + F_{\epsilon\lambda} \Rightarrow k\Delta\ell = T_v - w_1$

όμως στη ράβδο

$\Sigma F = 0 \Rightarrow m_2 g + T_v' = F \Rightarrow T_v' = F - m_2 g$

$\Rightarrow T_v' = 3 - 1 = 2N$

Άρα $10 \cdot \Delta\ell = 2 - 1 \Rightarrow \Delta\ell = 0,1\,m.$

(πάνω από το σώμα) Αφετηία θέση.

Κόβω το νήμα $\Sigma F = 0 \Rightarrow m_1 g = k\xi \Rightarrow \xi = \frac{m_1 g}{k}$

$\xi = \frac{1}{10} = 0,1\,m.$ κάτω από το σώμα.

$A = 0,1 + 0,1 = 0,2m$

$x = 0,2\,\eta\mu\left(10t + \frac{\pi}{2}\right)$ (SI)

$\frac{K_{0}}{E} = \frac{3}{4} \Rightarrow K = \frac{3}{4} E_{ολ} \Rightarrow U = \frac{1}{4} E_{ολ} \Rightarrow \frac{1}{2} D x^2 = \frac{1}{4}\frac{1}{2} D A^2$

$x = \pm \frac{A}{2} \Rightarrow |a| = \left|-\omega^2 \frac{A}{2}\right| = 10 m/s^2.$

Δ3 $F_3 = 3N$. $w = 1N$

Ευθύγραμμη επιταχυνόμενη κίνηση ↑ με $a\downarrow$.

$\Sigma F = 0 \Rightarrow 0 = F - m_2 g - F_L \Rightarrow F_L = 2N$

$BIl = 2N \Rightarrow I = \frac{2}{1 \cdot 1} = 2A.$

$\frac{E_{επ}}{R_{ολ}} = 2 \Rightarrow E_{επ} = 2 \cdot (1+1) = 4V \Rightarrow$

$Bul = 4 \Rightarrow u_{ορ} = 4 m/s.$

Δ4 $h' = u_{ορ} \cdot \Delta t = 4 \cdot 0{,}125 = 0{,}5 m.$

ΘΜΚΕ $K_{τελ} - K_{αρχ} = W_{ολ} \Rightarrow 0 - 0 = -mgh' + W_F$

$-|W_{FL}| \Rightarrow$

(7)

$mgh = 1 \cdot 0,5 = 0,5\,J.$

$W_F = F \cdot 0,5 = 1,5\,J.$

$W_{FL} = 1\,J.$

ni $W_{FL} = F_L \cdot 0,5$

$2 \cdot 0,5 = 1\,J.$

$$\eta\% = \frac{W_{FL}}{W_F} = \frac{1}{1,5} = \frac{2}{3} \cdot 100$$