Θέμα Α

A.1 δ   A.3 α

A.2 γ   A.4 δ

A.5

α. Λ   β. Σ   γ. Σ   δ Σ   ε. Λ

Θέμα Β

B.1 ii

Θ.Φ.Μ → ακραία θέση εφόσον $υ = 0$.

Στη Θ.Ι. $ΣF = 0 \Rightarrow k \cdot Δl_0 = mg \Rightarrow Δl_0 = \frac{mg}{k}$

Άρα $Δl_{max} = 2Δl_0$ (στην κάτω Α.Θ.).

Έτσι $U_{ελ,max} = \frac{1}{2} k Δl_{max}^2 = \frac{1}{2} k\, 4 \frac{m^2 g^2}{k^2} \Rightarrow$

$$U_{ελ,max} = 2 \frac{m^2 g^2}{k}$$

B2 ...

Torricelli → $v_{εκ} = \sqrt{2g(H-h)} = 2\sqrt{2gh}$

εξ. συνέχειας $v_A A_A = v_{εκ} A_{στ} \Rightarrow$

$$v_A = v_{εκ} = 2\sqrt{2gh}$$

B3 ...

Είναι

$$f_B = \frac{v_{ηχ} + v_2}{v_{ηχ} + v_1} f_S = \frac{v_{ηχ} + \frac{v_{ηχ}}{10}}{v_{ηχ} + \frac{v_{ηχ}}{5}} f_S \Rightarrow$$

$$f_B = \frac{\frac{11}{10} v_{ηχ}}{\frac{6}{5} v_{ηχ}} f_S \Rightarrow f_B = \frac{11}{12} f_S$$

Ι

Θέμα Γ

Γ1 Είναι $\Delta t = \frac{T}{2} \Rightarrow T = 2\Delta t = 0{,}8\,s$

$\Delta x = \frac{\lambda}{2} \Rightarrow \lambda = 2\Delta x = 8\,cm$

$E_T = \frac{1}{2} D A^2 = \frac{1}{2} m \left(\frac{2\pi}{T}\right)^2 A^2 \Rightarrow$

$A = \sqrt{\frac{2 E_T \cdot T^2}{4\pi^2 m}} \Rightarrow A = 0{,}4\,m$

Γ2 : Είναι

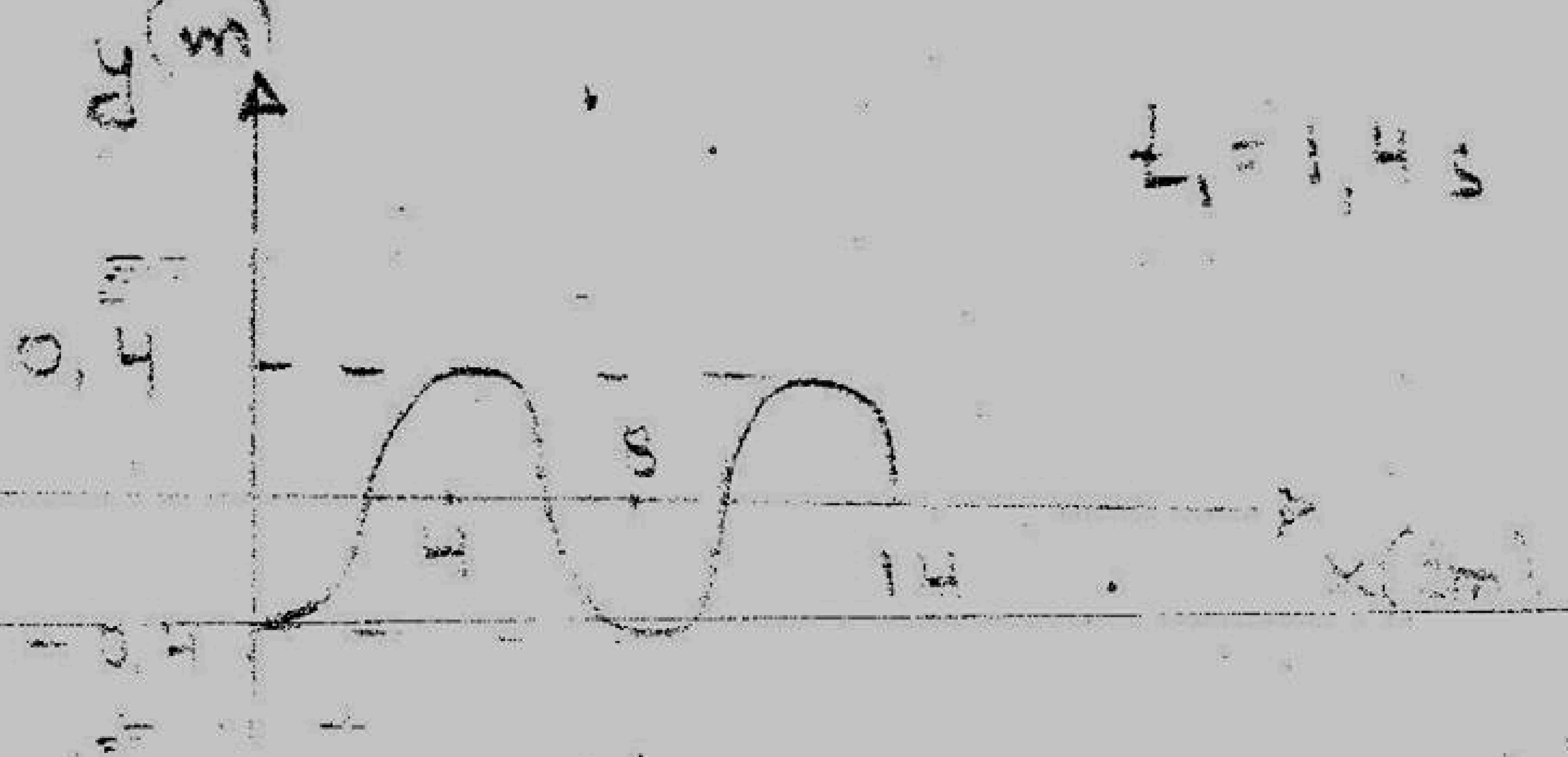
$$y = 0{,}4\,\eta\mu\left[2\pi\left(\frac{t}{0{,}8} - \frac{x}{0{,}08}\right)\right] \; S.I.$$

<u>στιγμιότυπο</u>

$y_{\sigma\tau} = 0{,}4 \cdot \eta\mu\left[2\pi\left(1{,}75 - \frac{x}{0{,}08}\right)\right]$

$x_1 = \upsilon_\delta \cdot t_1 = \frac{\lambda}{T} t_1 = 14\,cm$

$t_1 = 1{,}4\,s$



Γ3 Είναι

$$K = E_T - U = E_T - \frac{1}{2} D \cdot y^2 \Rightarrow$$

$$K = E_T - \frac{1}{2} m \cdot \left(\frac{2\pi}{T}\right)^2 y^2 \Rightarrow$$

$$K = 3,75 \pi^2 \cdot 10^{-7} \, J$$

Γ4 $y_P = A \cdot \eta\mu \varphi_P \Rightarrow \eta\mu \varphi_P = \frac{y_P}{A} = 1 \Rightarrow$

$$\varphi_P = 2k\pi + \frac{\pi}{2}, \quad k \in Z$$

Άρα $\varphi_I = \varphi_P - \frac{3\pi}{2} \Rightarrow \varphi_I = 2k\pi - \pi$

$$v_I = \frac{2\pi}{T} A \, \sigma\upsilon\nu \varphi_I = \frac{2\pi}{T} A \, \sigma\upsilon\nu (2k\pi - \pi) \Rightarrow$$

$$v_I = -\frac{2\pi}{T} A \Rightarrow v_I = -\pi \, m/s$$

Θέμα Δ

Δ.1 · Δίσκος

$$\Sigma F_y = m \cdot a_{cm} \Rightarrow mg - T = m \cdot a_{cm}$$

$$\Sigma \tau_c = I_{cm} \cdot a_\gamma \Rightarrow T \cdot R = \frac{1}{2} m R^2 \cdot a_\gamma \Rightarrow T = \frac{1}{2} m \cdot R \cdot a_\gamma \Bigg\} \Rightarrow$$

οχι ολίσθηση $\rightarrow a_{cm} = a_\gamma \cdot R$

$$mg = \frac{3}{2} m \cdot a_{cm} \Rightarrow a_{cm} = \frac{2g}{3} = \frac{20}{3}\ m/s^2$$

Δ2 $T' = T\ (\delta\rho - \alpha\nu\tau) \Rightarrow T' = m(g - a_{cm}) \Rightarrow T' = \frac{20}{3} N$

Ράβδος

$$\Sigma \tau_\Phi = 0 \Rightarrow Mg\frac{l}{2} + T' l - T_{\Gamma\Delta}\, \eta\mu\varphi \cdot l = 0$$

$$T_{\Gamma\Delta} = \frac{Mg + 2T'}{2 \cdot \eta\mu\varphi} \Rightarrow T_{\Gamma\Delta} = \frac{100}{3} N$$

Δ3 Α.Δ.Μ.Ε (μονάδα δίσκου)

$$mgh_1 = \frac{1}{2} m u_{cm}^2 + \frac{1}{2} I \omega_1^2 \Rightarrow$$

$$mgh_1 = \frac{1}{2} m R^2 \omega_1^2 + \frac{1}{2} m R^2 \omega_1^2 \Rightarrow$$

$$mgh_1 = \frac{3}{4} \omega_1^2 R^2 \Rightarrow \omega_1 = \sqrt{\frac{4gh_1}{3R^2}} \Rightarrow \omega_1 = 20\ rad/s$$

Αρα

$$L = I \cdot \omega_1 = \frac{1}{2} m R^2 \cdot \omega_1 \Rightarrow L = 0,2 \ kg \ m^2/s$$

Δ4. Την $L_1 \rightarrow v_{cm} = \omega_1 \cdot R = 2 \ m/s$

$$\frac{K_\pi}{K_\mu} = \frac{\frac{1}{2} I \cdot \omega_1^2}{\frac{1}{2} m (v_{cm} + g \Delta t')^2} = \frac{\frac{1}{2} R^2 \omega_1^2}{(v_{cm} + g \Delta t')^2} \Rightarrow$$

$$\frac{K_\pi}{K_\mu} = \frac{2}{9}$$