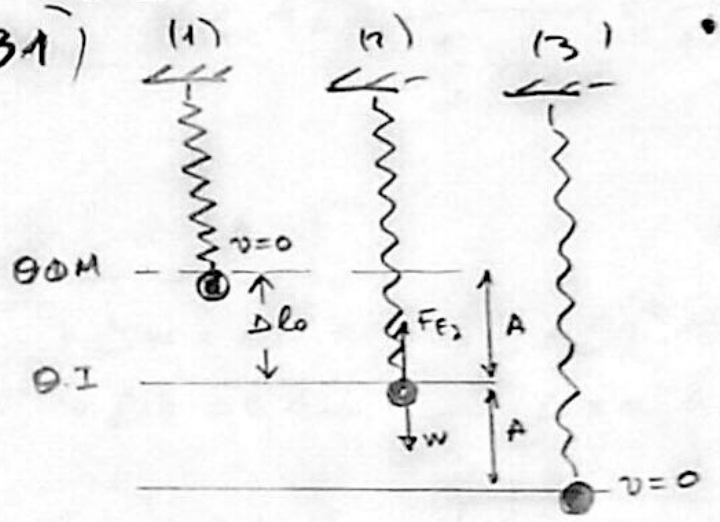
Απαντήσεις Φυσικής 2017.

ΘΕΜΑ Α

Α1) δ , Α2) γ , Α3) α , Α4) δ Α5) Λ, Σ, Σ, Σ, Λ

ΘΕΜΑ Β

Β1)



• Ισορ. (2): $\Sigma F_y = 0 \Rightarrow F_{\varepsilon_2} = w \Rightarrow$

$\Rightarrow k\Delta l_0 = mg \Rightarrow \Delta l_0 = \frac{mg}{k}$

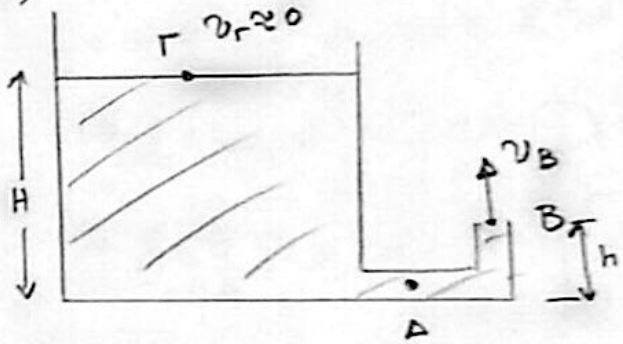
• Είναι $A = \Delta l_0$

• $U_{\varepsilon_2(max)} = \frac{1}{2} k \Delta l_{max}^2$ } $\Rightarrow$

• $\Delta l_{max} = 2A$

$\Rightarrow \boxed{U_{\varepsilon_2(max)} = \frac{2m^2g^2}{k}}$ (ii)

Β.2)



• Από Θεώρημα Torricelli, προκύπτει ότι: $\upsilon_B = \sqrt{2g(H-h)} \Rightarrow$

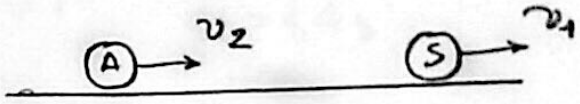
$\Rightarrow \upsilon_B = \sqrt{2g(5h-h)} = \sqrt{2g \cdot 4h} \Rightarrow$

$\Rightarrow \upsilon_B = 2\sqrt{2gh}$ (1)

• Εξίσωση συνέχειας: $A_A \cdot \upsilon_A = A_B \cdot \upsilon_B \Rightarrow \upsilon_A = \upsilon_B \Rightarrow$

$\Rightarrow \boxed{\upsilon_A = 2\sqrt{2gh}}$ (iii)

Β.3)



• Είναι $f_A = \frac{v_{HX} + v_2}{v_{HX} + v_1} f_s = \frac{v_{HX} + \frac{v_{HX}}{10}}{v_{HX} + \frac{v_{HX}}{5}} \cdot f_s \Rightarrow$

$\Rightarrow f_A = \frac{\frac{11}{10} v_{HX}}{\frac{6}{5} v_{HX}} f_s = \frac{5 \cdot 11}{10 \cdot 6} f_s \Rightarrow \boxed{f_A = \frac{11}{12} f_s}$ (ii)

• ΘΕΜΑ Γ

• $\Delta m = 10^{-6} kg$, $E = 5\pi^2 \cdot 10^{-7} J$.

• $\Delta t = 0,4 m \longrightarrow \Delta x = 4 cm$

Γ.1) • $\Delta t = \frac{T}{2} \Rightarrow \boxed{T = 0,8 s}$

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

• $\omega = \frac{2\pi}{T} \Rightarrow \omega = 2,5\pi \, rad/s$

• $D = \Delta m \cdot \omega^2 \Rightarrow D = 6,25\pi^2 \cdot 10^{-6} N/m$

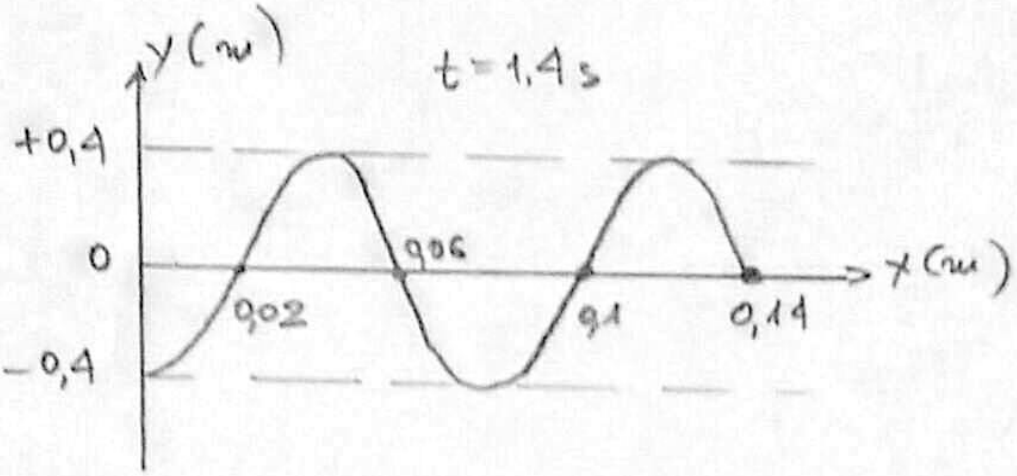
• $E = \frac{1}{2} D A^2 \Rightarrow A = \sqrt{\frac{2E}{D}} \Rightarrow \boxed{A = 0,4 m}$

Γ.2) • $y = A \cdot \eta\mu 2\pi \left(\frac{t}{T} - \frac{x}{\lambda} \right) \Rightarrow \boxed{y = 0,4 \cdot \eta\mu 2\pi (1,25t - 12,5x) \, (SI)}$

• $v_\delta = \frac{\lambda}{T} \Rightarrow v_\delta = 0,1 m/s$

• $x = v_\delta \cdot t \Rightarrow x = 0,14 m$

• $\frac{x}{\lambda} = \frac{7}{4} \Rightarrow x = \frac{7\lambda}{4}$ ή $x = \lambda + \frac{3}{4}\lambda$



Γ.3

ΑΔΕΤ $E = K + U \Rightarrow K = E - U \Rightarrow K = E - \frac{1}{2} D y^2 \Rightarrow$

$\Rightarrow K = 5\pi^2 \cdot 10^{-7} - \frac{1}{2} 6{,}25\pi^2 \cdot 10^{-6} \cdot 4 \cdot 10^{-2} \Rightarrow$

$\Rightarrow K = 5\pi^2 \cdot 10^{-7} - 1{,}25\pi^2 \cdot 10^{-7} \Rightarrow \boxed{K = 3{,}75\pi^2 \cdot 10^{-7}}$

Γ.4

• $\varphi_P - \varphi_Σ = \frac{3\pi}{2}$ rad $\Rightarrow \varphi_Σ = \varphi_P - \frac{3\pi}{2}$ (1)

• $y_P = 0{,}4 \eta\mu\varphi_P \Rightarrow 0{,}4 = 0{,}4 \eta\mu\varphi_P \Rightarrow \eta\mu\varphi_P = 1 = \eta\mu\frac{\pi}{2} \Rightarrow$

$\Rightarrow \varphi_P = 2k\pi + \frac{\pi}{2}$ (2)

(1), (2) $\Rightarrow \varphi_Σ = 2k\pi + \frac{\pi}{2} - \frac{3\pi}{2} \Rightarrow \varphi_Σ = 2k\pi - \pi$ (3)

• $v_Σ = \omega A \cdot \sigma\upsilon\nu\varphi_Σ \Rightarrow v_Σ = \pi \cdot \sigma\upsilon\nu\varphi_Σ \Rightarrow v_Σ = \pi \cdot \sigma\upsilon\nu(2k\pi - \pi) \Rightarrow$

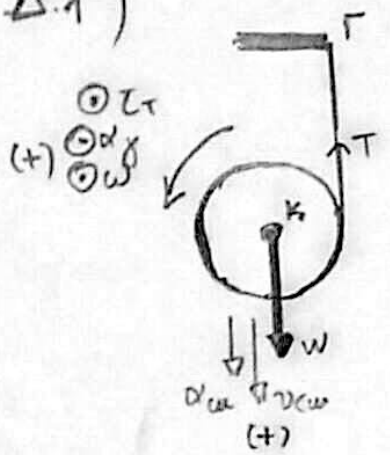
$\Rightarrow v_Σ = \pi \cdot \sigma\upsilon\nu(-\pi) \Rightarrow \boxed{v_Σ = -\pi \text{ m/s}}$

ΘΕΜΑ Δ.

ΑΓ: $M = 4kg$, Φ , $g = 10 m/s^2$, $\eta\mu\phi = 0{,}8$, $\sigma\upsilon\nu\phi = 0{,}6$

Δίσκος: $m = 2kg$, $R = 0{,}1m$, $I_{cm} = \frac{1}{2} m R^2$

Δ.1)



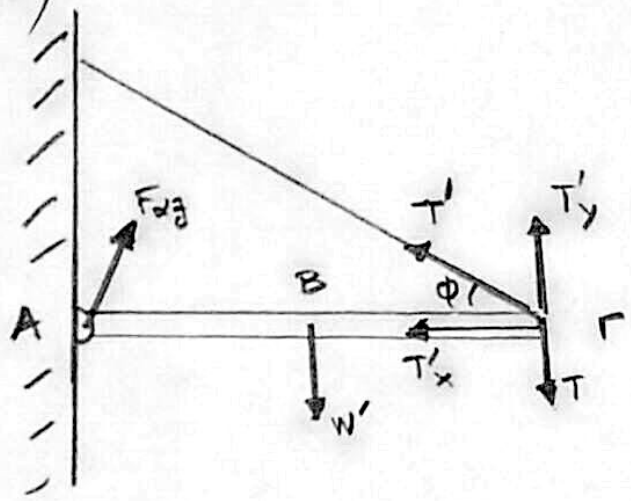
- $\Sigma F_x = m\alpha_{cm} \Rightarrow mg - T = m a_{cm} \Rightarrow 20 - T = 2\alpha_{cm}$ (1)
- $\Sigma\tau = I\alpha_\gamma \Rightarrow T \cdot R = \frac{1}{2} M R^2 \alpha_\gamma \Rightarrow T = \frac{1}{2} m R \alpha_\gamma$ (2)

$\alpha_{cm} = \alpha_\gamma \cdot R$ (3)

(2), (3) $\Rightarrow T = \frac{1}{2} m a_{cm} \Rightarrow T = a_{cm}$ (4)

(1) + (4) $\Rightarrow 20 = 3\alpha_{cm} \Rightarrow$ $\boxed{\alpha_{cm} = \frac{20}{3} \frac{m}{s^2}}$

Δ.2)



(4) $\Rightarrow T = \frac{20}{3} N$

- $\Sigma\tau_A = 0 \Rightarrow T'_y \cdot \ell - T \cdot \ell - Mg\frac{\ell}{2} = 0 \Rightarrow$

$\Rightarrow T'_y - \frac{20}{3} - 20 = 0 \Rightarrow$

$\Rightarrow T'_y = \frac{80}{3} N$

- $T'_y = T' \cdot \eta\mu\phi \Rightarrow \frac{80}{3} = T' \cdot 0{,}8 \Rightarrow$

$\Rightarrow$ $\boxed{T' = \frac{100}{3} N}$

Δ.3) $h_1 = 0{,}3m$, κόβεται το νήμα.

- $h_1 = \frac{1}{2}\alpha_{cm}\Delta t_1^2 \Rightarrow 0{,}3 = \frac{10}{3}\Delta t_1^2 \Rightarrow \Delta t_1^2 = \frac{0{,}9}{10} \Rightarrow \underline{\Delta t_1 = 0{,}3 s}$
- $v_{cm(1)} = a_{cm}\Delta t_1 = \frac{20}{3} \cdot 0{,}3 \Rightarrow \underline{v_{cm(1)} = 2 m/s}$
- $v_{cm(1)} = \omega_1 R \Rightarrow 2 = \omega_1 \cdot 0{,}1 \Rightarrow \underline{\omega_1 = 20 rad/s}$
- $L_1 = I\omega_1 = \frac{1}{2} m R^2 \omega_1 = \frac{1}{2} \cdot 2 \cdot 0{,}01 \cdot 20 \Rightarrow \underline{L_1 = 0{,}2 kg m^2/s}$

Αφού κοπή το νήμα, $\Sigma\tau = 0 \Rightarrow$ Α.Δ.Σ $\Rightarrow L = \text{σταθ.}$

Άρα $\boxed{L = 0,2\ kg \cdot m^2/s}$

Δ4) $\Delta t' = 0,1\ s$

- Αφού κοπή το νήμα, $\omega = \text{σταθ} \Rightarrow \omega = 20\ rad/s$

$K_{περ} = \frac{1}{2} I \omega^2 = \frac{1}{2} \cdot \frac{1}{2} m R^2 \omega^2 = \frac{1}{4} \cdot 2 \cdot 0,01 \cdot 400 \Rightarrow$

$\Rightarrow K_{περ} = 2J$

- $\Sigma F = m a'_{cm} \Rightarrow mg = m a_{cm'} \Rightarrow a_{cm'} = g = 10 m/s^2$
- $v_{cm} = v_1 + a_{cm'} \cdot \Delta t' \Rightarrow v_{cm} = 2 + 10 \cdot 0,1 \Rightarrow v_{cm} = 3 m/s$
- $K_{μετ} = \frac{1}{2} m v_{cm}^2 = \frac{1}{2} \cdot 2 \cdot 3^2 \Rightarrow K_{μετ} = 9J$
- Άρα $\boxed{\frac{K_{περ}}{K_{μετ}} = \frac{2}{9}}$