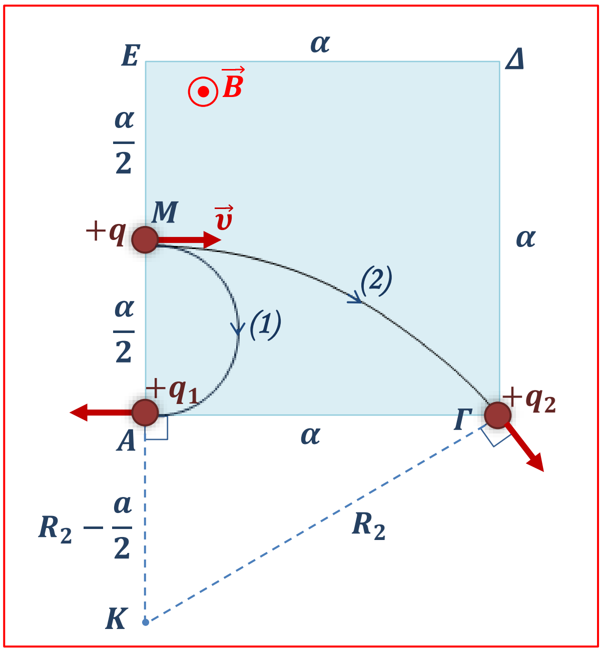
ΜΑΘΗΜΑ	ΦΥΣΙΚΗ ΠΡΟΣΑΝΑΤΟΛΙΣΜΟΥ
	ΛΥΣΕΙΣ
ΤΑΞΗ	Γ' ΛΥΚΕΙΟΥ
ΕΞΕΤΑΣΤΕΑ ΥΛΗ	ΚΡΟΥΣΕΙΣ, ΣΤΕΡΕΟ, ΤΑΛΑΝΤΩΣΕΙΣ, ΚΥΜΑΤΑ, ΜΑΓΝΗΤΙΚΟ ΠΕΔΙΟ, Η/Μ ΕΠΑΓΩΓΗ

ΘΕΜΑ Α

Α.1. δ **Α.2.** γ **Α.3.** β **Α.4.** δ **Α.5.** α. **Λ**, β. **Λ**, γ. **Σ**, δ. **Σ**, ε. **Σ**

ΘΕΜΑ Β

Β.1. α



Σωματίδιο (1): $R_1 = \frac{\alpha}{4}$ (1)

Σωματίδιο (2): Τρίγωνο $\widehat{K A \Gamma}$ $R_2^2 = \alpha^2 + \left(R_2 - \frac{\alpha}{2}\right)^2 \Rightarrow$

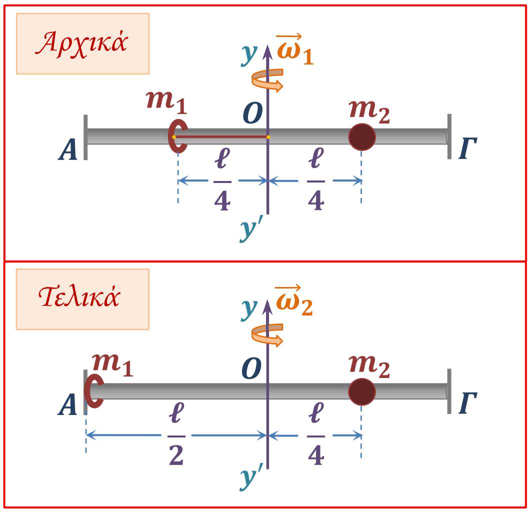
$\Rightarrow R_2^2 = \alpha^2 + R_2^2 - R_2\alpha + \frac{\alpha^2}{4} \Rightarrow R_2\alpha = \frac{5\alpha^2}{4} \Rightarrow$

$\Rightarrow R_2 = \frac{5\alpha}{4}$ (2)

$\frac{(1)}{(2)} \longrightarrow \frac{R_1}{R_2} = \frac{1}{5} \Rightarrow R_2 = 5R_1 \Rightarrow \frac{m_2 \cdot \upsilon}{B \cdot q_2} = 5\frac{m_1 \cdot \upsilon}{B \cdot q_1} \Rightarrow$

$\Rightarrow \frac{m_2 \cdot \upsilon}{B \cdot q_2} = 5\frac{m_1 \cdot \upsilon}{B \cdot 5q_2} \Rightarrow \boxed{\boldsymbol{m_2 = m_1}}$

Β.2. β



Α.Δ.Σ.: $L_{o\lambda}^{(\alpha\rho\chi)} = L_{o\lambda}^{(\tau\varepsilon\lambda)} \Rightarrow$

$\Rightarrow (m_1 + m_2)\omega_1\left(\frac{\ell}{4}\right)^2 = m_1\omega_2\left(\frac{\ell}{2}\right)^2 + m_2\omega_2\left(\frac{\ell}{4}\right)^2 \Rightarrow$

$\Rightarrow m_1\omega_1\frac{\ell^2}{16} + m_2\omega_1\frac{\ell^2}{16} = m_1\omega_2\frac{\ell^2}{4} + m_2\omega_2\frac{\ell^2}{16} \Rightarrow$

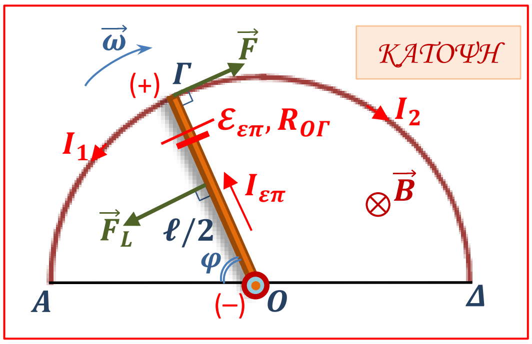
$\xRightarrow{(\omega_1 = 3\omega_2)} \frac{3}{16}m_1 + \frac{3}{16}m_2 = \frac{1}{4}m_1 + \frac{1}{16}m_2 \Rightarrow$

$$\Rightarrow \frac{2}{16} m_2 = \frac{1}{16} m_1 \Rightarrow m_1 = 2m_2 \;\; (1)$$

$$\frac{K_{o\lambda}^{(\alpha\rho\chi)}}{K_{o\lambda}^{(\tau\varepsilon\lambda)}} = \frac{\frac{1}{2} m_1 \omega_1^2 \left(\frac{\ell}{4}\right)^2 + \frac{1}{2} m_2 \omega_1^2 \left(\frac{\ell}{4}\right)^2}{\frac{1}{2} m_1 \omega_2^2 \left(\frac{\ell}{2}\right)^2 + \frac{1}{2} m_2 \omega_2^2 \left(\frac{\ell}{4}\right)^2} \xrightarrow{(\omega_1 = 3\omega_2)} \frac{K_{o\lambda}^{(\alpha\rho\chi)}}{K_{o\lambda}^{(\tau\varepsilon\lambda)}} = \frac{\frac{1}{2} m_1 9\omega_2^2 \frac{\ell^2}{16} + \frac{1}{2} m_2 9\omega_2^2 \frac{\ell^2}{16}}{\frac{1}{2} m_1 \omega_2^2 \frac{\ell^2}{4} + \frac{1}{2} m_2 \omega_2^2 \frac{\ell^2}{16}} \Rightarrow$$

$$\overset{(1)}{\Rightarrow} \frac{K_{o\lambda}^{(\alpha\rho\chi)}}{K_{o\lambda}^{(\tau\varepsilon\lambda)}} = \frac{9m_2 + \frac{9}{2} m_2}{4m_2 + \frac{1}{2} m_2} \Rightarrow \frac{K_{o\lambda}^{(\alpha\rho\chi)}}{K_{o\lambda}^{(\tau\varepsilon\lambda)}} = \frac{\frac{27}{2} m_2}{\frac{9}{2} m_2} \Rightarrow \boxed{\frac{K_{o\lambda}^{(\alpha\rho\chi)}}{K_{o\lambda}^{(\tau\varepsilon\lambda)}} = 3}$$

Β.3. γ



$$\left.\begin{aligned} R_{A\Gamma} &= \rho \frac{(A\Gamma)}{s} \\ R_{\Gamma\Delta} &= \rho \frac{(\Gamma\Delta)}{s} \end{aligned}\right\} \overset{(\div)}{\Longrightarrow} \frac{R_{A\Gamma}}{R_{\Gamma\Delta}} = \frac{(A\Gamma)}{(\Gamma\Delta)} \Rightarrow \frac{R_{A\Gamma}}{R_{\Gamma\Delta}} = \frac{\frac{\pi}{3}\ell}{\frac{2\pi}{3}\ell} \Rightarrow$$

$$\Rightarrow \frac{R_{A\Gamma}}{R_{\Gamma\Delta}} = \frac{1}{2} \Rightarrow R_{\Gamma\Delta} = 2R_{A\Gamma} \; (1)$$

Επίσης, ισχύει ότι: $R_{A\Gamma} + R_{\Gamma\Delta} = 3R \overset{(1)}{\Rightarrow} R_{A\Gamma} + 2R_{A\Gamma} = 3R \Rightarrow 3R_{A\Gamma} = 3R \Rightarrow R_{A\Gamma} = R \; (2)$

Επομένως $(1) \overset{(2)}{\rightarrow} R_{\Gamma\Delta} = 2R \; (3)$

$$R_{o\lambda} = \frac{R_{A\Gamma} \cdot R_{\Gamma\Delta}}{R_{A\Gamma} + R_{\Gamma\Delta}} + R_{o\Gamma} \xRightarrow{(2),(3)} R_{o\lambda} = \frac{R \cdot 2R}{R + 2R} + \frac{R}{3} \Rightarrow R_{o\lambda} = \frac{2R}{3} + \frac{R}{3} \Rightarrow R_{o\lambda} = R \; (4)$$

$$I_{\varepsilon\pi} = \frac{\mathcal{E}_{\varepsilon\pi}}{R_{o\lambda}} \overset{(4)}{\Rightarrow} I_{\varepsilon\pi} = \frac{\frac{1}{2} B\omega\ell^2}{R} \;\; (5)$$

$$\omega = \sigma\tau\alpha\theta. \longrightarrow \Sigma\tau^{(o)} = 0 \Rightarrow \tau_F^{(o)} + \tau_{F_L}^{(o)} = 0 \Rightarrow F\ell - F_L \frac{\ell}{2} = 0 \Rightarrow F = \frac{F_L}{2} \Rightarrow$$

$$\Rightarrow F = \frac{BI_{\varepsilon\pi}\ell}{2} \overset{(5)}{\Rightarrow} \boxed{F = \frac{B^2 \omega \ell^3}{4R}}$$

ΘΕΜΑ Γ

Γ.1.

$$T = \frac{1}{f} \Rightarrow T = \frac{1}{2{,}5}\ s \Rightarrow T = 0{,}4\ s$$

$$t_1 = t_M + \frac{T}{4} \Rightarrow t_1 = \frac{x_M}{\upsilon_\delta} + \frac{T}{4} \Rightarrow 0{,}5 = \frac{0{,}4}{\upsilon_\delta} + 0{,}1 \Rightarrow \frac{0{,}4}{\upsilon_\delta} = 0{,}4 \Rightarrow \upsilon_\delta = 1\ m/s$$

$$\upsilon_\delta = \lambda f \Rightarrow \lambda = \frac{\upsilon_\delta}{f} \Rightarrow \lambda = \frac{1}{2{,}5}\ m \Rightarrow \boxed{\boldsymbol{\lambda = 0{,}4\ m}}$$

Γ.2.

Επειδή $\upsilon_\delta > 0$ και $\varphi_o = 0$: $\varphi = 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right) \Rightarrow \left\{\begin{array}{l} \varphi_M = 2\pi\left(\frac{t}{T} - \frac{x_M}{\lambda}\right) \\ \varphi_N = 2\pi\left(\frac{t}{T} - \frac{x_N}{\lambda}\right) \end{array}\right\} \Rightarrow$

$$\Rightarrow \left\{\begin{array}{l} \varphi_M = 2\pi\frac{t}{T} - 2\pi\frac{x_M}{\lambda} \\ \varphi_N = 2\pi\frac{t}{T} - 2\pi\frac{x_N}{\lambda} \end{array}\right\} \overset{(-)}{\Rightarrow} \varphi_M - \varphi_N = -2\pi\frac{x_M}{\lambda} + 2\pi\frac{x_N}{\lambda} \Rightarrow \Delta\varphi_{M,N} = \frac{2\pi}{\lambda}(x_N - x_M) \Rightarrow$$

$$\Rightarrow \frac{3\pi}{4} = \frac{2\pi}{0{,}4}(x_N - 0{,}4) \Rightarrow x_N - 0{,}4 = \frac{3}{20} \Rightarrow x_N = (0{,}4 + 0{,}15)\ m \Rightarrow \boxed{\boldsymbol{x_N = 0{,}55\ m}}$$

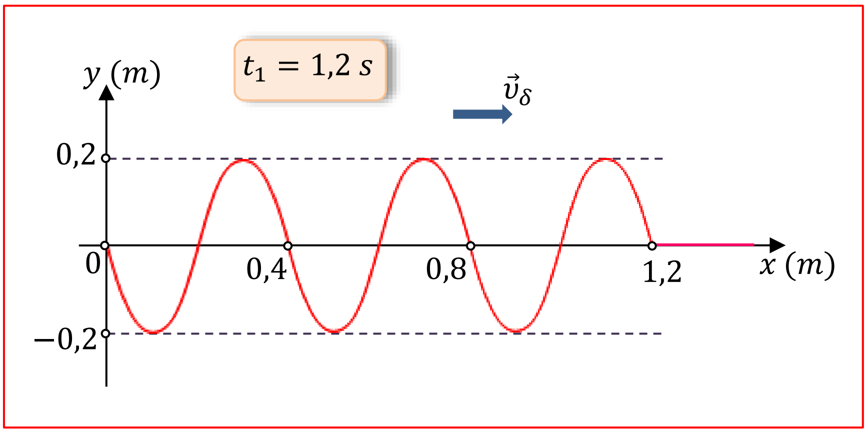
Γ.3.

Τη στιγμή $t = t_2 = 1{,}2\ s$:

$$y = A \cdot \eta\mu 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right) \Rightarrow y_2 = 0{,}2 \cdot \eta\mu 2\pi\left(\frac{1{,}2}{0{,}4} - \frac{x}{0{,}4}\right) \Rightarrow \boldsymbol{y_2 = 0{,}2 \cdot \eta\mu(6\pi - 5\pi x)}\ (S.I.)$$

$$x_2 = \upsilon_\delta \cdot t_2 \Rightarrow x_2 = \upsilon_\delta \cdot t_2 \Rightarrow x_2 = 1{,}2\ m$$

$$\left.\begin{array}{r} x_2 = 1{,}2\ m \\ \lambda = 0{,}4\ m \end{array}\right\} \overset{(\div)}{\Rightarrow} \frac{x_2}{\lambda} = 3 \Rightarrow \boldsymbol{x_2 = 3\lambda}$$



Γ.4.

α΄ τρόπος:

$$y_M = A \cdot \eta\mu\varphi_M \Rightarrow \frac{A}{2} = A \cdot \eta\mu\varphi_M \Rightarrow \eta\mu\varphi_M = \frac{1}{2}$$

Ισχύει ότι: $\eta\mu^2\varphi_M + \sigma\upsilon\nu^2\varphi_M = 1 \Rightarrow \sigma\upsilon\nu\varphi_M = \pm\sqrt{1-\eta\mu^2\varphi_M} \Rightarrow$

$$\Rightarrow |\sigma\upsilon\nu\varphi_M| = \sqrt{1-\frac{1}{4}} \Rightarrow |\sigma\upsilon\nu\varphi_M| = \sqrt{\frac{3}{4}} \Rightarrow |\sigma\upsilon\nu\varphi_M| = \frac{\sqrt{3}}{2}$$

Άρα $\upsilon_M = \omega A \cdot \sigma\upsilon\nu\varphi_M \Rightarrow |\upsilon_M| = 2\pi f A \cdot |\sigma\upsilon\nu\varphi_M| \Rightarrow |\upsilon_M| = 2\pi f A \cdot |\sigma\upsilon\nu\varphi_M| \Rightarrow$

$$\Rightarrow |\upsilon_M| = 5\pi \cdot 0{,}2 \cdot \frac{\sqrt{3}}{2}\, m/s \Rightarrow \boxed{|\boldsymbol{\upsilon_M}| = \frac{\sqrt{3}\boldsymbol{\pi}}{\mathbf{2}}\, \boldsymbol{m/s}}$$

β΄ τρόπος:

Α.Δ.Ε.Τ.: $\frac{1}{2}DA^2 = \frac{1}{2}m\upsilon_M^2 + \frac{1}{2}Dy_M^2 \Rightarrow \upsilon_M^2 = \frac{D}{m}(A^2 - y_M^2) \xRightarrow{(D=m\omega^2)}$

$$\Rightarrow \upsilon_M^2 = \omega^2(A^2 - y_M^2) \Rightarrow \upsilon_M^2 = 4\pi^2 f^2 (A^2 - y_M^2) \Rightarrow \upsilon_M^2 = 4\pi^2 \cdot 6{,}25 \cdot (0{,}2^2 - 0{,}1^2)\, m^2/s^2 \Rightarrow$$

$$\Rightarrow \upsilon_M^2 = 25\pi^2 \cdot 0{,}03\, m^2/s^2 \Rightarrow \upsilon_M^2 = 0{,}75\pi^2\, m^2/s^2 \Rightarrow \upsilon_M^2 = \frac{3}{4}\pi^2\, m^2/s^2 \Rightarrow$$

$$\Rightarrow |\boldsymbol{\upsilon_M}| = \frac{\sqrt{3}\boldsymbol{\pi}}{\mathbf{2}}\, \boldsymbol{m/s}$$

Γ.5.

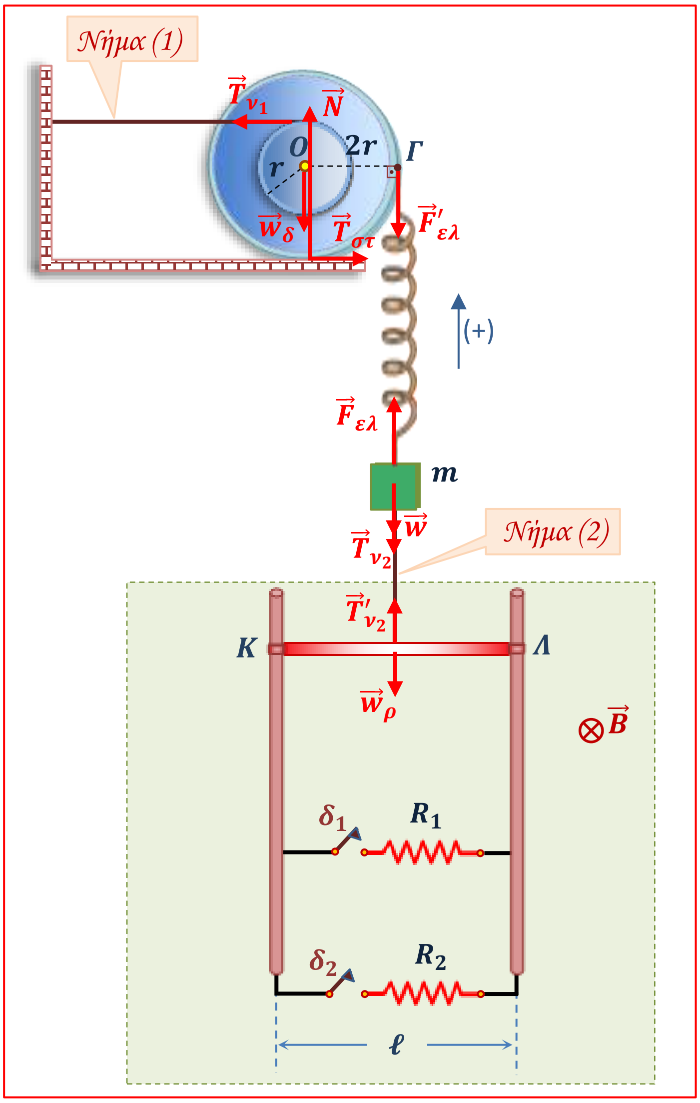
Ίδιο μέσο διάδοσης: $\upsilon'_\delta = \upsilon_\delta \Rightarrow \lambda' f' = \lambda f \Rightarrow \lambda' = \frac{\lambda f}{f'} \Rightarrow \lambda' = \frac{\lambda f}{2f} \Rightarrow \lambda' = 0{,}2\, m$

Άρα $\varphi'_M - \varphi'_N = \left(2\pi\frac{t}{T'} - 2\pi\frac{x_M}{\lambda'}\right) - \left(2\pi\frac{t}{T'} - 2\pi\frac{x_N}{\lambda'}\right) \Rightarrow \Delta\varphi'_{M,N} = \frac{2\pi}{\lambda'}(x_N - x_M) \Rightarrow$

$$\Rightarrow \Delta\varphi'_{M,N} = \frac{2\pi}{0{,}2}(0{,}55 - 0{,}4)\, rad \Rightarrow \boxed{\boldsymbol{\Delta\varphi'_{M,N}} = \frac{\mathbf{3}\boldsymbol{\pi}}{\mathbf{2}}\boldsymbol{rad}}$$

ΘΕΜΑ Δ

Δ.1.



Ισορροπία ράβδου ΚΛ:

$\Sigma F_y = 0 \Rightarrow T'_{\nu_2} = w_\rho \Rightarrow T'_{\nu_2} = M_\rho g \Rightarrow T'_{\nu_2} = 10\ N$

Αβαρές νήμα (2): $T_{\nu_2} = T'_{\nu_2} \Rightarrow T_{\nu_2} = 10\ N$

Ισορροπία σώματος μάζας m, μέσω του νήματος (2):

$\Sigma F_y = 0 \Rightarrow F_{\varepsilon\lambda} = T_{\nu_2} + w \Rightarrow F_{\varepsilon\lambda} = T_{\nu_2} + mg \Rightarrow$

$\Rightarrow F_{\varepsilon\lambda} = (10 + 20)\ N \Rightarrow F_{\varepsilon\lambda} = 30\ N$

Αβαρές ελατήριο: $F'_{\varepsilon\lambda} = F_{\varepsilon\lambda} \Rightarrow F'_{\varepsilon\lambda} = 30\ N$

Ισορροπία δίσκου:

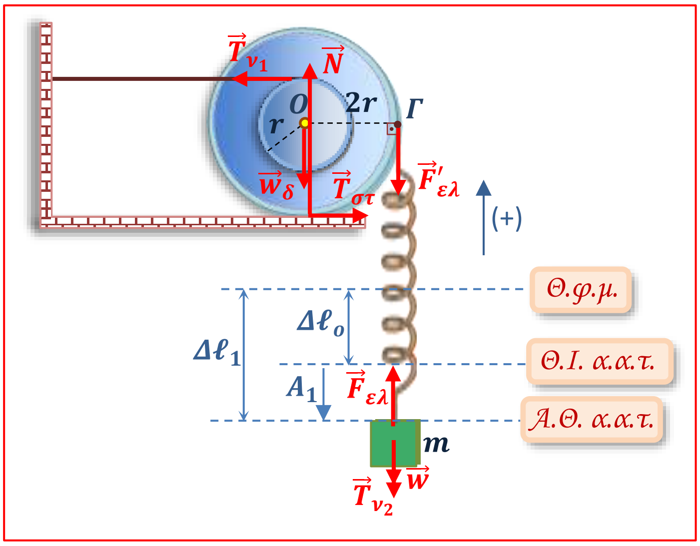
$$\left.\begin{array}{l} \Sigma\tau^{(o)} = 0 \Rightarrow T_{\nu_1}\cdot r + T_{\sigma\tau}\cdot 2r = F'_{\varepsilon\lambda}\cdot 2r \\ \text{και}\ \ \Sigma F_x = 0 \Rightarrow T_{\nu_1} = T_{\sigma\tau} \end{array}\right\} \Rightarrow$$

$\Rightarrow T_{\nu_1}\cdot r + T_{\nu_1}\cdot 2r = F'_{\varepsilon\lambda}\cdot 2r \Rightarrow$

$\Rightarrow T_{\nu_1}\cdot 3r = F'_{\varepsilon\lambda}\cdot 2r \Rightarrow T_{\nu_1} = \frac{2}{3}F'_{\varepsilon\lambda} \Rightarrow$

$\Rightarrow T_{\nu_1} = \left(\frac{2}{3}\cdot 30\right)\ N \Rightarrow \boxed{T_{\nu_1} = 20\ N}$

Δ.2.



Η θέση ισορροπίας του σώματος μάζας m, μέσω του νήματος (2), ταυτίζεται με την κάτω ακραία θέση ταλάντωσής του, μετά το κόψιμο του νήματος. Από το ερώτημα Δ.1., στη θέση αυτή έχουμε ότι:

$F_{\varepsilon\lambda} = 30\ N \Rightarrow k\Delta\ell_1 = 30 \Rightarrow \Delta\ell_1 = 0{,}3\ m$

Θ.Ι. α.α.τ. του σώματος μάζας m:

$\Sigma F_y = 0 \Rightarrow F_{\varepsilon\lambda_o} = w \Rightarrow k\Delta\ell_o = mg \Rightarrow$

$\Rightarrow \Delta\ell_o = 0{,}2\ m$

Άρα $A_1 = \Delta\ell_1 - \Delta\ell_o \Rightarrow A_1 = 0{,}1\ m$

Με την ίδια λογική, βρίσκουμε ότι $A_{max} = \Delta\ell_{max} - \Delta\ell_o \Rightarrow A_{max} = \frac{F_{\varepsilon\lambda_{max}}}{k} - 0{,}2$ (1)

Δίνεται ότι $A_{max} = 2A_1 \Rightarrow A_{max} = 0{,}2\ m$ (2)

Επομένως (1) $\xrightarrow{(2)} 0{,}2 = \frac{F_{\varepsilon\lambda_{max}}}{k} - 0{,}2 \Rightarrow \frac{F_{\varepsilon\lambda_{max}}}{k} = 0{,}4 \Rightarrow F_{\varepsilon\lambda_{max}} = 40\ N$

<u>Αβαρές ελατήριο</u>: $F'_{\varepsilon\lambda_{max}} = F_{\varepsilon\lambda_{max}} \Rightarrow F'_{\varepsilon\lambda_{max}} = 40\ N$

<u>Ισορροπία περιστροφής δίσκου ως προς το κέντρο του</u>:

$$\Sigma\tau^{(o)} = 0 \Rightarrow T_{\nu_1}\cdot r + T_{\sigma\tau}\cdot 2r = F'_{\varepsilon\lambda}\cdot 2r \xrightarrow{(T_{\nu_1}=T_{\sigma\tau})} T_{\sigma\tau}\cdot 3r = F'_{\varepsilon\lambda}\cdot 2r \Rightarrow$$

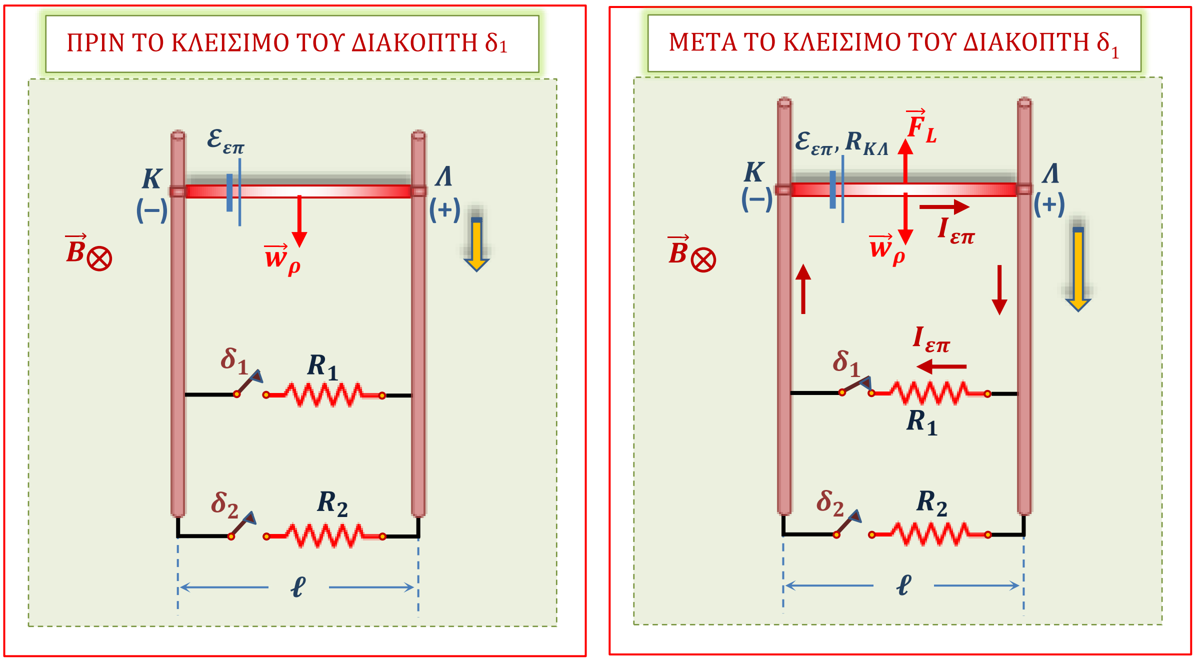
$$\Rightarrow T_{\sigma\tau_{max}}\cdot 3r = F'_{\varepsilon\lambda_{max}}\cdot 2r \Rightarrow T_{\sigma\tau_{max}} = \frac{2}{3}F'_{\varepsilon\lambda_{max}} \Rightarrow T_{\sigma\tau_{max}} = \frac{80}{3}\ N \Rightarrow \mu_{o\rho}\cdot N = \frac{80}{3}\ N \ (3)$$

<u>Ισορροπία μεταφοράς δίσκου στον άξονα y'y</u>:

$$\Sigma F_y = 0 \Rightarrow N = w_\delta + F'_{\varepsilon\lambda_{max}} \Rightarrow N = M_\delta g + F'_{\varepsilon\lambda_{max}} \Rightarrow N = 80\ N \ (4)$$

Επομένως (3) $\xrightarrow{(4)} \boxed{\boldsymbol{\mu_{o\rho} = \frac{1}{3}}}$

Δ.3.



<u>ΠΡΙΝ το κλείσιμο του διακόπτη δ_1</u>: $\Sigma F_y = w_\rho \Rightarrow M_\rho\cdot\alpha = M_\rho\cdot g \Rightarrow \alpha = 10\ m/s^2$

Τη στιγμή $t_1 = 1\ s$: $\upsilon_1 = \alpha\cdot t_1 \Rightarrow \upsilon_1 = 10\ m/s$

και $V_{\Lambda K_1}^{(\pi\rho\iota\nu)} = \mathcal{E}_{\varepsilon\pi_1} \Rightarrow V_{\Lambda K_1}^{(\pi\rho\iota\nu)} = B\upsilon_1\ell \Rightarrow V_{\Lambda K_1}^{(\pi\rho\iota\nu)} = 10\ V$

ΜΕΤΑ το κλείσιμο του διακόπτη δ_1, τη στιγμή t_1:

$$I_{\varepsilon\pi_1} = \frac{\mathcal{E}_{\varepsilon\pi_1}}{R_{o\lambda}} \Rightarrow I_{\varepsilon\pi_1} = \frac{B\upsilon_1\ell}{R_1 + R_{K\Lambda}} \Rightarrow I_{\varepsilon\pi_1} = \frac{10}{3+2}\ A \Rightarrow I_{\varepsilon\pi_1} = 2\ A$$

$$V_{\Lambda K_1}^{(\mu\varepsilon\tau\acute{\alpha})} = \mathcal{E}_{\varepsilon\pi_1} - I_{\varepsilon\pi_1}\cdot R_{K\Lambda} \Rightarrow V_{\Lambda K_1}^{(\mu\varepsilon\tau\acute{\alpha})} = B\upsilon_1\ell - I_{\varepsilon\pi_1}\cdot R_{K\Lambda} \Rightarrow$$

$$\Rightarrow V_{\Lambda K_1}^{(\mu\varepsilon\tau\acute{\alpha})} = (10 - 2\cdot 2)\ V \Rightarrow V_{\Lambda K_1}^{(\mu\varepsilon\tau\acute{\alpha})} = 6\ V$$

Άρα $\pi(\%) = \dfrac{V_{\Lambda K_1}^{(\mu\varepsilon\tau\acute{\alpha})} - V_{\Lambda K_1}^{(\pi\rho\iota\nu)}}{V_{\Lambda K_1}^{(\pi\rho\iota\nu)}}\cdot 100(\%) \Rightarrow \pi(\%) = \dfrac{6-10}{10}\cdot 100(\%) \Rightarrow \boxed{\boldsymbol{\pi(\%) = -40\ \%}}$

Δ.4.

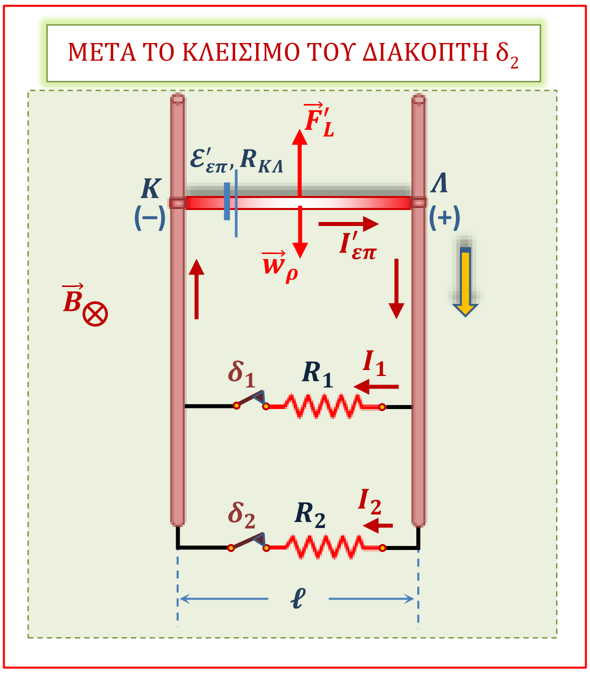
Τη στιγμή t_2, ακριβώς πριν το κλείσιμο του διακόπτη δ_2, ισχύει ότι:

$$\frac{dp}{dt} = 0 \Rightarrow \Sigma F_y = 0 \Rightarrow F_L = w_\rho \Rightarrow BI_{\varepsilon\pi}\ell = M_\rho g \Rightarrow B\frac{\mathcal{E}_{\varepsilon\pi}}{R_1 + R_{K\Lambda}}\ell = M_\rho g \Rightarrow$$

$$\Rightarrow B\frac{B\upsilon\ell}{R_1 + R_{K\Lambda}}\ell = M_\rho g \xRightarrow{(\upsilon=\upsilon_{o\rho})} \frac{B^2\ell^2}{R_1 + R_{K\Lambda}}\upsilon_{o\rho} = M_\rho g \Rightarrow \upsilon_{o\rho} = \frac{M_\rho g(R_1 + R_{K\Lambda})}{B^2\ell^2} \Rightarrow$$

$$\Rightarrow \upsilon_{o\rho} = \frac{10\cdot(3+2)}{2^2\cdot 0{,}5^2}\ m/s \Rightarrow \upsilon_{o\rho} = 50\ m/s$$

Τη στιγμή t_2, αμέσως μετά το κλείσιμο του διακόπτη δ_2, ισχύει ότι:



$$R'_{o\lambda} = \frac{R_1\cdot R_2}{R_1 + R_2} + R_{K\Lambda} \Rightarrow R'_{o\lambda} = \left(\frac{3\cdot 6}{3+6} + 2\right)\ \Omega \Rightarrow$$

$$\Rightarrow R'_{o\lambda} = 4\ \Omega$$

$$F'_L = BI'_{\varepsilon\pi}\ell = B\frac{\mathcal{E}'_{\varepsilon\pi}}{R'_{o\lambda}}\ell = B\frac{B\upsilon\ell}{R'_{o\lambda}}\ell = \frac{B^2\ell^2}{R'_{o\lambda}}\upsilon \xRightarrow{(\upsilon=\upsilon_{o\rho})}$$

$$\Rightarrow F'_L = \frac{2^2\cdot 0{,}5^2}{4}\cdot 50\ N \Rightarrow F'_L = 12{,}5\ N$$

$$\Sigma F'_y = w_\rho - F'_L = M_\rho g - F'_L \Rightarrow \Sigma F'_y = -2{,}5\ N$$

Άρα $\dfrac{dK}{dt} = \Sigma F'_y\cdot\upsilon \xRightarrow{(\upsilon=\upsilon_{o\rho})} \dfrac{dK}{dt} = -2{,}5\cdot 50\ J/s \Rightarrow$

$$\Rightarrow \boxed{\boldsymbol{\frac{dK}{dt} = -125\ J/s}}$$

Δ.5.

Από τη στιγμή t_2 και μετά, η ράβδος εκτελεί ***επιβραδυνόμενη κίνηση με φθίνουσα επιβράδυνση***, αφού:

$$\Sigma F'_y < 0 \Rightarrow |\upsilon| \downarrow \ \text{ και } \ |\alpha'| = \frac{|w_\rho - F'_L|}{M_\rho} \xRightarrow{(F'_L > w_\rho)} |\alpha'| = \frac{F'_L - w_\rho}{M_\rho} = \frac{B^2\ell^2}{M_\rho R'_{o\lambda}}\upsilon - g \xRightarrow{(|\upsilon|\downarrow)} |\alpha'| \downarrow$$

Όταν $\upsilon = 48\ m/s$, θα έχουμε:

$$I'_{\varepsilon\pi} = \frac{B\upsilon\ell}{R'_{o\lambda}} \Rightarrow I'_{\varepsilon\pi} = \frac{48}{4}\ A \Rightarrow I'_{\varepsilon\pi} = 12\ A$$

$$\begin{Bmatrix} I'_{\varepsilon\pi} = I_1 + I_2 \\ I_1 R_1 = I_2 R_2 \end{Bmatrix} \Rightarrow \begin{Bmatrix} 12 = I_1 + I_2 \\ 3I_1 = 6I_2 \end{Bmatrix} \Rightarrow \begin{Bmatrix} 12 = I_1 + I_2 \\ I_1 = 2I_2 \end{Bmatrix} \Rightarrow 12 = 3I_2 \Rightarrow I_2 = 4\ A$$

Επομένως, η θερμική ισχύς που καταναλώνει η αντίσταση R_2 ισούται με:

$$P_{R_2} = I_2^2 \cdot R_2 \Rightarrow P_{R_2} = 4^2 \cdot 6\ W \Rightarrow \boxed{\boldsymbol{P_{R_2} = 96\ W}}$$