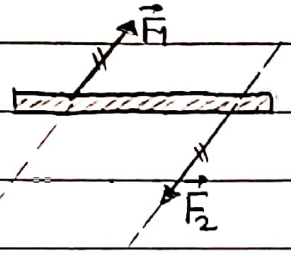
ΘΕΜΑ Α (Επαναληπτικές Νέο)

Α1. $V_{ev} = \frac{V_{max}}{\sqrt{2}} = \frac{100\,V}{\sqrt{2}} \Rightarrow V_{ev} = 50\sqrt{2}\,V \rightsquigarrow (\gamma)$

Α2. $T_\delta = \frac{1}{f_2 - f_1} = \frac{1}{4}\,sec \rightsquigarrow \Delta t = 1\,sec = 4 \cdot T_\delta \rightsquigarrow (\beta)$

Α3.



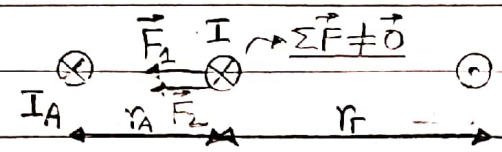
$\rightsquigarrow \Sigma\vec{F} = \vec{0}$ κ' $\Sigma\vec{\tau}_{cm} \neq \vec{0} \rightsquigarrow (\delta)$

Α4. $\Sigma\vec{F}_{\epsilon\xi} = \vec{0} \Rightarrow \vec{p}_{\sigma\tau\alpha\theta.}$ με $K_{\Pi PIN} \leq K_{META}$ γενικά $\rightsquigarrow (\alpha)$

Α5. α.Σ, β.Σ, γ.Λ, δ.Λ, ε.Λ

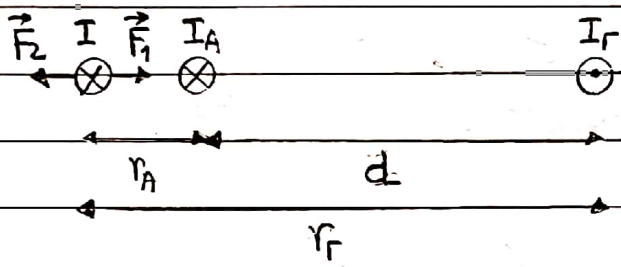
ΘΕΜΑ Β (Επαναληπτικές Νέο)

Β1.



$I_r = 3 \cdot I_A$ κ' $r_A + r_r = d$

$r_r = ?$



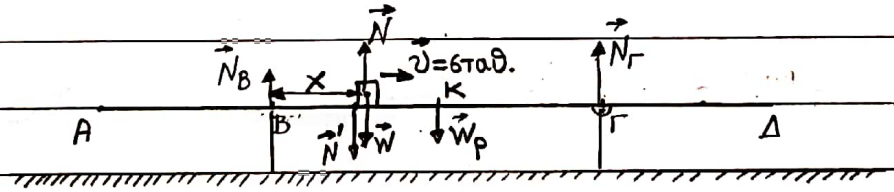
$I_r = 3 \cdot I_A$ κ' $r_r - r_A = d$ (1)

αρκεί $|F_1| = |F_2| \rightsquigarrow \Sigma\vec{F} = \vec{0}$.

Άρα: $k_\mu \frac{2I \cdot I_A}{r_A} \cdot l = k_\mu \cdot \frac{2I \cdot I_r}{r_r} \cdot l \Rightarrow \frac{I_A}{r_A} = \frac{3I_A}{r_r} \Rightarrow r_r = 3 \cdot r_A$. (2)

(1) κ' (2) $\Rightarrow r_r - \frac{r_r}{3} = d \Rightarrow \frac{2}{3} r_r = d \Rightarrow r_r = \frac{3d}{2} \rightsquigarrow$ (ii)

Β2.



$AB = BK = K\Gamma = \Gamma\Delta = l/4$

$M = \frac{m}{2} \rightsquigarrow m = 2M$ (1)

$\Sigma\vec{F}_m = \vec{0} \Rightarrow mg = N$, $N' = N$ 3ος Ν.Ν. $\rightsquigarrow N' = mg$. (2).

$\Sigma\vec{\tau}_r = \vec{0} \overset{+}{\Rightarrow} -N_B \cdot \frac{2l}{4} + N' \cdot \left(\frac{2l}{4} - x\right) + Mg \cdot \frac{l}{4} = 0 \overset{(1)}{\underset{(2)}{\Rightarrow}}$

$\Rightarrow 2M \cdot g \cdot \left(\frac{2 \cdot l}{4} - x\right) + Mg\frac{l}{4} = N_B \cdot \frac{2l}{4} \Rightarrow 5 \cdot Mg \cdot \frac{l}{4} - 2Mg \cdot x = N_B \cdot \frac{2l}{4} \Rightarrow$

$\Rightarrow 2.5Mg - 4Mg \cdot \frac{x}{l} = N_B \xrightarrow{N_B \geq 0} 2.5 \geq \frac{4 \cdot x}{l} \Rightarrow x_{max} = \frac{5}{8} \cdot l$

Είναι: $x_{max} = \upsilon \cdot t_1 \Rightarrow t_1 = \frac{5 \cdot l}{8 \cdot \upsilon} \rightsquigarrow$ (iii)

B3.

Γενικά για την οριζόντια βολή έχουμε:

$$\left.\begin{matrix} x = v_{\varepsilon\kappa} \cdot t \\ y = \frac{1}{2} g \cdot t^2 \end{matrix}\right\} \Rightarrow y = \frac{g}{2 \cdot v_{\varepsilon\kappa}^2} \cdot x^2 \quad (1)$$

Θ. Torricelli: $v_{\varepsilon\kappa 1} = \sqrt{2g \cdot (H - h_1)}$ κ' $v_{\varepsilon\kappa 2} = \sqrt{2g \cdot (H - h_2)}$ (2)

Εξ υποθέσεως έχουμε ίσα βεληνεκή: $x_1 = x_2$. (3)

Τότε (1), (2) $\Rightarrow$

$$h_1 = \frac{g}{2 \cdot 2g(H - h_1)} \cdot x_1^2$$

κ'

$$h_2 = \frac{g}{2 \cdot 2g(H - h_2)} \cdot x_2^2$$

$\Big\} \overset{(3)}{\Rightarrow}$

$$\Rightarrow \frac{h_1}{h_2} = \frac{H - h_2}{H - h_1} \Rightarrow h_1 \cdot H - h_1^2 = h_2 \cdot H - h_2^2 \Rightarrow$$

$$\Rightarrow (h_2 - h_1) \cdot (h_2 + h_1) = H \cdot (h_2 - h_1) \Rightarrow H = h_1 + h_2 \rightarrow (i)$$

ΘΕΜΑ Γ (Επαναληπτικές Νέο)

ΚΛ: $m=0.2kgr$, $\ell=1m$, $R_2=6\Omega$, $B=2T\otimes$

$R_1=2\Omega$

$R_{ολ}=8\Omega$

$t=0sec: v_0=12m/s\downarrow$

Γ1. $|a_0|=?\rightarrow t=0sec$

$$|F_{L_0}|=\frac{B^2\cdot\ell^2}{R_{ολ}}\cdot|v_0|=6N\uparrow,\quad |W|=m\cdot|g|=2N\downarrow.$$

άρα $|a_{0}|=\frac{|F_{L_0}|-|W|}{m}=20m/s^2$ κ' $\vec{a}_0\uparrow$ επιβραδυνόμενη.

Γ2. $v_{op}=?$

$\Sigma F=0$ όταν $v=v_{op}\rightsquigarrow \frac{B^2\ell^2}{R_{ολ}}\cdot|v_{op}|=mg\Rightarrow$

$$\Rightarrow |v_{op}|=\frac{m\cdot g\cdot R_{ολ}}{B^2\ell^2}\Rightarrow |v_{op}|=4m/s.$$

Έλεγχος: $\tau=\frac{m\cdot R_{ολ}}{B^2\ell^2}=0.4sec.\rightsquigarrow |v_{op}|=g\cdot\tau$

$\Sigma F=m\cdot a\rightsquigarrow \tau\cdot\dot{v}+v=v_{op}\rightsquigarrow v=v_{op}-(v_{op}-v_0)\cdot e^{-t/\tau}\rightsquigarrow$

$$\rightsquigarrow y=v_{op}\cdot t+(v_{op}-v_0)\cdot\tau\cdot(e^{-t/\tau}-1)$$

$t_{op}=5\cdot\tau\rightsquigarrow y_{op}=(4\cdot v_{op}+v_0)\cdot\tau=11.2m$

Τότε: $q_{en}=\frac{B\cdot\ell\cdot y_{op}}{R_{ολ}}=2.8cb.$

Γ3. $q_{en}=0.4cb$ από $t_0=0\rightsquigarrow t_1=t_{op}\rightsquigarrow Q_1=?,\ Q_2=?$

Λύνουμε για : $q_{επ} = 0.4 C \rightsquigarrow y_{op} = \frac{q_{επ} \cdot R_{ολ}}{B \cdot l} = 1.6 m$

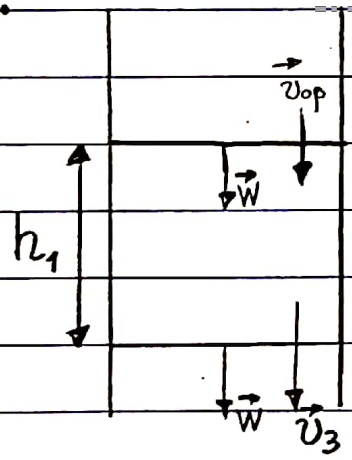
ΑΔΕ : $\frac{1}{2} m \cdot v_0^2 + mg \cdot y_{op} - Q = \frac{1}{2} m \cdot v_{op}^2 \Rightarrow$

$\Rightarrow Q = \frac{m}{2} \cdot (v_0^2 - v_{op}^2) + m \cdot g \cdot y_{op} \Rightarrow Q = 16 j$

Για Δt : $\left.\begin{matrix} \Delta Q_1 = I^2 \cdot R_1 \cdot \Delta t \\ \Delta Q_2 = I^2 \cdot R_2 \cdot \Delta t \end{matrix}\right\} \rightsquigarrow \frac{Q_1}{Q_2} = \frac{R_1 \cdot \Sigma I^2 \cdot \Delta t}{R_2 \cdot \Sigma I^2 \cdot \Delta t} \Rightarrow \frac{Q_1}{Q_2} = \frac{R_1}{R_2} = \frac{1}{3}$

$Q = Q_1 + Q_2 \Rightarrow Q = 4 Q_1 \Rightarrow Q_1 = \frac{Q}{4} = 4 j$ κ' $Q_2 = 12 j$

Γ4. $h_1 = 0.45 m \rightsquigarrow t_3 : \frac{dK}{dt} = ?$



$\left.\begin{matrix} \Sigma \vec{F} = m \cdot \vec{g} \Rightarrow \vec{a} = \vec{g} \\ \frac{dK}{dt} = \Sigma \vec{F} \cdot \vec{v}_3 \end{matrix}\right\} \Rightarrow$

$\Rightarrow \frac{dK}{dt} = + m \cdot |g| \cdot |v_3|$

ΘΜΚΕ : $\frac{m}{2} \cdot (v_3^2 - v_{op}^2) = + mg \cdot h_1 \Rightarrow |v_3| = \sqrt{v_{op}^2 + 2gh_1} = 5 m/s$

$\Rightarrow \frac{dK}{dt} = + 10 j/s.$

ΘΕΜΑ Δ (Επαναληπτικές Νέο)

Σ_1 : $m_1 = 5kgr$, $k_1 = 80 N/m \rightsquigarrow \omega_1 = \sqrt{\frac{k_1}{m_1}} = 4 r/s$

Σ_2 : $m_2 = 12kgr$, $k_2 = 300 N/m \rightsquigarrow \omega_2 = \sqrt{\frac{k_2}{m_2}} = 5 r/s$.

$\Theta I_1 \xleftarrow{d} \Theta I_2$: $d = 0.6m$

Δ1. $\omega_1 = 4 r/s \rightsquigarrow T_1 = 2\pi/\omega_1 = 2\pi/4$ sec $= 10\pi/20$ sec

$\omega_2 = 5 r/s \rightsquigarrow T_2 = 2\pi/\omega_2 = 2\pi/5$ sec $= 8\pi/20$ sec.

$d_1 = 0.6m$ $(\leftarrow)$ κ' $v_0 = 0 \Rightarrow A_1 = d_1 = 0.6m$

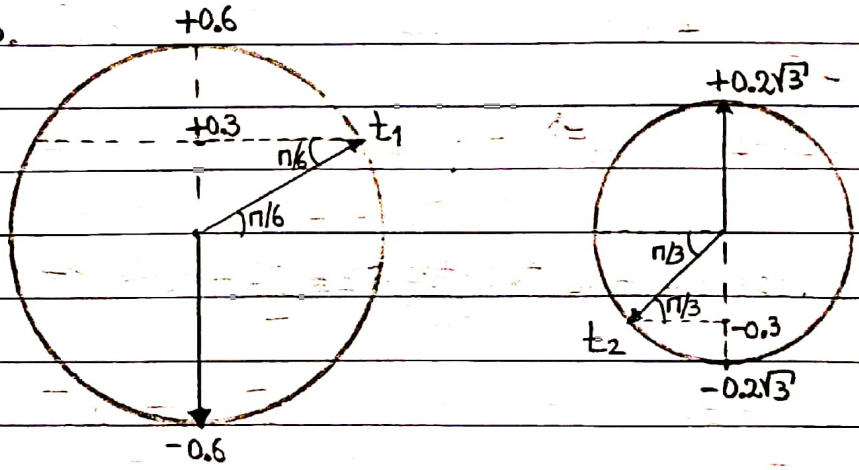
$d_2 = 0.2\sqrt{3} m$ $(\rightarrow)$ κ' $v_0 = 0 \Rightarrow A_2 = d_2 = 0.2\sqrt{3} m$

Δ2. Είναι $\phi_{01} = \frac{3\pi}{2} r$ κ' $\phi_{02} = \frac{\pi}{2} r$ επομένως:

$x_1 = 0.6 \cdot \eta\mu(4t + 3\pi/2)$ (1α) , $v_1 = 2.4 \cdot \sigma\upsilon\nu(4t + 3\pi/2)$ (1β) } (SI)

$x_2 = 0.2\sqrt{3} \cdot \eta\mu(5t + \pi/2)$ (2α) , $v_2 = \sqrt{3} \cdot \sigma\upsilon\nu(5t + \pi/2)$ (2β)

Δ3.



$t_1 = \frac{T_1}{4} + \frac{T_1}{12} = \frac{T_1}{3} = \frac{2\pi}{12}$ sec , $t_2 = \frac{T_2}{4} + \frac{2T_2}{12} = \frac{5 \cdot T_2}{12} = \frac{2\pi}{12}$ sec

άρα $t_1 = t_2 = 2\pi/12$ sec $= \pi/6$ sec $= t_{κρ}$.

ΘΕΜΑ Δ (Επαναληπτικές Νέο)

Σ_1 : $m_1 = 5kgr$, $k_1 = 80N/m$ $\rightsquigarrow$ $\omega_1 = \sqrt{\frac{k_1}{m_1}} = 4r/s$

Σ_2 : $m_2 = 12kgr$, $k_2 = 300N/m$ $\rightsquigarrow$ $\omega_2 = \sqrt{\frac{k_2}{m_2}} = 5r/s$.

$\Theta I_1 \xleftarrow{d} \Theta I_2$: $d = 0.6m$

Δ1. $\omega_1 = 4r/s \rightsquigarrow T_1 = 2\pi/\omega_1 = 2\pi/4\ sec = 10\pi/20\ sec$

$\omega_2 = 5r/s \rightsquigarrow T_2 = 2\pi/\omega_2 = 2\pi/5\ sec = 8\pi/20\ sec.$

$d_1 = 0.6m$ $(\leftarrow)$ κ' $v_0 = 0$ $\Rightarrow$ $A_1 = d_1 = 0.6m$

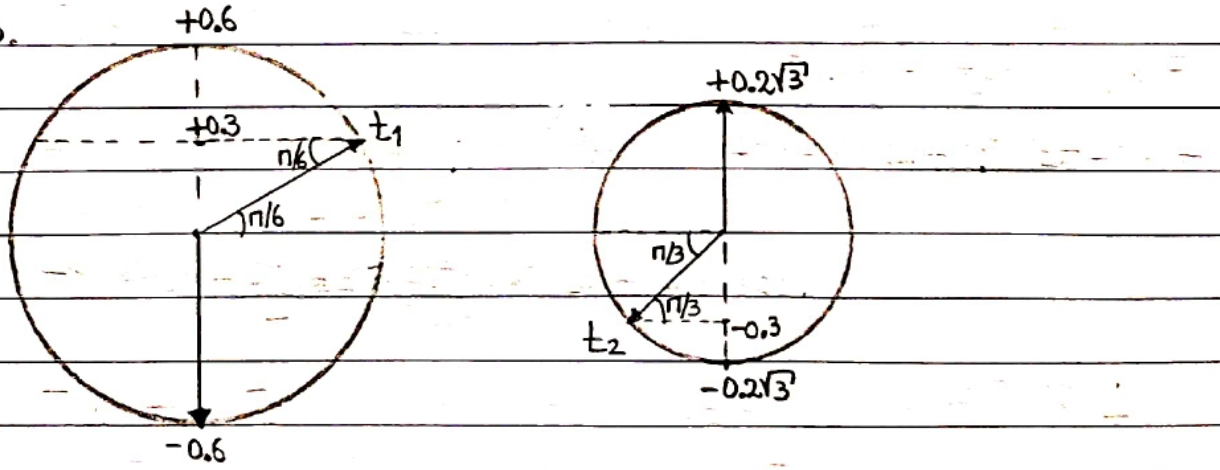
$d_2 = 0.2\sqrt{3}m$ $(\overset{+}{\rightarrow})$ κ' $v_0 = 0$ $\Rightarrow$ $A_2 = d_2 = 0.2\sqrt{3}\ m$

Δ2. Είναι $\phi_{01} = \frac{3\pi}{2}\ r$ κ' $\phi_{02} = \frac{\pi}{2}\ r$ επομένως:

$x_1 = 0.6 \cdot \eta\mu(4t + 3\pi/2)$ (1α) , $v_1 = 2.4 \cdot \sigma\upsilon\nu(4t + 3\pi/2)$ (1β) $\}$ (SI)

$x_2 = 0.2\sqrt{3} \cdot \eta\mu(5t + \pi/2)$ (2α) , $v_2 = \sqrt{3} \cdot \sigma\upsilon\nu(5t + \pi/2)$ (2β)

Δ3.



$t_1 = \frac{T_1}{4} + \frac{T_1}{12} = \frac{T_1}{3} = \frac{2\pi}{12}\ sec$, $t_2 = \frac{T_2}{4} + \frac{2T_2}{12} = \frac{5 \cdot T_2}{12} = \frac{2\pi}{12}\ sec$

άρα $t_1 = t_2 = 2\pi/12\ sec = \pi/6\ sec. = t_{κρ}$.

Δ4. Την $t_{κρ} = \frac{\pi}{6}$ sec έχουμε:

(1Β): $v_1 = 2.4\,συν\left(\frac{4\pi}{6} + \frac{3\pi}{2}\right) = 2.4 \cdot συν\left(\frac{13\pi}{6}\right) \Rightarrow$

$v_1 = 2.4\,συν\left(2\pi + \frac{\pi}{6}\right) \Rightarrow v_1 = 1.2\sqrt{3}$ m/s (→).

(2Β): $v_2 = \sqrt{3} \cdot συν\left(\frac{5\pi}{6} + \frac{\pi}{2}\right) = \sqrt{3} \cdot συν\left(\frac{4\pi}{3}\right) \Rightarrow$

$v_2 = \sqrt{3} \cdot συν\left(\pi + \frac{\pi}{3}\right) \Rightarrow v_2 = -0.5\sqrt{3}$ (←).

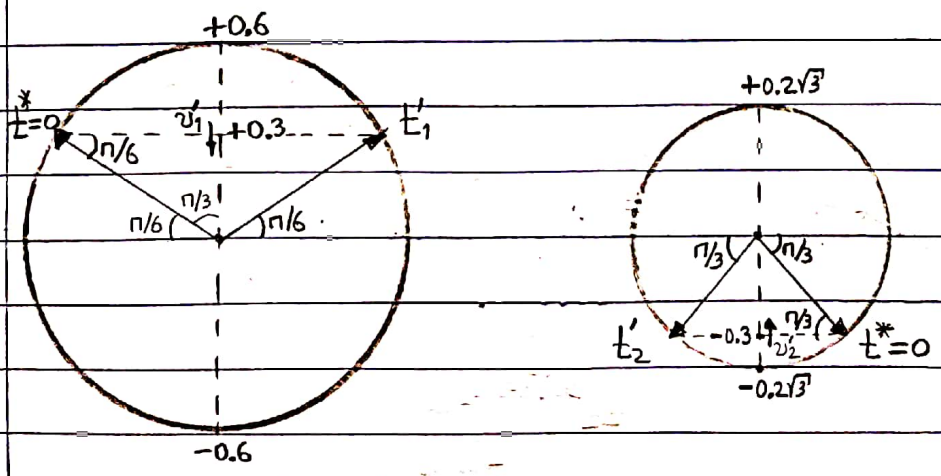
Ελαστική κρούση: $v_1' = \frac{2m_2 \cdot v_2 + (m_1 - m_2) \cdot v_1}{m_1 + m_2} \Rightarrow$

$\Rightarrow v_1' = \frac{-12 \cdot \sqrt{3} + (-7) \cdot 1.2\sqrt{3}}{17} \frac{m}{s} \Rightarrow v_1' = -1.2\sqrt{3}$ m/s. (←)

Κ' $v_1 + v_1' = v_2 + v_2' \Rightarrow (+1.2\sqrt{3} - 1.2\sqrt{3})$ m/s $= -0.5\sqrt{3}$ m/s $+ v_2' \Rightarrow$

$\Rightarrow v_2' = +0.5\sqrt{3}$ m/s (→).

Δ5. Έχουμε $|v_1'| = |v_1| \Rightarrow A_1 = 0.6$ m
και $|v_2'| = |v_2| \Rightarrow A_2 = 0.2\sqrt{3}$ m } δεν αλλάζουν



$t_1' = \frac{T_1}{2} + \frac{T_1}{6} = \frac{2T_1}{3} = \frac{\pi}{3}$ sec Κ' $t_2' = \frac{T_2}{2} + \frac{T_2}{3} = \frac{5 \cdot T_2}{6} = \frac{\pi}{3}$ sec

$t_1' = t_2' = \frac{\pi}{3}$ sec $= t_{κρ}'$