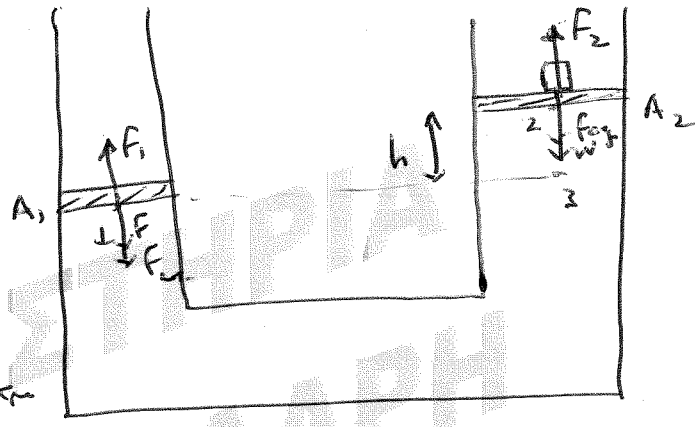
ΘΕΜΑ Α — ΑΡΧΑΙΜΗΔΗΣ (ΠΑΛΑΙΟ ΣΥΣΤΗΜΑ)

A_1) β , A_2) γ , A_3) α A_4) α

A_5) Σ , Λ , Λ , Λ , Σ

B_1) Ισχύει $P_1 = P_3 \hookrightarrow$



$P_1 = P_2 + \rho g h$ (1)

Εμβ 1: $\Sigma f = 0 \Rightarrow F_1 = f + f_{ατμ}$

$P_1 = \frac{f}{A_1} + P_{ατμ}$ (2)

Εμβ 2: $\Sigma f = 0 \rightarrow F_2 = f_{ατμ} + w \hookrightarrow P_2 = P_{ατμ} + \frac{w}{A_2}$ (3)

(1) (2) (3) $\Leftrightarrow \frac{F}{A_1} + P_{ατμ} = P_{ατμ} + \frac{w}{A_2} + \rho g h \hookrightarrow$

$\Rightarrow \frac{F}{A_1} = \frac{w + \rho g h A_2}{A_2}$ Ως προς το (ii)

B.2)

x_1 ενίσχυση

$x_2 = x_1 + 4cm$ απόσβεση

$r_B - r_A = N\lambda$ (1)

$r_B' - r_A = (2N+1)\frac{\lambda}{2}$ (2)

(2) − (1) $\quad r_B' - r_A - r_B + r_A = (2N+1)\frac{\lambda}{2} - N\lambda$

$(r_B + 2\Delta x) - r_B = N\lambda + \frac{\lambda}{2} - N\lambda \Rightarrow 2(x_2 - x_1) = \frac{\lambda}{2} \Rightarrow$

$\Rightarrow 2 \cdot 4 = \frac{\lambda}{2} \Rightarrow \boxed{\lambda = 16\,cm}$ Σωστό το ii

Β3 iii

Πρώτη κρούση: $U_1' = \frac{m_1 - m_2}{m_1 + m_2} U_1$, $U_2' = \frac{2m_1 U_1}{m_1 + m_2}$

$$\Pi_1\% = \frac{\Delta K_2}{K_{1\alpha\rho\chi}} \cdot 100\% = \frac{\frac{1}{2} m_2 U_2'^2}{\frac{1}{2} m_1 U_1^2} \cdot 100\% = \frac{m_2 \frac{4 m_1^2 U_1^2}{(m_1+m_2)^2}}{m_1 U_1^2} \cdot 100\%$$

$$\Pi_1\% = \frac{4 m_1 m_2}{(m_1+m_2)^2} 100\%$$

Δεύτερη κρούση: $U_2' = \frac{m_2 - m_1}{m_1 + m_2} U_2$, $U_1' = \frac{2 m_2 U_2}{m_1 + m_2}$

$$\Pi_2\% = \frac{\Delta K_1}{K_{2\alpha\rho\chi}} \cdot 100\% = \frac{\frac{1}{2} m_1 U_1'^2}{\frac{1}{2} m_2 U_2^2} \cdot 100\% = \frac{m_1 \frac{4 m_2^2}{(m_1+m_2)^2} \cdot U_2^2}{m_2 U_2^2} \cdot 100\%$$

$$\Pi_2\% = \frac{4 m_1 m_2}{(m_1+m_2)^2} \cdot 100\%$$

$$\frac{\Pi_1}{\Pi_2} = \frac{\frac{4 m_1 m_2}{(m_1+m_2)^2} \cdot 100\%}{\frac{4 m_1 m_2}{(m_1+m_2)^2} \cdot 100\%} \Rightarrow \frac{\Pi_1}{\Pi_2} = 1 \Rightarrow \Pi_1 = \Pi_2$$ (iii)

ΘΕΜΑ Γ

$m_1 = 1kg$

$\theta = 30^\circ$

$k = 100 N/m$

$h = 0,6 m$

$m_2 = 3kg$

Γ1) $\upsilon_{\sigma\upsilon\sigma} = ;$

Γ2) $A = ;$

Γ3) $x(t)$

Γ4) $K = 8U$

2η φορά

$\frac{|F_{\varepsilon\lambda}|}{|\Sigma F|} = ;$

$g = 10 m/s^2$

⊙ $\upsilon = 0$

$(U=0)$ ---- ⊙ ↓ υ_2

Γ1) ΑΔΜΕ

$K_A + U_A = K_T + U_T$

$mgh = \frac{1}{2} m \upsilon_2^2$

$\boxed{\upsilon_2 = 2\sqrt{3}\ m/s}$

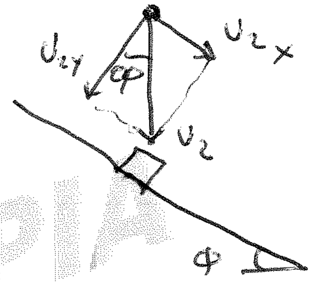
ΑΔΟ (Άξονας x)

$\vec{P}_2 + \vec{P}_1 = \vec{P}_{\sigma\upsilon\sigma}$

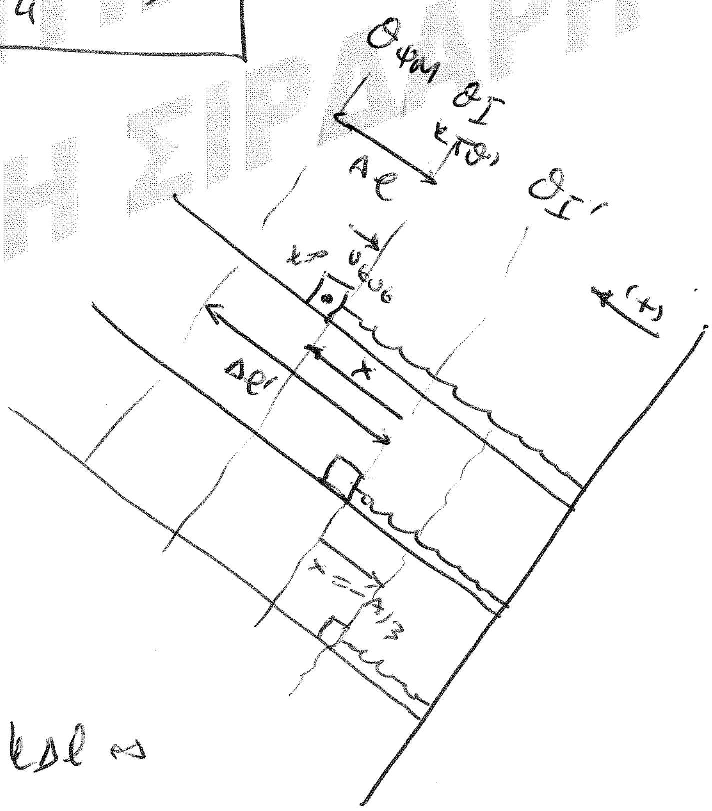
$m_2 \upsilon_{2x} = (m_1 + m_2)\upsilon_{\sigma\upsilon\sigma}$

$m_2 \upsilon_2 \cdot \eta\mu\varphi = (m_1 + m_2)\upsilon_{\sigma\upsilon\sigma}$

$\boxed{\upsilon_{\sigma\upsilon\sigma} = \frac{3\sqrt{3}}{4}\ m/s}$



Γ2)



ΘΙ: $\Sigma F = 0 \Leftrightarrow$

$w_{1x} = F_{\varepsilon\lambda} \Leftrightarrow m_1 g\,\eta\mu\varphi = k\Delta\ell \Leftrightarrow$

$\boxed{\Delta\ell = 0,05 m}$

ΘΙ': $\Sigma F = 0 \Leftrightarrow (m_1 + m_2) g\,\eta\mu\varphi = k\Delta\ell' \Leftrightarrow \boxed{\Delta\ell' = 0,2 m}$

Αρα $x = \Delta l' - \Delta l \mapsto \boxed{x = 0,15\,m}$

$E = K + U \Rightarrow \frac{1}{2} K A^2 = \frac{1}{2}(m_1 + m_2)\omega^2 + \frac{1}{2} K x^2 \Rightarrow$

$\mapsto \boxed{A = 0,3\,m.}$

(3) $K = (m_1 + m_2)\omega^2 \mapsto \omega = 5\,rad/s$

Ισχύει ότι $t = 0$, $x = 0,15\,m = \frac{A}{2}$, $v < 0$.

$x = A\eta\mu(\omega t + \phi_0)$, $t = 0$, $x = \frac{A}{2}$ $\Big\} \quad \frac{A}{2} = A\eta\mu\phi_0 \dashrightarrow \eta\mu\phi_0 = \eta\mu\frac{\pi}{6}$

$\phi_0 = 2k\pi + \frac{\pi}{6} \overset{k=0}{\mapsto} \phi_0 = \frac{\pi}{6}$ αποδ.

$\phi_0 = 2k\pi + \frac{5\pi}{6} \overset{k=0}{\mapsto} \phi_0 = \frac{5\pi}{6}$ δεκτό

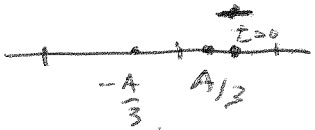
άρα $x = 0,3\,\eta\mu(5t + \frac{5\pi}{6})$ (SI).

(4) $K = 8U \mapsto E - U = 8U \mapsto E = 9U \mapsto$

$\frac{1}{2} K A^2 = 9 \cdot \frac{1}{2} K x^2 \mapsto x = \pm \frac{A}{3}$

1η φορά $x = A/3$

2η φορά $x = -A/3$



$\left|\frac{F_{ελ}}{\Sigma F}\right| = \frac{K(\Delta l' + A/3)}{|-K \cdot (-\frac{A}{3})|} = \frac{0,3}{0,1} = 3.$ ΣΩ

ΘΕΜΑ Δ

$M_1 = 6kg$

$m = 1kg$.

$r = 0,1m$.

$L = 1m$

$R = 2,8m$.

$\eta\mu\varphi = 0,6$

$\sigma\upsilon\nu\varphi = 0,8$

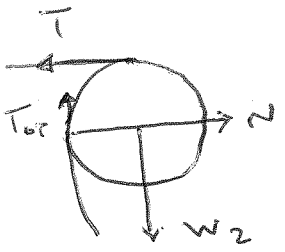
Δ1) $T = ;$

$M_2 = ;$

Δ2) $a_{\gamma\omega\nu} = ;$

Δ3)

Δ1) i) Δίσκος



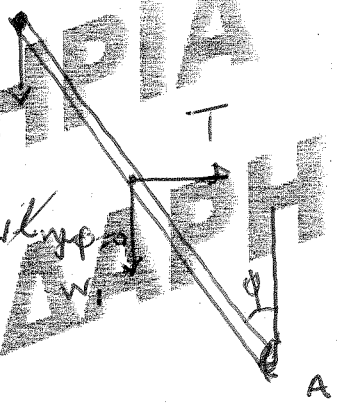
$\Sigma\tau_{(O)} = 0 \curvearrowright$

$TR - T_{\delta\tau}R = 0 \curvearrowright$

$T = T_{\delta\tau}$ (1)

$\Sigma F_y = 0 \curvearrowright W_2 = T_{\delta\tau} \Rightarrow W_2 = T$ (2)

Ράβδος



$\Sigma\tau_{(A)} = 0 \Rightarrow$

$\tau_{W_1} + \tau_{W} + \tau_{T} = 0$

$T \cdot \frac{\ell}{2}\sigma\upsilon\nu\varphi - W_1 \frac{\ell}{2}\eta\mu\varphi - W\ell\eta\mu\varphi = 0$

$T \frac{1}{2} 0,8 - 60 \cdot \frac{1}{2} 0,6 - 10 \cdot 0,6 = 0$

$\Rightarrow 0,4T - 18 - 6 = 0 \Leftrightarrow \boxed{T = 60N}$

ii) (2) $M_2 g = T \curvearrowright \boxed{M_2 = 6kg.}$

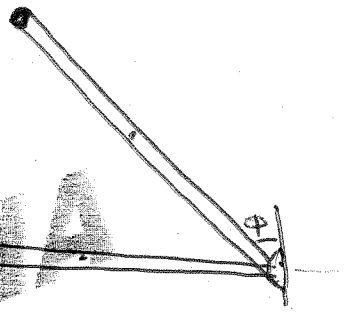
Δ2) $I_{\delta\tau} = I_p + I_m = \frac{1}{3}M_1L^2 + mL^2 \Rightarrow I_{\delta\tau} = 3\,kg\,m^2$.

$\Sigma\tau = I\,a_{\gamma\omega\nu} \Rightarrow mg \cdot L\eta\mu\varphi + M_1 g \frac{L}{2}\eta\mu\varphi = I_{\delta\tau}\,a_{\gamma\omega\nu} \curvearrowright$

$\Rightarrow 10 \cdot 0,6 + 60 \cdot \frac{0,6}{2} = 3\alpha_{\gamma\omega} \hookrightarrow$

$\Rightarrow 24 = 3\alpha_{\gamma\omega} \hookrightarrow \boxed{\alpha_{\gamma\omega} = 8\ rad/s^2}$

Δ_3) ΑΑΜΕ



$K_A^{\nearrow 0} + U_A = K_T + U_C^{\nearrow 0}$

$m_1 g \cdot l \cos\phi + M_1 g \frac{l}{2} \cos\phi = \frac{1}{2} I_{ολ} \cdot \omega^2 \quad (U=0)$

$10 \cdot 0,8 + 60 \cdot 0,4 = \frac{1}{2} 3 \cdot \omega^2 \rightarrow 8 + 24 = \frac{1}{2} 3\omega^2 \hookrightarrow$

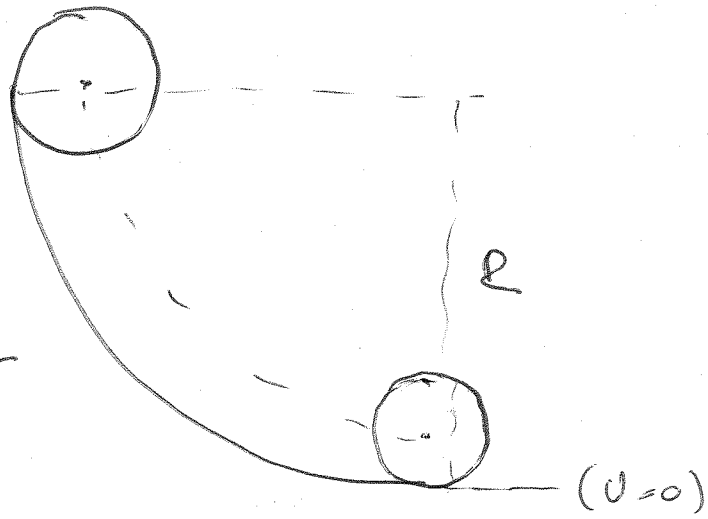
$\omega = \frac{8}{\sqrt{3}} \hookrightarrow \boxed{\omega = 8\frac{\sqrt{3}}{3}\ rad/s}$

$L_T = I\omega \hookrightarrow \boxed{L_T = 8\sqrt{3}\ kg m^2/s}$

$\Delta L = L_T - L_{ΑΡΧ}^{\nearrow 0} \Rightarrow \boxed{|\Delta L| = 8\sqrt{3}\ kg m^2/s}$

ii) Φορα προς τα εξω ⊙

Δ4) ΑΔΜΕ



$\cancel{K_A}^{\,0} + U_A = K_\Phi + U_\Gamma$

$M_2 g R = \frac{1}{2} I \omega^2 + \frac{1}{2} M_2 U_{cm}^2 + M_2 g r$

$M_2 g R = \frac{1}{2}\cdot\frac{1}{2} M_2 r^2 \frac{U_{cm}^2}{r^2} + \frac{1}{2} M_2 U_{cm}^2 + M_2 g r$

$gR = \frac{1}{4} U_{cm}^2 + \frac{1}{2} U_{cm}^2 + gr \leftrightarrow g(R-r) = \frac{3}{4} U_{cm}^2$

$\leftrightarrow U_{cm} = \sqrt{\frac{4g(R-r)}{3}} \leftrightarrow U_{cm} = \sqrt{\frac{4\cdot 10 \cdot 2,7}{3}} \rightarrow \boxed{U_{cm} = 6\,m/s}$

Δ5) i)

$N = \frac{S_{cm}}{2\pi r} = \frac{\frac{2\pi(R-r)}{4}}{2\pi r} = \frac{R-r}{4r} = \frac{2,7}{0,4} = \frac{27}{4}$ περ.

ii) $N = \frac{\theta}{2\pi} = \frac{\omega \cdot t}{2\pi}$ (3)

Σύνολο $\Sigma F_x = 0 \Rightarrow U = 6\pi\vartheta$ | $S = U_{cm} t \rightarrow \boxed{t = \frac{\eta}{6} s}$

$\Sigma \tau = 0 \Rightarrow \omega = 6\pi\vartheta$ | $\omega = \frac{U_{cm}}{r} = \frac{6}{0,1} = 60\ rad/s$

(3) $N = \frac{60 \cdot \frac{\pi}{6}}{2\pi} \leftrightarrow \boxed{N = 5\ \text{περ.}}$

Αγωνίσου

Καλή

ΣΥΝΕΧΕΙΑ