(1)

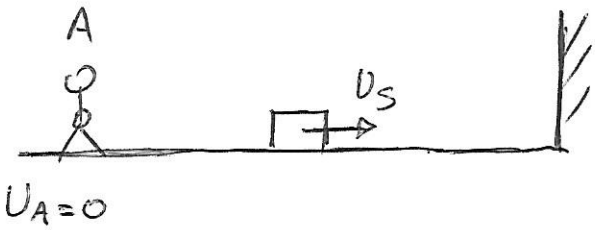
ΘΕΜΑ Α

Α1	β	Α3	β	Α5	α Σ
Α2	γ	Α4	δ		β Λ
					γ Σ
					δ Λ
					ε Λ

Β. ΘΕΜΑ

Β1

(i i i)



$$U_S = \frac{U_{ηχ}}{10}$$

$$f_1 = \frac{U_{ηχ}}{U_{ηχ} + U_S} f_S \Rightarrow f_1 = \frac{U_{ηχ}}{U_{ηχ} + \frac{U_{ηχ}}{10}} f_S \Rightarrow f_1 = \frac{U_{ηχ}}{\frac{11U_{ηχ}}{10}} f_S \Rightarrow$$

$$\boxed{f_1 = \frac{10}{11} f_S}$$

$$f_2 = \frac{U_{ηχ}}{U_{ηχ} - U_S} f_S \Rightarrow f_2 = \frac{U_{ηχ}}{U_{ηχ} - \frac{U_{ηχ}}{10}} f_S \Rightarrow f_2 = \frac{U_{ηχ}}{\frac{9U_{ηχ}}{10}} f_S$$

$$\boxed{f_2 = \frac{10}{9} f_S}$$

$$\frac{f_1}{f_2} = \frac{\frac{10}{11} f_S}{\frac{10}{9} f_S} \Rightarrow \boxed{\frac{f_1}{f_2} = \frac{9}{11}}$$

Β2 | σωστό (i)

$$A'_M = \left| 2A \sigma\upsilon\nu 2\pi \frac{\frac{9\lambda}{8}}{\lambda} \right| = \left| 2A \sigma\upsilon\nu \frac{\pi 9\lambda}{4\lambda} \right| \Rightarrow$$

$$A'_M = \left| 2A \sigma\upsilon\nu \frac{9\pi}{4} \right| \Rightarrow A'_M = 2A \frac{\sqrt{2}}{2} \Rightarrow \underline{A'_M = A\sqrt{2}}$$

$$U_{max} = \omega |A'_M| = \frac{2\pi}{T} A\sqrt{2} \Rightarrow \boxed{U_{max} = \frac{2\sqrt{2}\pi A}{T}}$$

Β3 | σωστό (ii)

$$\Pi_A = \Pi_B \Rightarrow A_A U_A = A_B \cdot U_B \Rightarrow$$

$$2A_B \cdot U_A = A_B U_B \Rightarrow \underline{U_B = 2U_A}$$

Θέτουμε: $\frac{1}{2}\rho U_A^2 = \Lambda$

και $\frac{1}{2}\rho U_B^2 = \frac{1}{2}\rho (2U_A)^2 = \frac{1}{2}\rho 4U_A^2 = 4\Lambda$

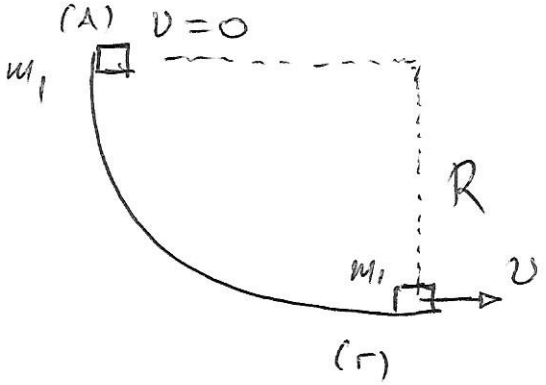
$$P_A + \frac{1}{2}\rho U_A^2 = P_B + \frac{1}{2}\rho U_B^2 \Rightarrow$$

$$P_A + \Lambda = P_B + 4\Lambda \Rightarrow$$

$$\boxed{P_A - P_B = 3\Lambda}$$

ΘΕΜΑ Γ

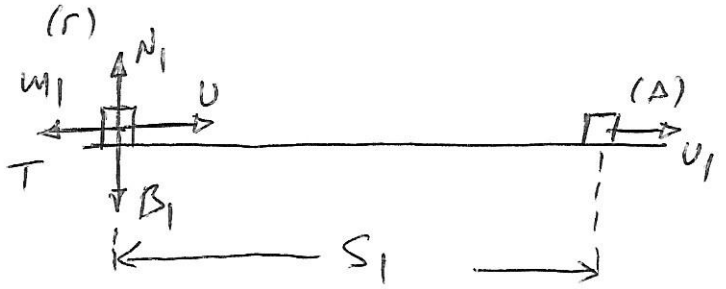
Γ1



Α.Δ.Μ.Ε $\frac{1}{2}m_1\upsilon^2 = m_1 \cdot g R \Rightarrow \upsilon = \sqrt{2 \cdot 10 \cdot 5} \Rightarrow$

$\upsilon = 10\ m/sec$

Γ2

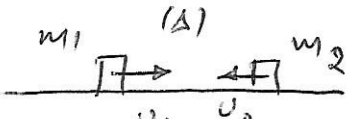


$T = \mu \cdot N_1 = \mu \cdot B_1 = \mu m_1 g$

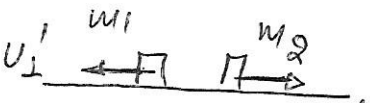
ΘΜΚΕ απ: (Γ) μ.χ.ρ. (Δ)

$\frac{1}{2}m_1\upsilon_1^2 - \frac{1}{2}m_1\upsilon^2 = -T \cdot S_1 \Rightarrow \frac{1}{2}m_1\upsilon_1^2 - \frac{1}{2}m_1\upsilon^2 = -\mu \cdot m_1 g \cdot S_1$

$\ldots\ldots\ldots \boxed{\upsilon_1 = 8\ m/sec}$



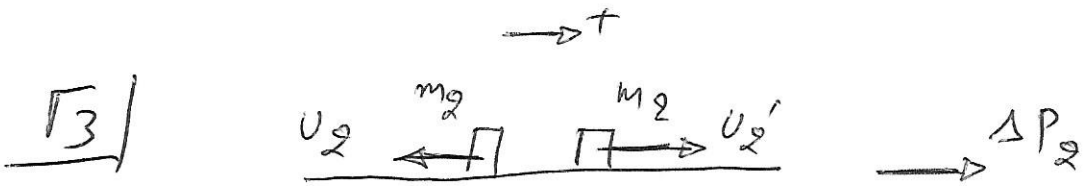
ΠΡΙΝ



ΜΕΤΑ

$\upsilon_1' = \frac{(m_1 - m_2)\upsilon_1 + 2m_2\upsilon_2}{m_1 + m_2} \Rightarrow$ $\upsilon_2 = -4\ m/s$ $\ldots\ldots \upsilon_1' = -10\ m/s$

$\upsilon_2' = \frac{2m_1\upsilon_1 + (m_2 - m_1)\upsilon_2}{m_1 + m_2} \Rightarrow$ $\upsilon_2 = -4\ m/s$ $\ldots\ldots \upsilon_2' = 2\ m/s$



[3]

$$\Delta \vec{P}_2 = \vec{P}_{\text{cel}} - \vec{P}_{\text{apx}} \Rightarrow \dots$$

$$\Delta P_2 = 16 \text{ kgr m/sec}$$

[4]

$$K_{\text{prin}} = \frac{1}{2} m_1 v_1^2 = \frac{1}{2} m_1 8^2 = 32 m_1$$

$$K_{\text{meta}} = \frac{1}{2} m_1 v_1'^2 = \frac{1}{2} m_1 (-10)^2 = 50 m_1$$

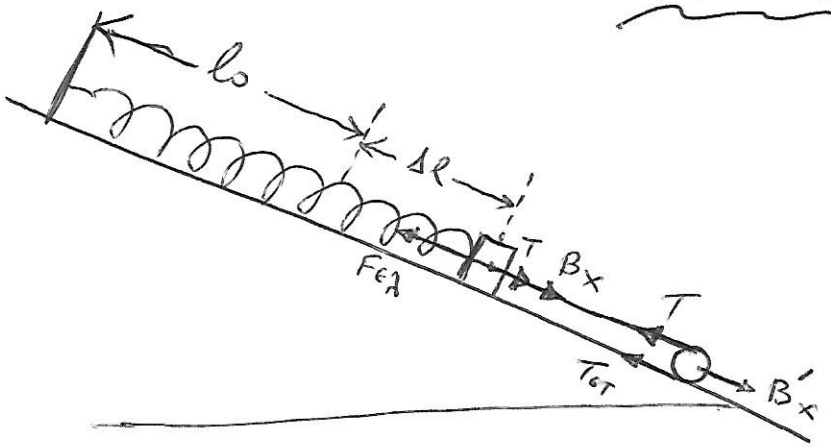
$$\Delta K(\%) \quad \frac{\Delta K}{K_{\text{prin}}} \; 100\% \Rightarrow$$

$$\Delta K(\%) = \frac{18 m_1}{32 m_1} 100\% \Rightarrow \dots$$

$$\Delta K = 56{,}25\%$$

ΘΕΜΑ Δ

Δ4



Κύλινδρος: $\Sigma\tau = 0 \Rightarrow T_{ΘΤ}\cdot R - T R = 0 \Rightarrow T_{ΘΤ} = T$ (1)

$\Sigma F_x = 0 \Rightarrow T + T_{ΘΤ} = B'_x \xrightarrow{(1)}$

$2T = Mg\eta\mu 30^\circ \Rightarrow \ldots \quad \underline{T = 5\,N}$

Σώμα Μ: $B_x = mg\eta\mu\phi = 5\,N$

$\Sigma F_x = 0 \Rightarrow B_x + T = F_{ελ} \Rightarrow l_0 = K\cdot\Delta l \Rightarrow$

$$\boxed{\Delta l = 0{,}1\,m}$$

Δ2 Νέα θέση ισορροπίας για $\alpha = 0$ το Μ

$\Sigma F'_x = 0 \Rightarrow K\Delta l' = B_x \Rightarrow \ldots \quad \Delta l' = 0{,}05\,m$

$K = m\omega^2 \Rightarrow \ldots \quad \omega = 10\,rad/sec$

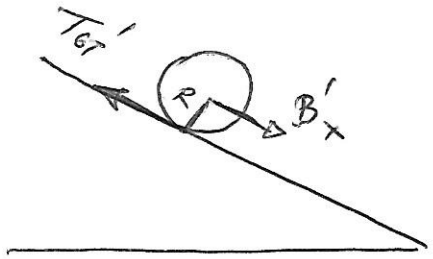
Το σώμα ξεκινά ταλάντωση από $X = -A$

άρα $\phi_{0\pi} = 3\pi/2$ και $\Delta l' = A$

Άρα $x = 0{,}05\,\eta\mu(10t + 3\pi/2)$

$\Sigma F_{επ} = -D x \Rightarrow \Sigma F_{επ} = -5\,\eta\mu\left(10t + \frac{3\pi}{2}\right)$ S.I.

Δ3



$$\Sigma F_x = m a_{cm} \Rightarrow Mg\sin\varphi - T_{GT}' = M a_{cm} \quad (1)$$

$$\Sigma \tau = I \cdot \alpha_{yw} \Rightarrow T_{GT}' R = \frac{1}{2} M R^2 \cdot \alpha_{yw} \Rightarrow$$

$$T_{GT}' = \frac{1}{2} M a_{cm} \quad (2)$$

מ(1) ו(2)

$$\boxed{a_{cm} = \frac{10}{3}\ m/sec^2}$$

$$a_{yw} = \frac{a_{cm}}{R} \Rightarrow a_{yw} = \frac{100}{3}\ rad/sec^2$$

$$\theta = N \cdot 2\pi = 24\ rad \quad \text{ו}\quad x = \theta \cdot R = 2,4\ m$$

$$x = \frac{1}{2} a_{cm} t^2 \Rightarrow 2,4 = \frac{1}{2}\frac{10}{3} t^2 \Rightarrow \dots \quad t = 1,2\ sec$$

$$v = a_{cm} t \Rightarrow v = \frac{10}{3} \cdot 1,2 \Rightarrow v = 4\ m/sec$$

$$v = \omega \cdot R \Rightarrow 4 = \omega\, 0,1 \Rightarrow \omega = 40\ rad/s.$$

ומ $L = I\omega \Rightarrow \dots \quad L = 0,4\ Kg\ m^2/sec$

Δ4

$$\left(\frac{\Delta K}{\Delta t}\right)_{0} = \left(\frac{\Delta K}{\Delta t}\right)_{net} + \left(\frac{\Delta K}{\Delta t}\right)_{GR} = \Sigma \tau \cdot \omega + \Sigma f \cdot v_{cm}$$

$$\Rightarrow \dots \quad \left(\frac{\Delta K}{\Delta t}\right) = 100\ J/sec$$