ΘΕΜΑ Δ

Δ1) Για m_2 που ισορροπεί:

$$\Sigma \vec{F} = \vec{0} \Rightarrow T_2 = w_2 \Rightarrow T_2 = m_2 \cdot g \Rightarrow$$

$$T_2 = 30N$$

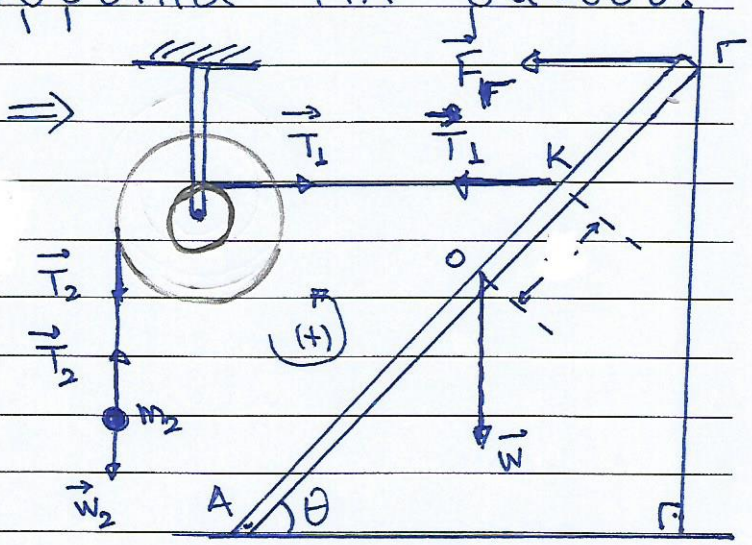
Για το στερεό που ισορροπεί:

$$\Sigma \vec{\tau}_{(K)} = \vec{0} \Rightarrow T_2 \cdot R = T_1 \cdot r \Rightarrow$$

$$T_2 \cdot 2r = T_1 \cdot r \Rightarrow T_1 = 60N$$

Για την ισορροπία της ράβδου:

$\Rightarrow$



$$\Sigma \vec{\tau}_{(A)} = \vec{0} \Rightarrow$$

$$F_\Gamma \cdot \ell \cdot \eta\mu 45^\circ + T_1 \cdot \left(\frac{\ell}{2} + d\right) \cdot \eta\mu 45^\circ - w \cdot \frac{\ell}{2} \cdot \sigma\upsilon 45^\circ = 0$$

$\left.\begin{matrix} T_1 = T_1' \\ T_2 = T_2' \end{matrix}\right\}$ νήμα αβαρές και μη εκτατό

$$F_F \cdot \ell \cdot \eta\mu 45^\circ + T_1 \cdot \left(\frac{\ell}{2} + \frac{\ell}{6}\right) \cdot \eta\mu 45^\circ = w \cdot \frac{\ell}{2} \cdot \sigma\upsilon 45^\circ \Rightarrow$$

$$F_F \cdot \ell \cdot \eta\mu 45^\circ + T_1 \cdot \frac{4\ell}{6} \cdot \eta\mu 45^\circ = w \cdot \frac{\ell}{2} \cdot \sigma\upsilon 45^\circ \Rightarrow$$

$$F_T = \frac{w}{2} - \frac{2T_1}{3} \Rightarrow$$

$$F_L = 50 - 40 \Rightarrow F_T = 10\,N$$

Αρ) $\Theta\Sigma_{w_1}$: $\Sigma\vec{F} = \vec{0} \Rightarrow F_{\epsilon\lambda} = w_{1x} \Rightarrow$

$$k \cdot \Delta l_1 = m_1 \cdot g \cdot \eta\mu\varphi \Rightarrow \Delta l_1 = \frac{m_1 g \eta\mu\varphi}{k} \Rightarrow$$

$$\Delta l_1 = 0,05\,m$$

$N.\Theta.\Sigma_{(m_1+m_2)}$: $\Sigma\vec{F} = \vec{0} \Rightarrow F'_{\epsilon\lambda} = w_{1,2,x} \Rightarrow$

$$k \cdot \Delta l_{1,2} = (m_1 + m_2) g \cdot \eta\mu\varphi \Rightarrow$$

$$\Delta l_{1,2} = \frac{(m_1 + m_2) g \eta\mu\varphi}{k} \Rightarrow \Delta l_{1,2} = 0,2\,m$$

$$x = \Delta l_{1,2} - \Delta l_1 \Rightarrow x = 0,15\,m$$

Εφαρμόζω ΑΔΕΤ για το συσσωμάτωμα:

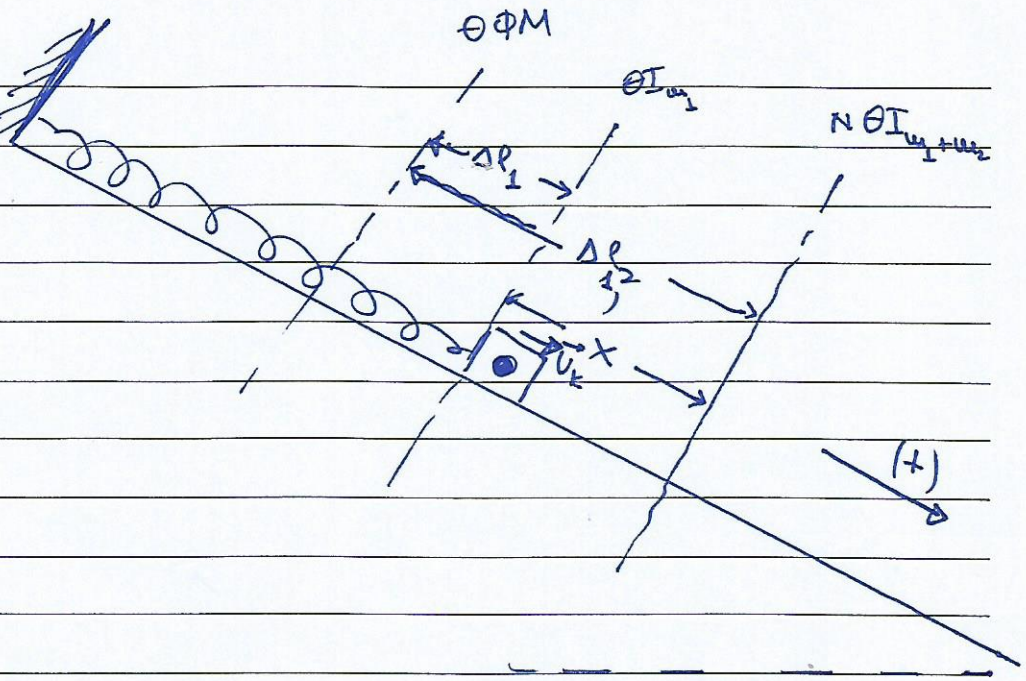
$$E_T = K + U \Rightarrow$$

$$\frac{1}{2} k A^2 = \frac{1}{2}(m_1 + m_2) U_K^2 + \frac{1}{2} k x^2 \Rightarrow$$

$$100 \cdot A^2 = 4 \cdot \left(\frac{3\sqrt{3}}{4}\right)^2 + 100 \cdot 0,15^2 \Rightarrow$$

$$100\,A^2 = \frac{27}{4} + \frac{9}{4} \Rightarrow A = 0,3\,m$$

Δ_3)



Για $t=0$, $x=-0,15\,m$ οπότε:

$x = A\cdot ημ(\omega t+\varphi_0) \Rightarrow$

$-0,15 = 0,3\, ημ\varphi_0 \Rightarrow ημ\varphi_0 = -\frac{1}{2} \Rightarrow$

$\varphi_0 = 2κπ - \frac{π}{6}$ ή $\varphi_0 = 2κπ + π + \frac{π}{6}$ $κ\in\mathbb{N}$

$κ=1$

$\varphi_0 = \frac{11π}{6}\,rad$ ή $\varphi_0 = \frac{7π}{6}\,rad$

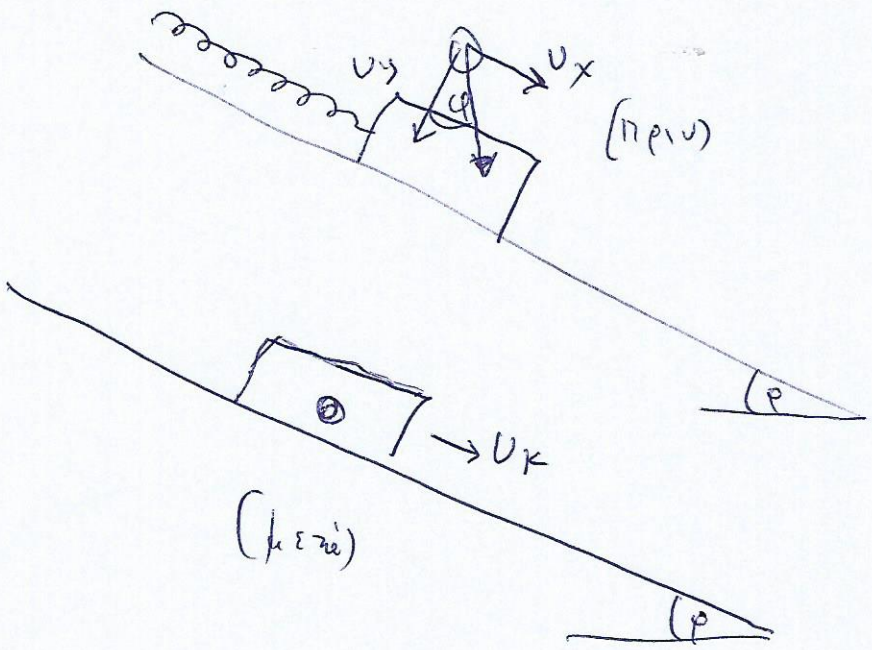
Επειδή $υ_κ>0$ και $\cos\frac{11π}{6}>0$ είναι:

$\varphi_0 = \frac{11π}{6}\,rad$

$\omega = \sqrt{\frac{k}{m_1+m_2}} \Rightarrow \omega = 5\,rad/s$

$x = 0,3\, ημ\left(5t+\frac{11π}{6}\right)\ (SI)$

Δ4|

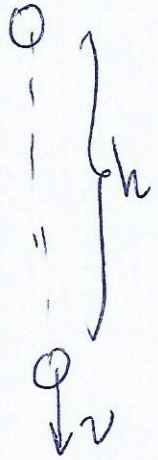


Α.Δ.Ο x'x

$$m_2 \cdot \upsilon_x = (m_1 + m_2) \cdot \upsilon_K \Rightarrow$$

$$m_2 \cdot \upsilon \cdot \sin\varphi = (m_1 + m_2) \cdot \upsilon_K \Rightarrow \upsilon = 2\sqrt{3}\ m/s$$

Θ.Μ.Κ.Ε για Σ2

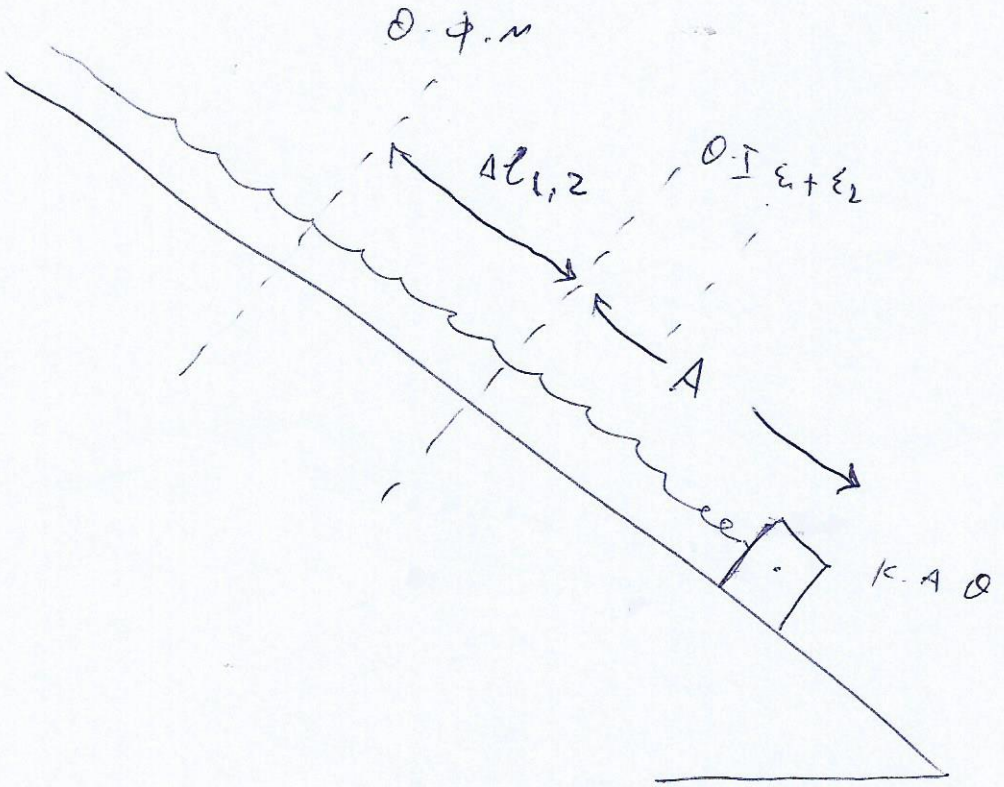


$$K_{τελ} - K_{αρχ} = W_{βαρους}$$

$$\frac{1}{2} m_2 \upsilon^2 - 0 = m_2 g h$$

$$h = \frac{\upsilon^2}{2g} \Rightarrow h = 0{,}6\ m$$

Α5



Σεν Θ.Ι ζωυ ε1+ε2

$$\Sigma F_x = 0 \Rightarrow (m_1 + m_2)\, g \cdot \mu_\kappa = K \cdot \Delta \ell_{1,2}$$

$$\Rightarrow \quad \Delta \ell_{1,2} = \frac{4 \cdot 10 \cdot \frac{1}{2}}{100} = 0,2\ m$$

$$\frac{F_{\varepsilon\lambda}}{F_{\varepsilon\sigma}} = \frac{K \cdot (\Delta \ell_{1,2} + A)}{K A} = \frac{0,2 + 0,3}{0,3} = \frac{5}{3}$$