Μοριοδότηση 2019

Ενδεικτικές απαντήσεις και από γραπτά μαθητών

Θέμα Α

A1 - β ⑤

A2 - γ ⑤

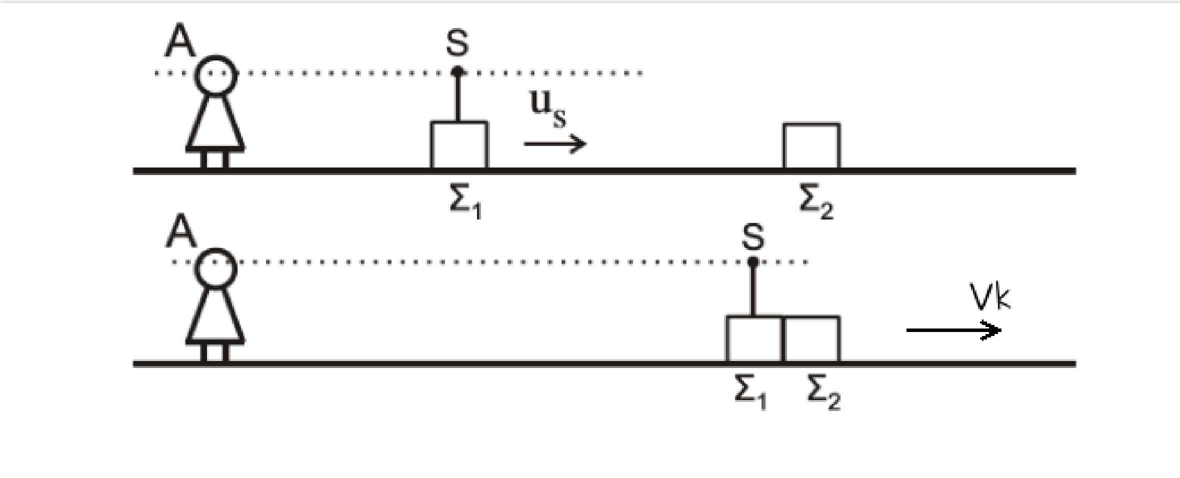
A3 - α ⑤

A4 - γ ⑤

A5: Λ – Σ – Λ – Σ – Σ ⑤

Θέμα Β

B1-(ii) ②



$$\Sigma\vec{F}_{\varepsilon\xi} = 0 \Rightarrow \text{Α.Δ.Ο.} \quad \vec{p}_{\pi\rho\iota\nu} = \vec{p}_{\mu\varepsilon\tau\alpha}$$

$$m \cdot u_s = (m+m)\cdot V_k \Rightarrow V_k = \frac{m \cdot u_s}{2 \cdot m} \Rightarrow V_k = \frac{u_H}{40}$$

$$f_1 = \frac{u_H}{u_H + u_s} \cdot f_s$$

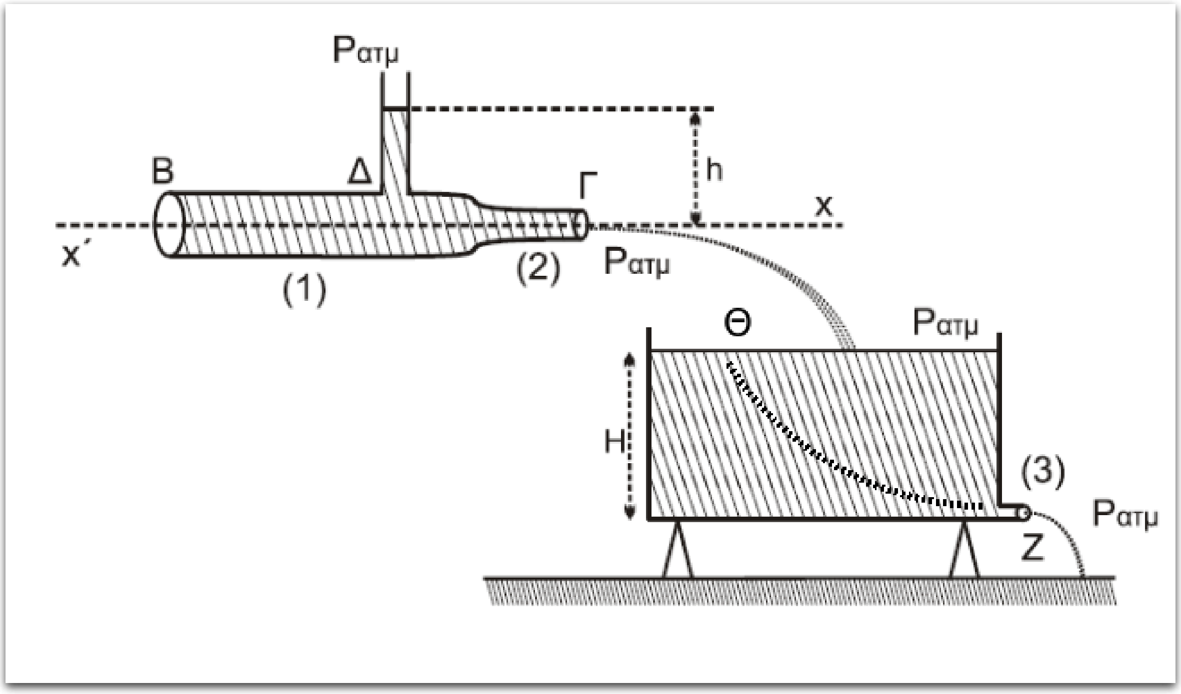
$$f_2 = \frac{u_H}{u_H + V_k} \cdot f_s$$

$$\frac{f_1}{f_2} = \frac{u_H + V_k}{u_H + u_s} = \frac{u_H + \frac{u_H}{40}}{u_H + \frac{u_H}{20}} = \frac{\frac{41u_H}{40}}{\frac{21u_H}{20}} = \frac{41}{42}$$

άρα σωστό το ii

Β2 - (iii)

②



Όταν σταθεροποιείται το ύψος στο δοχείο

$$\Pi_2 = \Pi_3 \Rightarrow A_2 \cdot \upsilon_2 = A_3 \cdot \upsilon_3 \overset{A_3 = \frac{A_2}{2}}{\Longrightarrow} \upsilon_2 = \frac{\upsilon_3}{2}$$

Εξίσωση Bernoulli για μια ρευματική γραμμή $(\Theta \rightarrow Z)$

$$P_\Theta + \frac{1}{2}\rho \cdot \upsilon_H^2 + \rho \cdot g \cdot h = P_Z + \frac{1}{2}\rho \cdot \upsilon_3^2 \Rightarrow P_{\alpha\tau\mu} + \rho \cdot g \cdot h = P_{\alpha\tau\mu} + \frac{1}{2}\rho \cdot \upsilon_3^2$$

$$\upsilon_3 = \sqrt{2 \cdot g \cdot H}$$

Εξίσωση συνέχειας $(\Delta \to \Gamma)$

$$\Pi_1 = \Pi_2 \Rightarrow A_1 \cdot \upsilon_1 = A_2 \cdot \upsilon_2 \xRightarrow{A_1=2A_2} \upsilon_2 = 2\upsilon_1$$

Εξίσωση Bernoulli για μια οριζόντια ρευματική γραμμή $(\Delta \to \Gamma)$

$$P_\Delta + \frac{1}{2}\rho \cdot \upsilon_1^2 = P_2 + \frac{1}{2}\rho \cdot \upsilon_2^2$$

$$P_\Delta = P_{\alpha\tau\mu} + \rho \cdot g \cdot h$$

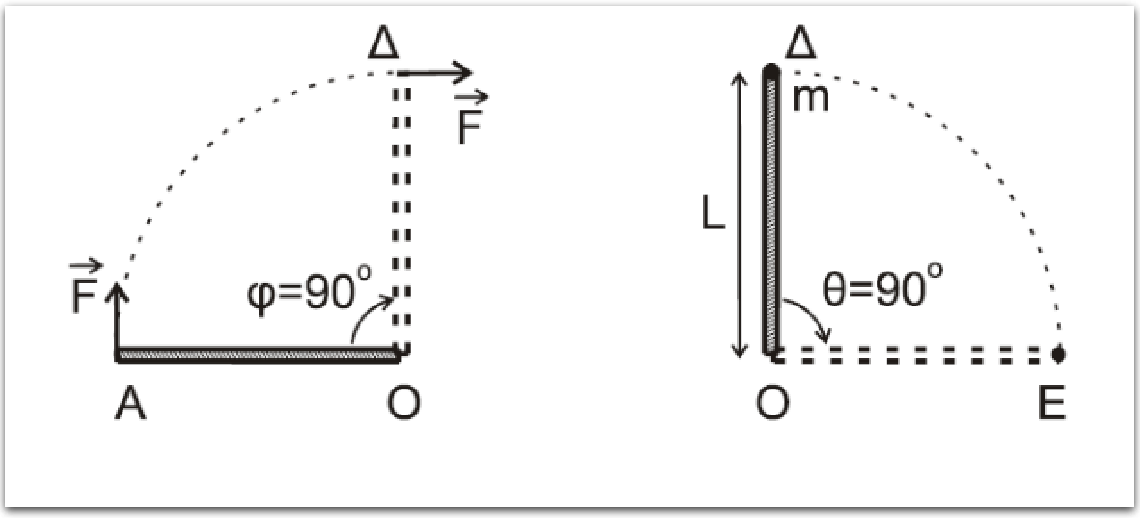
$$P_{\alpha\tau\mu} + \rho \cdot g \cdot h + \frac{1}{2}\rho \cdot \upsilon_1^2 = P_{\alpha\tau\mu} + \frac{1}{2}\rho \cdot \upsilon_2^2 \Rightarrow \rho \cdot g \cdot h = \frac{1}{2} \cdot (\upsilon_2^2 - \upsilon_1^2)$$

$$g \cdot h = \frac{3}{8} \cdot \upsilon_2^2 \xRightarrow{\upsilon_2=\frac{\upsilon_3}{2}} g \cdot h = \frac{3}{8} \cdot \frac{\upsilon_3^2}{4}$$

$$\upsilon_3^2 = \frac{32}{3} \cdot g \cdot h \xRightarrow{\upsilon_3=\sqrt{2\cdot g\cdot H}} 2 \cdot g \cdot H = \frac{32}{3} \cdot g \cdot h \Rightarrow \frac{h}{H} = \frac{3}{16}$$

άρα σωστό το iii

B3 - (ii)



α)τρόπος

$$\Sigma\tau = I \cdot \alpha_{\gamma\omega\nu} \Rightarrow F \cdot L = \frac{1}{3} \cdot M \cdot L^2 \cdot \alpha_{\gamma\omega\nu} \Rightarrow \alpha_{\gamma\omega\nu} = \frac{3F}{ML}$$

$$\varphi = \frac{1}{2} \cdot \alpha_{\gamma\omega\nu} \cdot t^2 \Rightarrow \frac{\pi}{2} = \frac{1}{2} \cdot \alpha_{\gamma\omega\nu} \cdot t_{A\Delta} \Rightarrow t_{A\Delta} = \sqrt{\frac{\pi \cdot M \cdot L}{3F}}$$

$$\omega = \alpha_{\gamma\omega\nu} \cdot t_{A\Delta} = \frac{3F}{ML} \cdot \sqrt{\frac{\pi \cdot M \cdot L}{3F}} \Rightarrow \omega = \sqrt{\frac{3 \cdot Fcdot\pi}{M \cdot L}} \Rightarrow \omega = 3\pi\frac{rad}{s}$$

β)τρόπος

$$\Theta MKE(A \rightarrow \Delta) \quad K_\Delta - K_A = \Sigma W_\tau \Rightarrow \frac{1}{2} \cdot I_\rho \cdot \omega^2 - 0 = \tau_F \cdot \theta$$

$$\frac{1}{2} \cdot I_\rho \cdot \omega^2 = F \cdot L \cdot \frac{\pi}{2} \Rightarrow \frac{M}{3} \cdot L^2 \cdot \omega^2 = F \cdot L \cdot \pi$$

$$\omega = \sqrt{\frac{3 \cdot F \cdot \pi}{M \cdot L}} = \sqrt{9 \cdot \pi^2}$$

$$\omega = 3\pi \frac{rad}{s}$$

$$\Sigma\tau_{\varepsilon\xi} = 0 \Rightarrow A.\Delta.\Sigma\tau\rho_0 \Rightarrow \vec{L}_{\pi\rho\iota\nu} = \vec{L}_{\mu\varepsilon\tau\acute{\alpha}} \Rightarrow I_\rho \cdot \omega = (I_\rho + m \cdot L^2) \cdot \omega_k$$

$$\frac{1}{3} \cdot M \cdot L^2 \cdot \omega = (\frac{1}{3} \cdot M \cdot L^2 + m \cdot L^2) \cdot \omega_k \Rightarrow \omega = 2 \cdot \omega_k \Rightarrow \omega_k = \frac{\omega}{2}$$

Ομαλή στροφική κίνηση

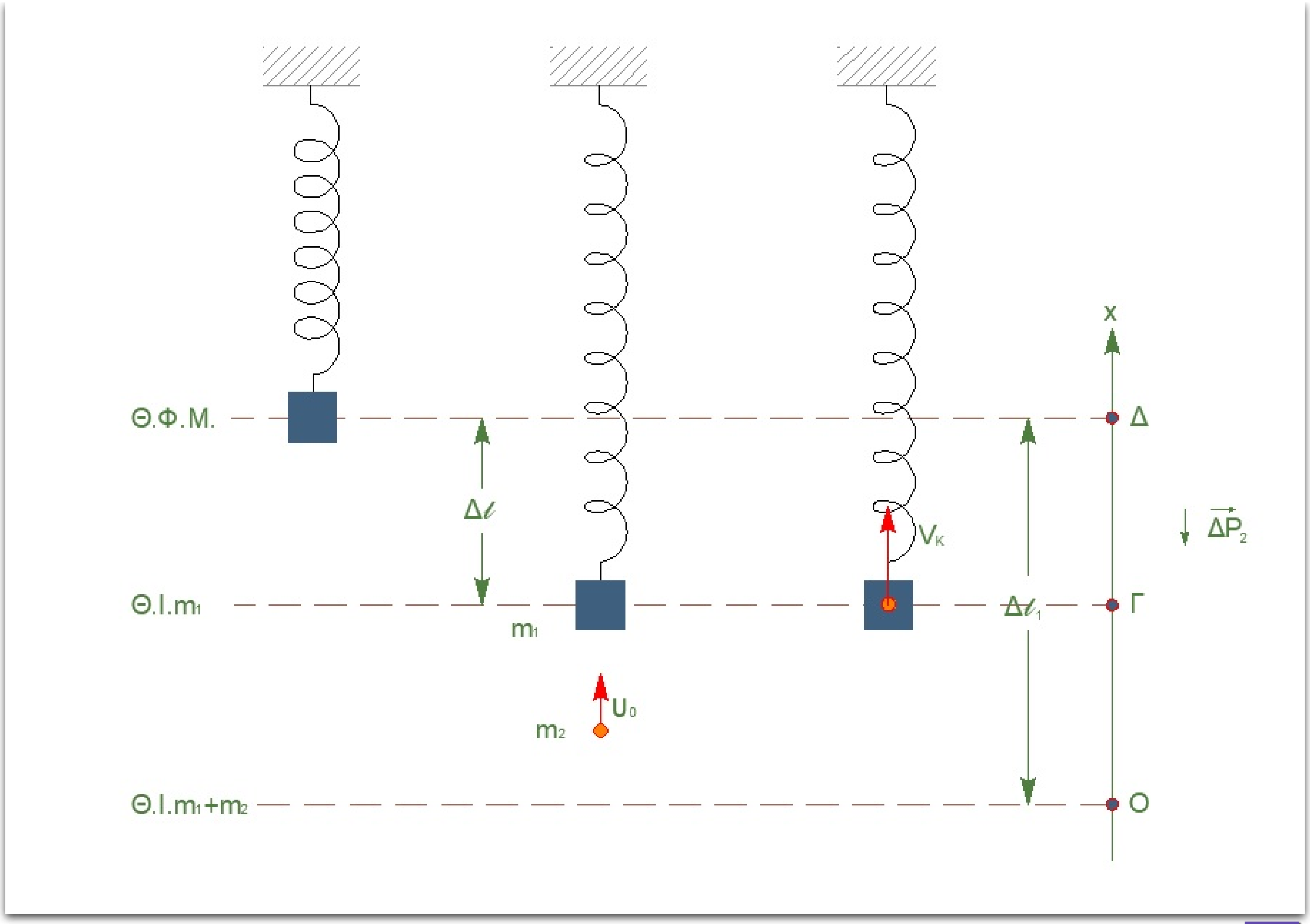
$$\Delta\theta = \omega_k \cdot \Delta t \Rightarrow \Delta t = \frac{\Delta\theta}{\omega_k} = \frac{\Delta\theta}{\frac{\omega}{2}} = \frac{2\Delta\theta}{\omega} = \frac{2 \cdot \frac{\pi}{2}}{\omega} = \frac{\pi}{\omega}$$

$$\Delta t = \frac{1}{3} s$$

άρα σωστό το ii

Θέμα Γ

Γ1



$$(\Theta I_{m_1}) \quad \Sigma F = 0 \Rightarrow$$
$$F_{\varepsilon\lambda} = m_1 \cdot g \Rightarrow$$
$$k \cdot \Delta l = m_1 \cdot g \Rightarrow$$
$$k = \frac{m_1 \cdot g}{\Delta l} = 200\frac{N}{m}$$

$$(\Theta I_{m_1,m_2}) \quad \Sigma F = 0 \Rightarrow$$
$$F'_{\varepsilon\lambda} = (m_1 + m_2) \cdot g \Rightarrow$$
$$k \cdot \Delta l_1 = (m_1 + m_2) \cdot g \Rightarrow$$
$$\Delta l_1 = \frac{(m_1 + m_2) \cdot g}{k} \Rightarrow$$
$$\Delta l_1 = 0.1m$$

Στην ακραία θέση $\upsilon_{\tau\alpha\lambda} = 0 \Rightarrow A = 0.1m$

Γ2

$$\Sigma \vec{F}_{\varepsilon\xi} = 0 \Rightarrow \text{Α.Δ.Ο.} \quad \vec{p}_{\pi\rho\iota\nu} = \vec{p}_{\mu\varepsilon\tau\alpha}$$

$$m_2 \cdot u_o = (m_1 + m_2) \cdot V_k \Rightarrow V_k = \frac{m \cdot u_s}{2 \cdot m} \Rightarrow V_k = \frac{u_H}{40}$$

$$\text{ΑΔΕ}_{\tau\alpha\lambda}(\Gamma \rightarrow \Delta)$$

$$K_\Gamma + U_{\tau\alpha\lambda\Gamma} = K_\Delta + U_{\tau\alpha\lambda\Delta} \Rightarrow \frac{1}{2} \cdot (m_1 + m_2) \cdot V_k^2 + \frac{1}{2} \cdot D \cdot (\Delta l_1 - \Delta l)^2 = 0 + \frac{1}{2} \cdot D \cdot A^2$$

$$2V_k^2 + 200 \cdot 0.05^2 = 200 \cdot 0.01 \Rightarrow V_k^2 + 0.25 = 1 \Rightarrow V_k = \sqrt{0.75} \Rightarrow |V_k| = 0.5\sqrt{3}\frac{m}{s}, V_k > 0$$

$$K_2 = \frac{1}{2} \cdot m_2 \cdot u_o^2 \Rightarrow K_2 = 1.5J$$

Γ3

$$\Delta\vec{p_2} = \vec{p}_{\tau\varepsilon\lambda} - \vec{p}_{\alpha\rho\chi} \Rightarrow \Delta p_2 = m_2 \cdot V_k - m_2 \cdot u_o \Rightarrow \Delta p_2 = 0.5\sqrt{3} - \sqrt{3} \Rightarrow \Delta p_2 = -0.5\sqrt{3}$$

$$|\Delta\vec{p_2}| = 0.5\sqrt{3}kg \cdot \frac{m}{s}$$

$$\Delta p_2 = -0.5\sqrt{3}$$

Το πρόσημο δηλώνει την κατεύθυνση του διανύσματος. (Βλέπε παραπάνω σχήμα)@

Γ4

$$D = k = (m_1 + m_2) \cdot \omega^2 \Rightarrow \omega = \sqrt{\frac{k}{m_1 + m_2}} \Rightarrow \omega = 10\frac{rad}{s}$$

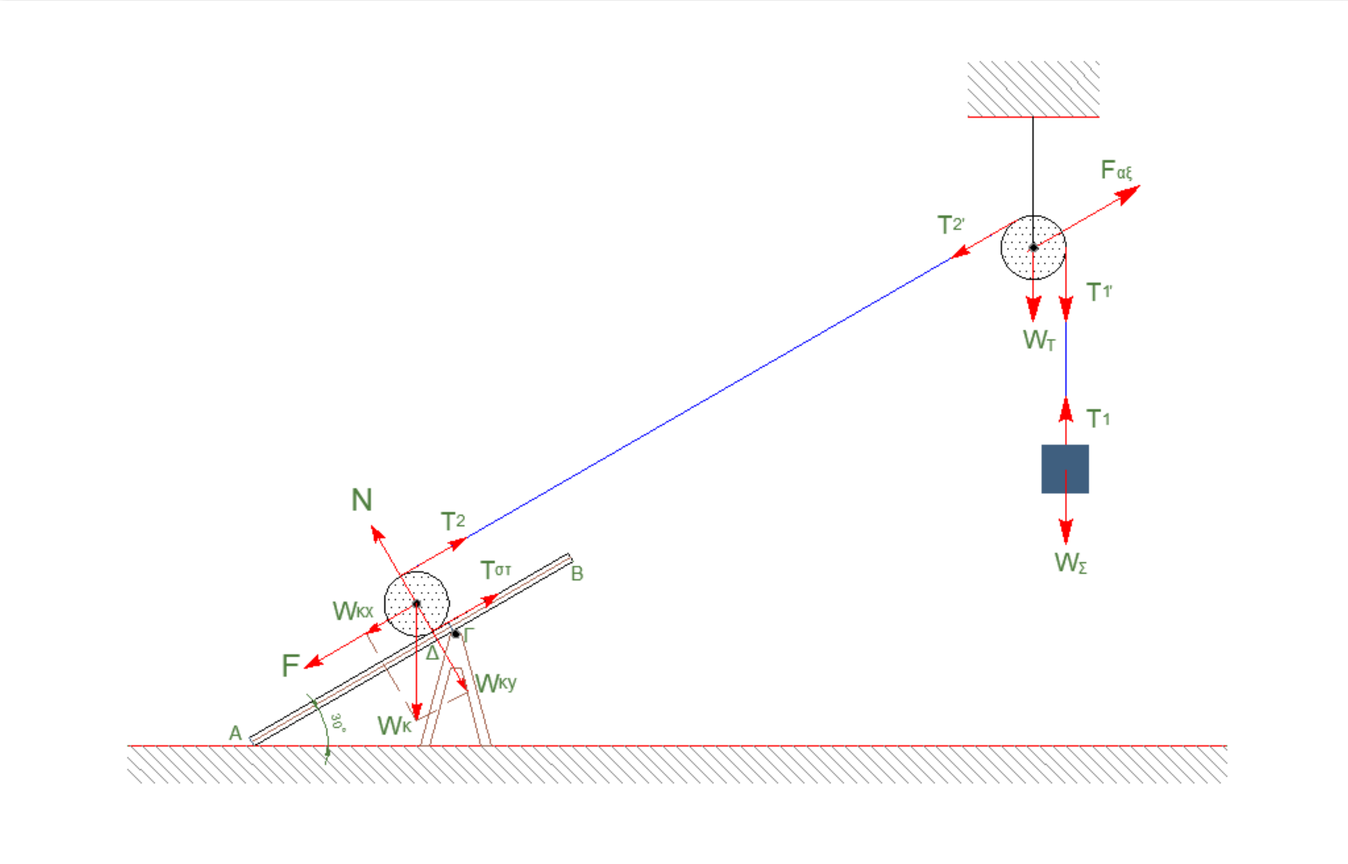
$$t_o = 0, \quad y = +\frac{A}{2}, \quad \upsilon > 0$$

$$y = A \cdot \eta\mu(\omega t + \varphi_o) \Rightarrow \frac{A}{2} = A \cdot \eta\mu\varphi_o$$

$$\eta\mu\varphi_o = \frac{1}{2} \Rightarrow \eta\mu\varphi_o = \eta\mu\frac{\pi}{6} \Rightarrow \varphi_o = \begin{cases} 2k\pi + \frac{\pi}{6}, & k = 0 \Rightarrow \varphi_o = \frac{\pi}{6} \quad \sigma\upsilon\nu\varphi_o > 0 \\ 2k\pi + \frac{5\pi}{6}, & k = 0 \Rightarrow \varphi_o = \frac{5\pi}{6} \quad \sigma\upsilon\nu\varphi_o < 0, \text{απορρίπτεται} \end{cases}$$

$$y = 0.1 \cdot \eta\mu(10t + \frac{\pi}{6}), \quad S.I.$$

Θέμα Δ



Δ1

$$M_\Sigma, \quad \text{ισορροπία}, \Rightarrow \Sigma F = 0 \Rightarrow T_1 = M_\Sigma \cdot g \Rightarrow T_1 = 20N$$

$$M_T, \quad \text{ισορροπία}, \Rightarrow \Sigma\tau = 0 \Rightarrow T_1 \cdot R_T = T_1 \cdot R_T \Rightarrow T_2 = 20N$$

α)τρόπος

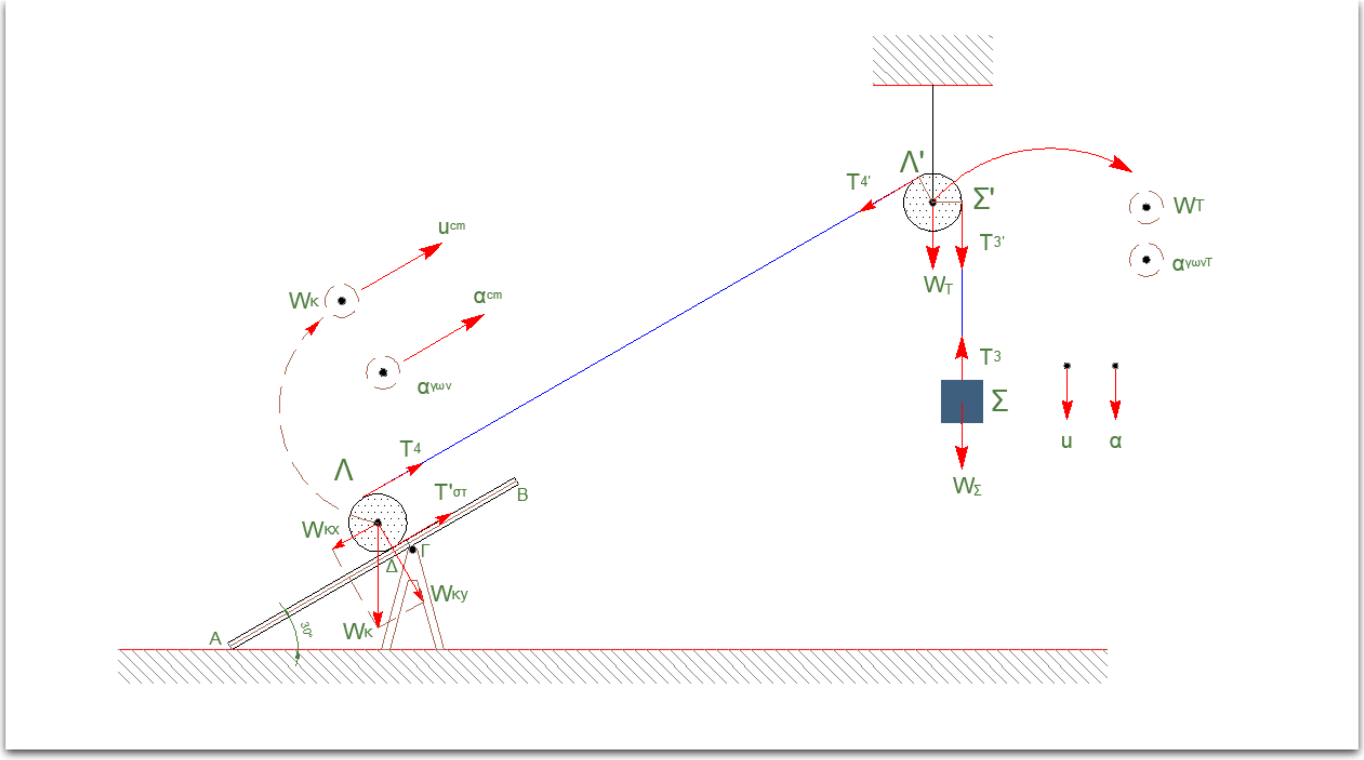
$$M_K, \quad \text{ισορροπία}, \Rightarrow \Sigma\tau_{(K)} = 0 \Rightarrow T_2 \cdot R_K = T_{\sigma\tau} \cdot R_K \Rightarrow T_2 = T_{\sigma\tau}$$

$$\Sigma F = 0 \Rightarrow T_2 + T_{\sigma\tau} = F + M_K \cdot g \cdot \eta\mu\varphi \Rightarrow 2T_2 = F + 10 \Rightarrow F = 30N$$

β)τρόπος

$$M_K, \quad \text{ισορροπία}, \Rightarrow \Sigma\tau_{(\Delta)} = 0 \Rightarrow T_2 \cdot 2 \cdot R_K = (F + M_K \cdot g \cdot \eta\mu\varphi) \cdot R_K \Rightarrow 40 = F + 10 \Rightarrow F = 30N$$

Δ2



$$M_{\Sigma}: \quad META\Phi OPIKH$$

$$\Sigma F = M_{\Sigma} \cdot g - T_3 = M_{\Sigma} \cdot \alpha_{\Sigma} \quad (1)$$

$$M_T: \quad \Sigma TPO\Phi IKH$$

$$\Sigma\tau = I_T \cdot \alpha_{\gamma\omega\nu_T} \Rightarrow T_3 \cdot R_T - T_4 \cdot R_T = \frac{1}{2} \cdot M_T \cdot R_T^2 \cdot \alpha_{\gamma\omega\nu_T} \Rightarrow T_3 - T_4 = \frac{1}{2} \cdot M_T \cdot R_T \cdot \alpha_{\gamma\omega\nu_T} \quad (2)$$

νήμα αβαρές, μη εκτατό

$$\alpha_{\Sigma} = \alpha'_{\Sigma} = \alpha_{\gamma\rho} = \alpha_{\gamma\omega\nu_T} \cdot R_T \quad (3)$$

$$(2)\Lambda(3) \Rightarrow T_3 - T_4 = \alpha_{\Sigma} \quad (4)$$

$$M_K: \quad META\Phi OPIKH$$

$$\Sigma F = M_K \cdot \alpha_{cm}$$

$$T_4 + T_{\sigma\tau} - M_K \cdot g \cdot \eta\mu\varphi = M_K \cdot \alpha_{cm} \Rightarrow T_4 + T_{\sigma\tau} - 10 = 2 \cdot \alpha_{cm} \quad (5)$$

$$M_K: \quad \Sigma TPO\Phi IKH$$

$$\Sigma\tau = I_K \cdot \alpha_{\gamma\omega\nu_K} \Rightarrow T_4 \cdot R_K - T_{\sigma\tau} \cdot R_K = \frac{1}{2} \cdot M_K \cdot R_K^2 \cdot \alpha_{\gamma\omega\nu_K} \Rightarrow T_4 - T_{\sigma\tau} = \frac{1}{2} \cdot M_K \cdot R_K \cdot \alpha_{\gamma\omega\nu_K}$$

$$K.X.O.\ \upsilon_A = 0 \Rightarrow \upsilon_{cm} = \omega \cdot R_K \Rightarrow \alpha_{cm} = \alpha_{\gamma\omega\nu_K} \cdot R_K$$

$$T_4 - T_{\sigma\tau} = \frac{1}{2} \cdot M_K \cdot R_K \cdot \alpha_{\gamma\omega\nu_K} \Rightarrow T_4 - T_6 = \alpha_{cm} \quad (6)$$

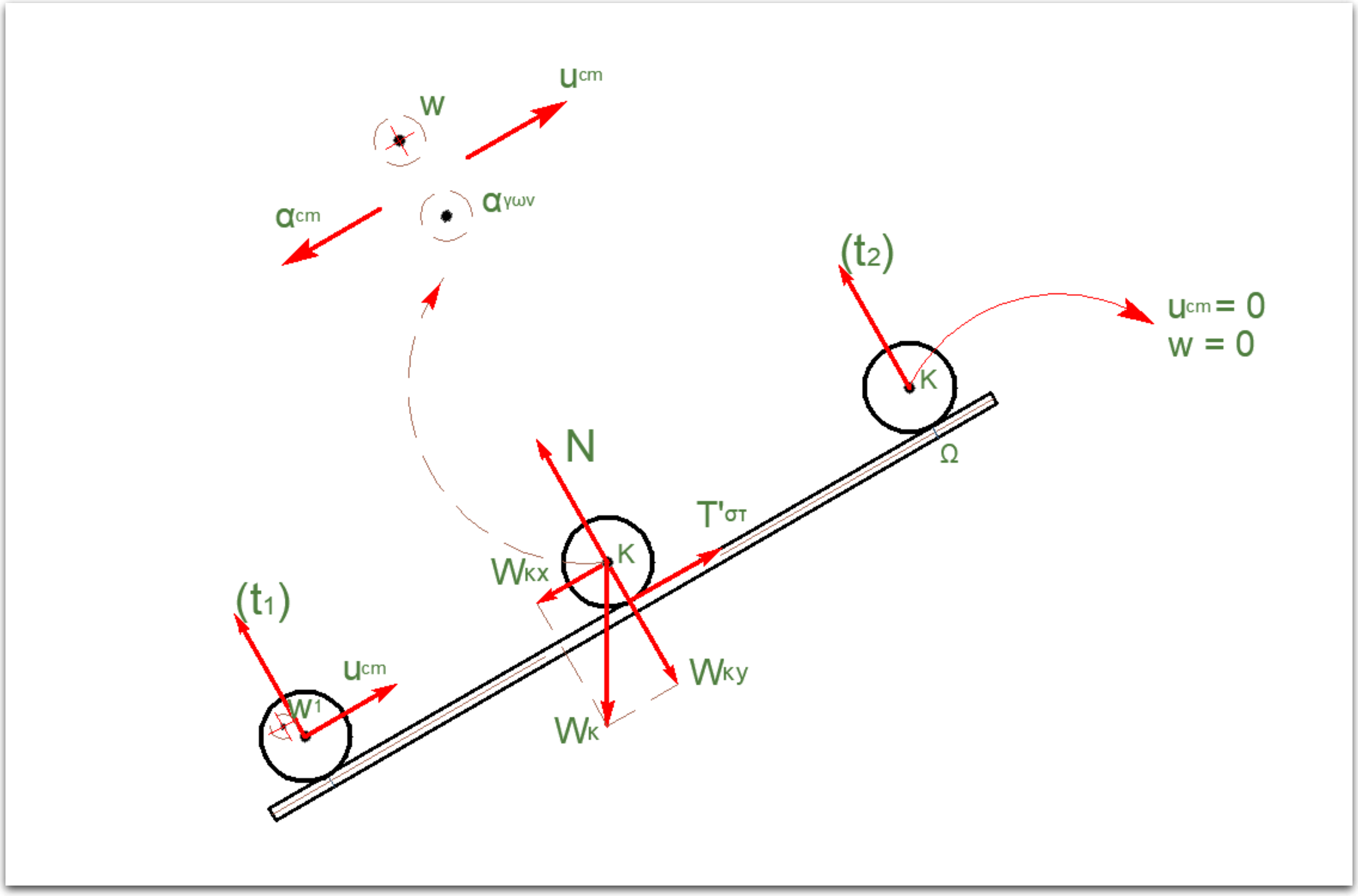
νήμα αβαρές, μη εκτατό

$$\alpha_\Lambda = \alpha'_\Lambda = \alpha_{\gamma\rho} = \alpha_{\gamma\omega\nu_T} \cdot R_T$$

$$\upsilon_\Lambda = \upsilon_{cm} + \omega \cdot R_K \Rightarrow \upsilon_\Lambda = 2 \cdot \upsilon_{cm} \Rightarrow \alpha_\Lambda = 2 \cdot \alpha_{cm}$$
$$2 \cdot \alpha_{cm} = \alpha_{\gamma\omega\nu_T} \cdot R_T \Rightarrow 2 \cdot \alpha_{cm} = \alpha_\Sigma \quad (7)$$

Λύση του συστήματος $\alpha_\Sigma = 4\frac{m}{s^2}$

Δ3



$$M_K : \text{ΜΕΤΑΦΟΡΙΚΗ}, \quad 0 - t_1$$

$$\upsilon_{cm1} = \alpha_{cm} \cdot t_1 \Rightarrow \upsilon_{cm1} = 1\frac{m}{s}$$

$$M_K : \quad \textit{ΜΕΤΑΦΟΡΙΚΗ}$$
$$\Sigma F = \text{M}_\text{K} \cdot \alpha_{cm}$$
$$\text{M}_\text{K} \cdot g \cdot \eta\mu\varphi - T_{\sigma\tau} = \text{M}_\text{K} \cdot \alpha_{cm} \Rightarrow 10 - \text{T}_{\sigma\tau} = 2\alpha_{cm}, \text{επιβραδυνόμενη}$$

$$M_K: \quad \text{ΣΤΡΟΦΙΚΗ}$$

$$\Sigma\tau = I_K \cdot \alpha_{\gamma\omega\nu_K} \Rightarrow T_{\sigma\tau} \cdot R_K = \frac{1}{2} \cdot M_K \cdot R_K^2 \cdot \alpha_{\gamma\omega\nu_K} \Rightarrow T_{\sigma\tau} = R_K \cdot \alpha_{\gamma\omega\nu_K} \Rightarrow T_{\sigma\tau} = \alpha_{cm}, \text{επιβραδυνόμενη}$$

$$10 - \alpha_{cm} = 2 \cdot \alpha_{cm} \Rightarrow \alpha_{cm} = \frac{10}{3}\frac{m}{s^2}$$

$$\upsilon_{cm} = \upsilon_{cm1} - \alpha_{cm} \cdot \Delta t \Rightarrow 0 = 1 - \frac{10}{3} \cdot \Delta t \Rightarrow \Delta t = 0.3s$$

$$t_2 = t_1 + \Delta t \Rightarrow t_2 = 0.8s$$

Δ4

$$M_K: \text{ΜΕΤΑΦΟΡΙΚΗ}, \quad 0 - t_1$$

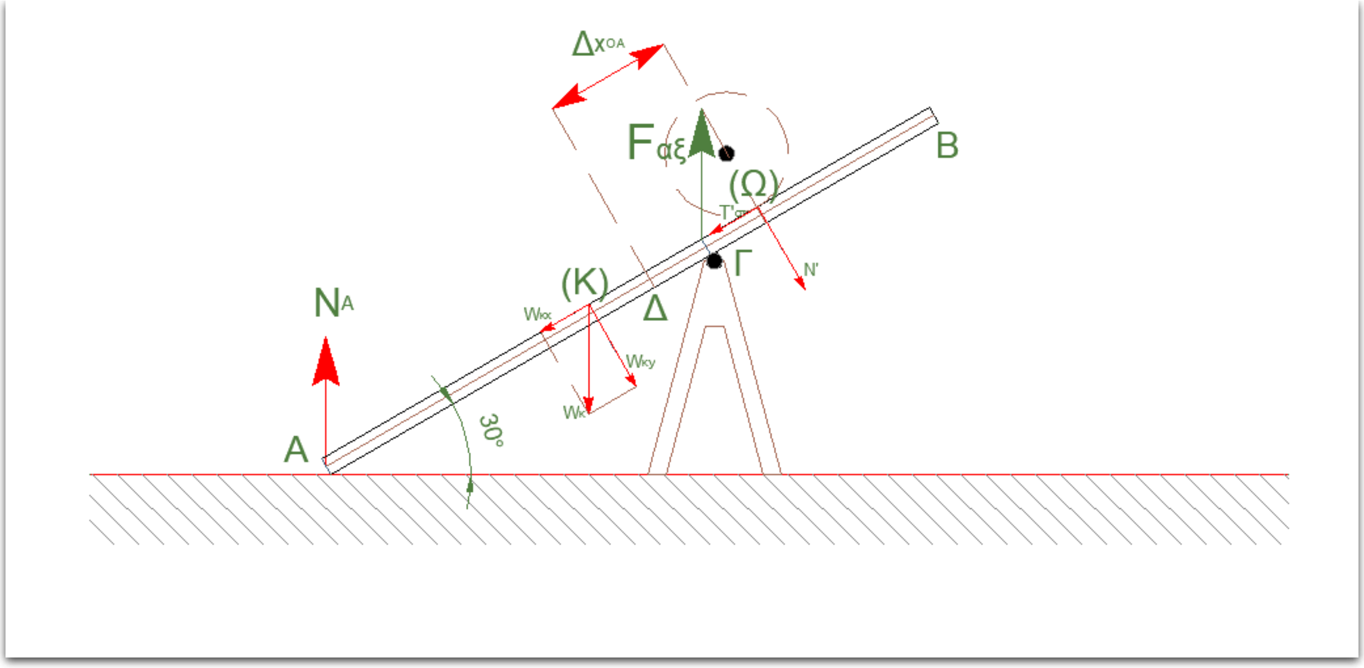
$$x_{cm1} = \frac{1}{2} \cdot \alpha_{cm} \cdot t_1^2 \Rightarrow x_{cm1} = 0.25m$$

$$M_K: \text{ΜΕΤΑΦΟΡΙΚΗ}, \quad t_1 - t_2$$

$$\Delta x_{cm} = \upsilon_{cm1} \cdot \Delta t - \frac{1}{2} \cdot \alpha_{cm} \cdot \Delta t^2 \Rightarrow \Delta x_{cm} = 0.15m$$

$$x_{o\lambda} = x_{cm1} + \Delta x_{cm} \Rightarrow x_{o\lambda} = 0.4m$$

Δ5



$$(\Gamma\Delta) = 0.2m, \quad (K\Gamma) = 0.5m, \quad (\Gamma\Omega) = x_{o\lambda} - (\Gamma\Delta) \Rightarrow (\Gamma\Omega) = 0.2m$$

$$|\tau_{W_\rho}| = M_\rho \cdot g \cdot \sigma\upsilon\nu\varphi \cdot (K\Gamma) \Rightarrow |\tau_{W_\rho}| = 5\sqrt{3}N \cdot m$$

$$|\tau'_N| = M_\rho \cdot g \cdot \sigma\upsilon\nu\varphi \cdot (K\Gamma) \Rightarrow |\tau'_N| = 2\sqrt{3}N \cdot m$$

$$|\tau_{W_\rho}| > |\tau'_N|$$

άρα η σανίδα δεν ανατρέπεται.-

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0 Σχόλια Science Technology Engineering Mathematics Panagiotis Petridis

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Published
12 June 2019

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