

# Μοριοδότηση 2021

Ενδεικτικές απαντήσεις και από γραπτά μαθητών

Θέμα A

A1 -  $\gamma$

A2 -  $\delta$

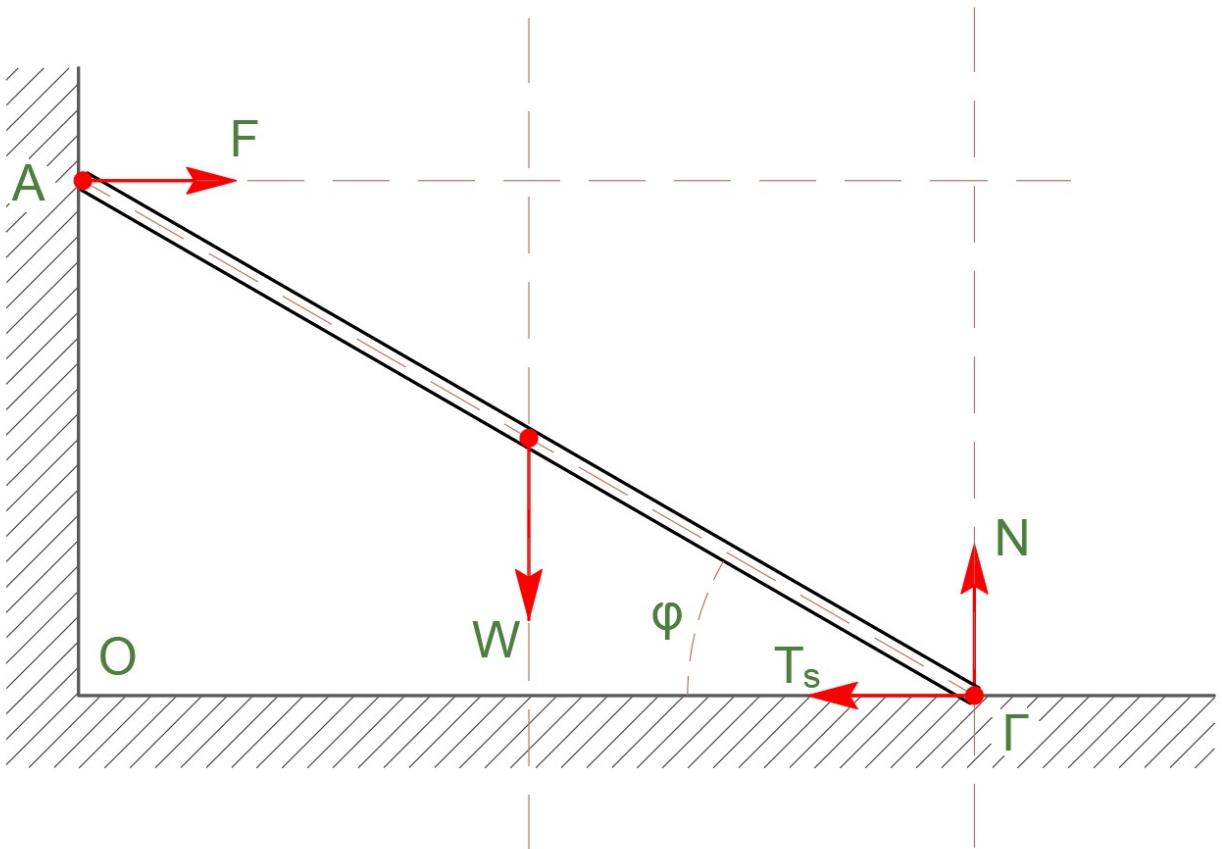
A3 -  $\gamma$

A4 -  $\beta$

A5:  $\Sigma - \Lambda - \Sigma - \Sigma - \Lambda$

Θέμα B

B1(ii) – 2 – 6



$\alpha)$  τρόπος

σκάλα ισορροπία  $\sum \vec{\tau}_T = \vec{0}$

$$\vec{\tau}_W + \vec{\tau}_F = \vec{0} \Rightarrow W \cdot \frac{l}{2} \cdot \sigma v \nu \varphi = F \cdot l \cdot \eta \mu \varphi$$

$$\vec{\tau}_W + \vec{\tau}_F = \vec{0} \Rightarrow W_y \cdot \frac{l}{2} = F_y \cdot l \Rightarrow W \cdot \sigma v \nu \varphi \cdot \frac{l}{2} = F \cdot \eta \mu \varphi \cdot l$$

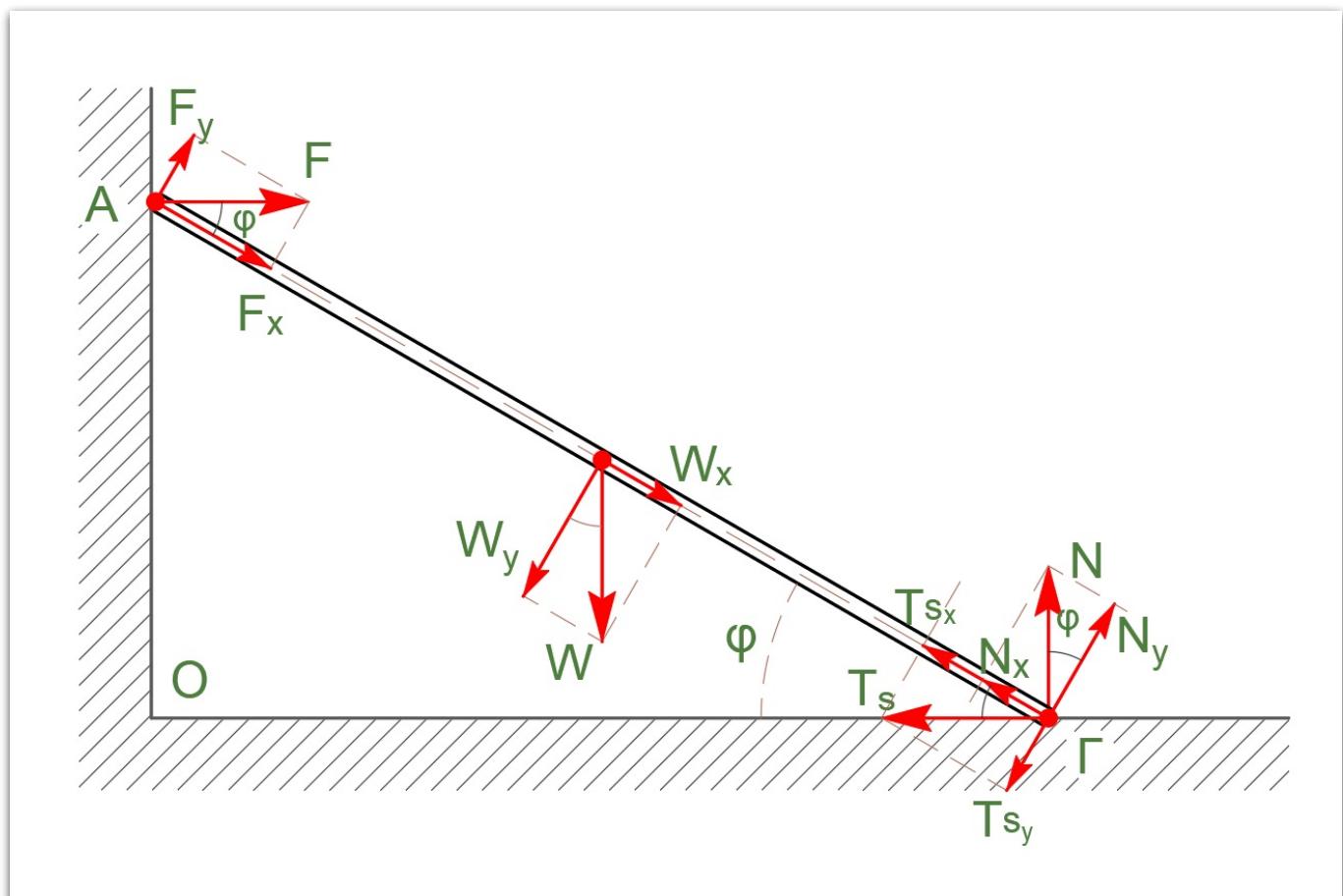
σκάλα ισορροπία  $\sum \vec{F}_x = \vec{0} \Rightarrow F = T_s$

σκάλα ισορροπία  $\sum \vec{F}_y = \vec{0} \Rightarrow W = N$

$$N \cdot \frac{l}{2} \cdot \sigma v \nu \varphi = T_s \cdot l \cdot \eta \mu \varphi \Rightarrow T_s = \frac{N}{2 \cdot \varepsilon \varphi \varphi}$$

στατική τριβή  $0 \leq T_s \leq \mu \cdot N$

$$T_s \leq \mu \cdot N \Rightarrow \frac{1}{2 \cdot \varepsilon \varphi \varphi} \leq \mu \Rightarrow \varepsilon \varphi \varphi \geq \frac{1}{2\mu}$$



$\beta) \underline{\tau \rho \delta \pi o \varsigma}$

σκάλα ισορροπία  $\sum \vec{\tau}_A = \vec{0}$

$$\vec{\tau}_W + \vec{\tau}_N + \vec{\tau}_{T_s} = \vec{0} \Rightarrow W \cdot \frac{l}{2} \cdot \sigma v \nu \varphi + T_s \cdot l \cdot \eta \mu \varphi = N \cdot l \cdot \sigma v \nu \varphi$$

$$\vec{\tau}_W + \vec{\tau}_N + \vec{\tau}_{T_s} = \vec{0} \Rightarrow W_y \cdot \frac{l}{2} + T_{s_y} \cdot l = N_y \cdot l$$

$$\text{σκάλα ισορροπία } \sum \vec{F}_y = \vec{0} \Rightarrow W = N$$

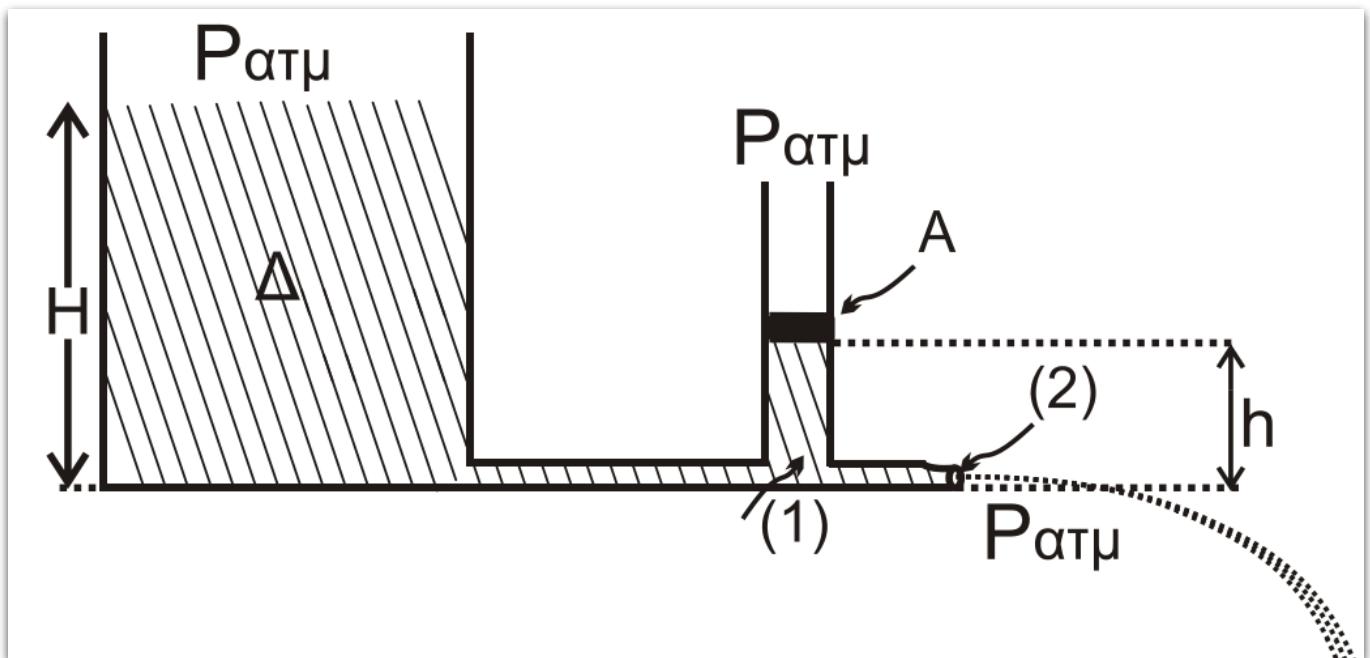
$$W \cdot \frac{l}{2} \cdot \sigma v \nu \varphi + T_s \cdot l \cdot \eta \mu \varphi = W \cdot l \cdot \sigma v \nu \varphi \Rightarrow T_s = \frac{W}{2 \cdot \varepsilon \varphi \varphi}$$

$$\text{στατική τριβή } 0 \leq T_s \leq \mu \cdot N$$

$$T_s \leq \mu \cdot N \Rightarrow \frac{1}{2 \cdot \varepsilon \varphi \varphi} \leq \mu \Rightarrow \varepsilon \varphi \varphi \geq \frac{1}{2\mu}$$

άρα σωστό το *ii*

B2 - (i) - 2 - 6

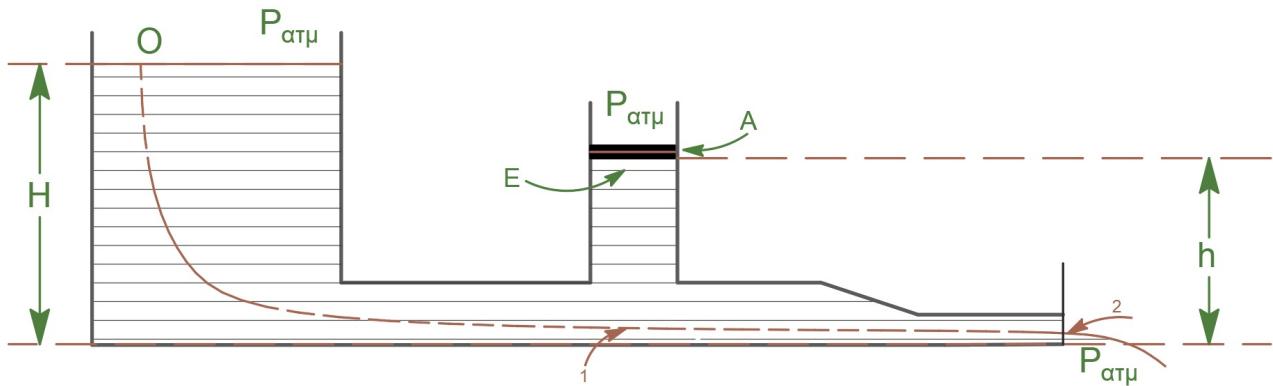


Bernoulli ( $0 \rightarrow 2$ )

$$P_{\alpha\tau\mu} + \frac{1}{2} \cdot \rho \cdot v_0^2 + \rho \cdot g \cdot H = P_{\alpha\tau\mu} + \frac{1}{2} \cdot \rho \cdot v_2^2 + 0$$

Bernoulli ( $1 \rightarrow 2$ )

$$P_1 + \frac{1}{2} \cdot \rho \cdot v_1^2 = P_{\alpha\tau\mu} + \frac{1}{2} \cdot \rho \cdot v_2^2$$

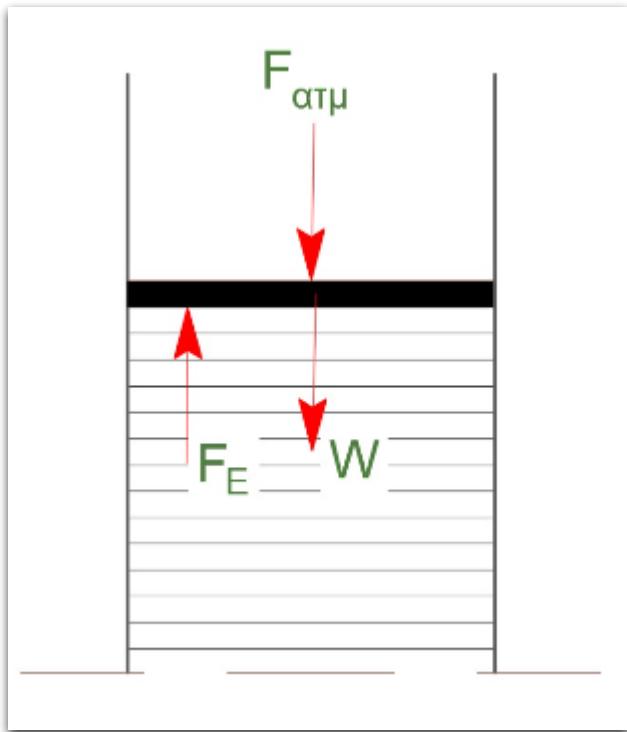


Εξίσωση συνέχειας ( $1 \rightarrow 2$ )

$$\Pi_1 = \Pi_2 \Rightarrow A_1 \cdot v_1 = A_2 \cdot v_2 \Rightarrow v_1 = \frac{v_2}{2}$$

$\alpha) \underline{\tau\rho\circ\pi\circ\varsigma}$

έμβολο ισορροπία  $\sum \vec{F} = \vec{0}$



$$F_E = F_{\alpha\tau\mu} + W \Rightarrow \frac{F_E}{A} = \frac{F_{\alpha\tau\mu}}{A} + \frac{W}{A} \Rightarrow P_E = P_{\alpha\tau\mu} + \frac{W}{A}$$

Θεμελιώδης νόμος της υδροστατικής

$$P_1 = P_E + \rho \cdot g \cdot \frac{H}{4}$$

### $\beta) \tau\rho\delta\pi\varsigma$

Η ολική πίεση  $P_1$  είναι υδροστατική και ατμοσφαιρική και η πίεση του εμβόλου άρα:

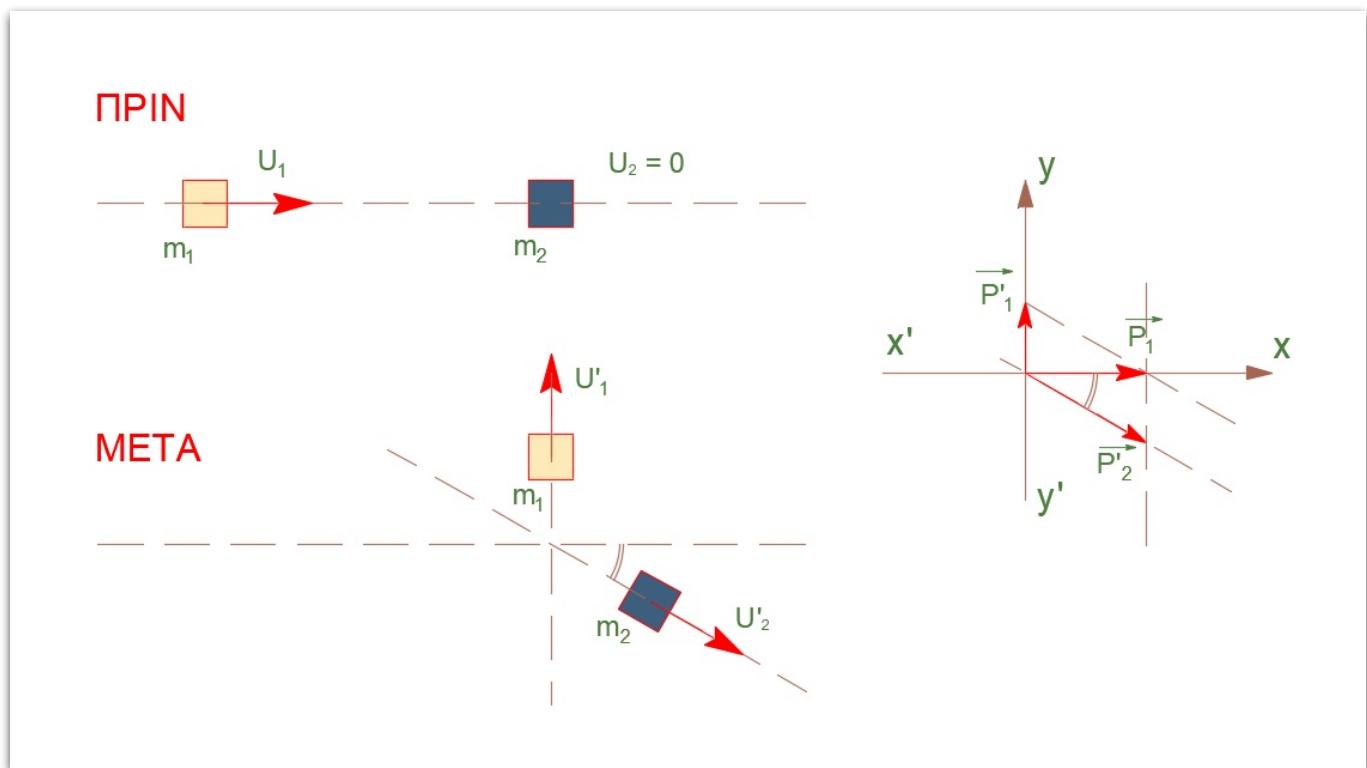
$$P_1 = P_{\alpha\tau\mu} + \frac{w}{A} + \rho \cdot g \cdot \frac{H}{4}$$

μετά τις πράξεις

$$W = \frac{\rho \cdot g \cdot H \cdot A}{2}$$

άρα σωστό το  $i$

B3 - (iii) - 2 - 7



### $\alpha) \tau\rho\delta\pi\varsigma$

Ελαστική κρούση

$$\Sigma \vec{F}_x^{\varepsilon\xi} = \vec{0} \Rightarrow A. \Delta. O. (x)$$

$$\vec{p}_{\pi\rho\nu} = \vec{p}_{\mu\varepsilon\tau\dot{\alpha}} \Rightarrow m_1 \cdot v_1 = m_2 \cdot v'_2 \cdot \sigma v \nu \varphi$$

$$\Sigma \vec{F}_y^{\varepsilon\xi} = \vec{0} \Rightarrow A. \Delta. O. (y)$$

$$\vec{p}_{\pi\rho\nu} = \vec{p}_{\mu\varepsilon\tau\dot{\alpha}} \Rightarrow 0 = m_1 \cdot v'_1 - m_2 \cdot v'_2 \cdot \eta \mu \varphi$$

$$v'_1 = \frac{v_1}{\sqrt{3}}$$

$\beta) \underline{\tau\rho\delta\pi\varsigma}$

Ελαστική κρούση

$$\eta\mu\varphi = \frac{p'_1}{p'_2} \Rightarrow \frac{1}{2} = \frac{p'_1}{p'_2} \Rightarrow p'_2 = 2 \cdot p'_1$$

$$p'^2_2 = p'^2_1 + p^2_1 \Rightarrow 4 \cdot p'^2_1 = p'^2_1 + p^2_1$$

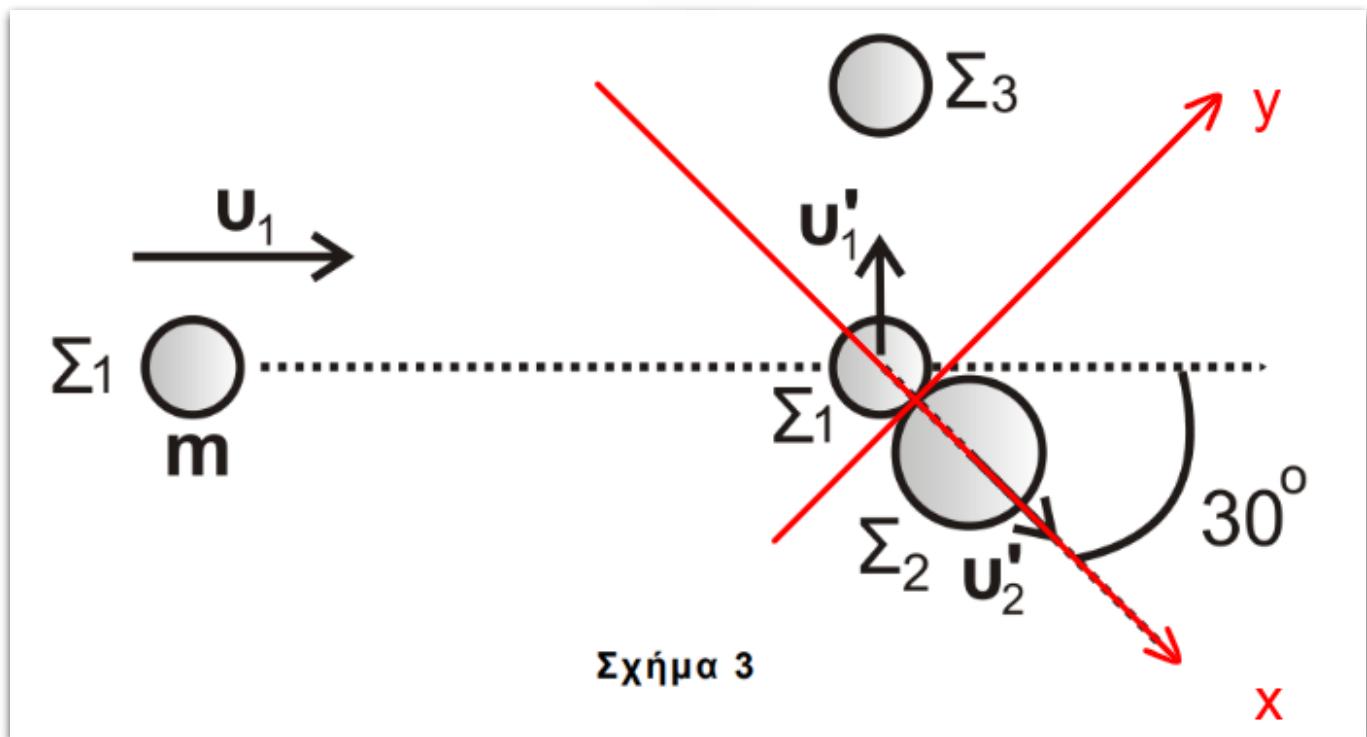
$$p'_1 = \frac{p_1}{\sqrt{3}} \Rightarrow v'_1 = \frac{v_1}{\sqrt{3}}$$

$\gamma) \underline{\tau\rho\delta\pi\varsigma}$

Ελαστική κρούση

$$\varepsilon\varphi\varphi = \frac{p'_1}{p_1} \Rightarrow v'_1 = \frac{v_1}{\sqrt{3}}$$

$\delta) \underline{\tau\rho\delta\pi\varsigma}$



άξονας x'x διάκεντρος, άξονας y'y κάθετος στην διάκεντρο.

Άξονας x'x κεντρική και ελαστική κρούση με ακίνητο σώμα  $\Sigma_2$

$$v'_{1x} = \frac{m_1 - m_2}{m_1 + m_2} \cdot v_{1x} \Rightarrow v'_{1x} = \frac{m - 2m}{m + 2m} \cdot v_1 \cdot \sigma v \nu 30^\circ$$

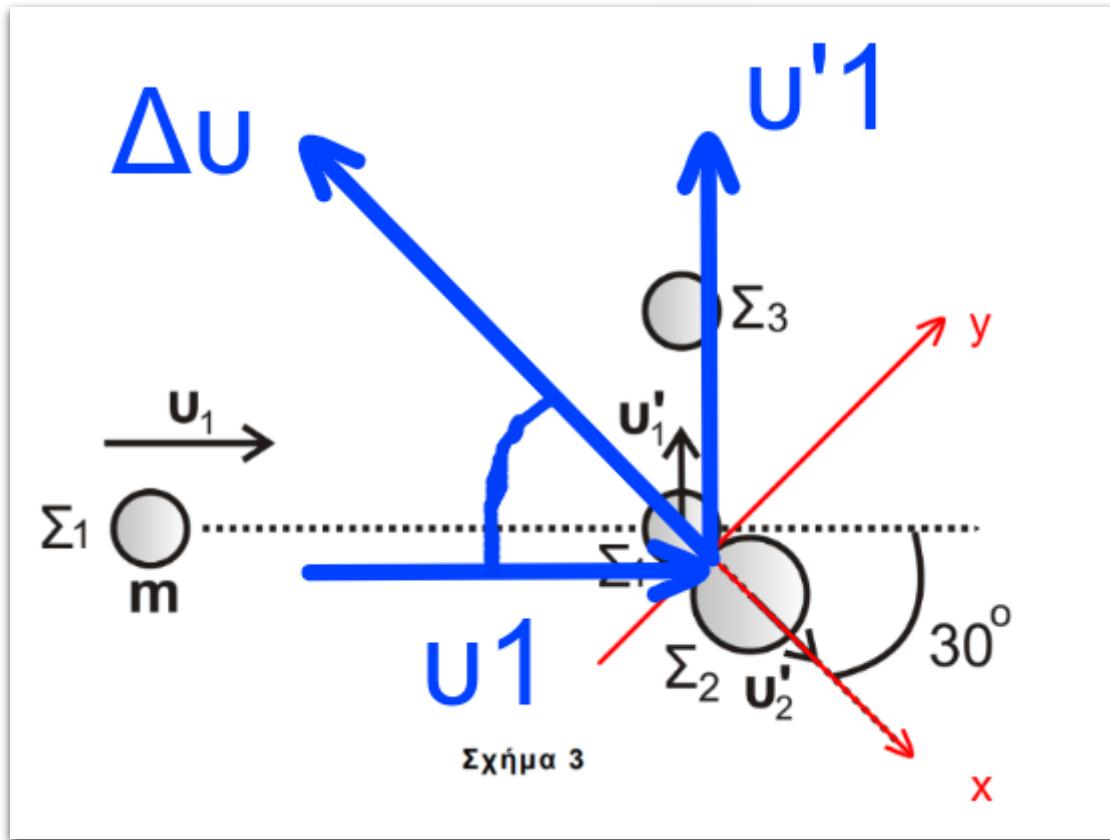
$$v'_{1x} = -\frac{v_1 \sqrt{3}}{6}$$

άξονας γ'γ η ορμή του  $\Sigma_1$  παραμένει σταθερή

$$v'_{1y} = v_{1y} \Rightarrow v'_{1y} = v_1 \cdot \eta \mu \varphi \Rightarrow v'_{1y} = \frac{v_1}{2}$$

$$v'_1 = \sqrt{(v'_{1x})^2 + (v'_{1y})^2} \Rightarrow v'_1 = \frac{v_1}{\sqrt{3}}$$

$\varepsilon) \underline{\tau \rho \delta \pi o s}$



Το  $\Sigma_1$  δέχεται ώθηση  $\Omega$  που έχει την διεύθυνση της διακέντρου x'x και φορά αντίθετη της  $v'_2$

$$\Sigma_1 : \vec{p_{\alpha\rho\chi}} + \vec{\Omega} = \vec{p_{\tau\varepsilon\lambda}} \Rightarrow m_1 \cdot \vec{v}_1 + m_1 \cdot \Delta \vec{v} = m_1 \cdot \vec{v}'_1$$

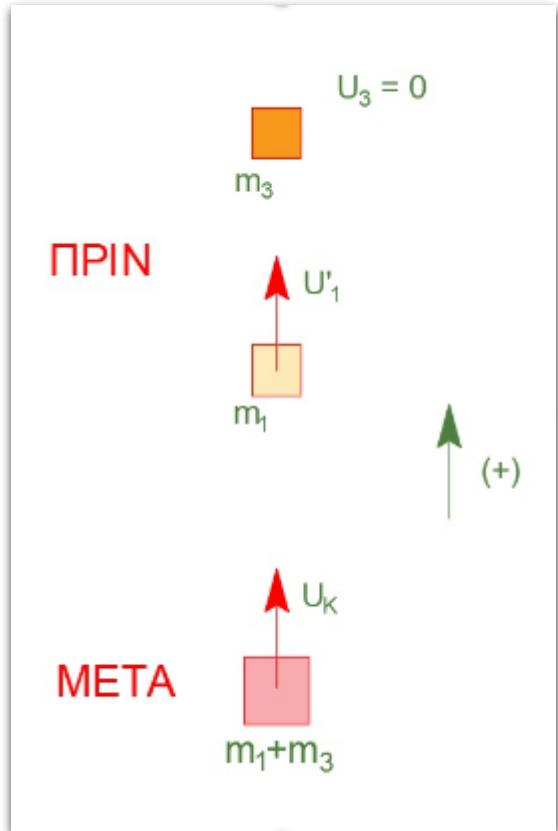
$$\vec{v}_1 + \Delta \vec{v} = \vec{v}'_1 \Rightarrow \Delta \vec{v} = \vec{v}'_1 - \vec{v}_1$$

$$\sigma v \nu 30^\circ = \frac{v_1}{\Delta v} \Rightarrow \Delta v = \frac{2v_1}{\sqrt{3}}$$

$$\eta \mu 30^\circ = \frac{v'_1}{\Delta v} \Rightarrow \Delta v = 2 \cdot v'_1$$

και μετά τις πράξεις

$$v'_1 = \frac{v_1}{\sqrt{3}}$$



Πλαστική κρούση

$$\sum \vec{F}_{\epsilon\xi} = \vec{0} \Rightarrow A. \Delta. O.$$

$$\vec{p}_{\pi\rho\nu} = \vec{p}_{\mu\varepsilon\tau\dot{\alpha}} \Rightarrow m_1 \cdot v'_1 = (m_1 + m_2) \cdot V_k$$

$$\frac{K_{\sigma\nu\sigma}}{K_1} = \frac{\frac{1}{2}(m_1 + m_3) \cdot V_k^2}{\frac{1}{2}m_1 \cdot v_1^2}$$

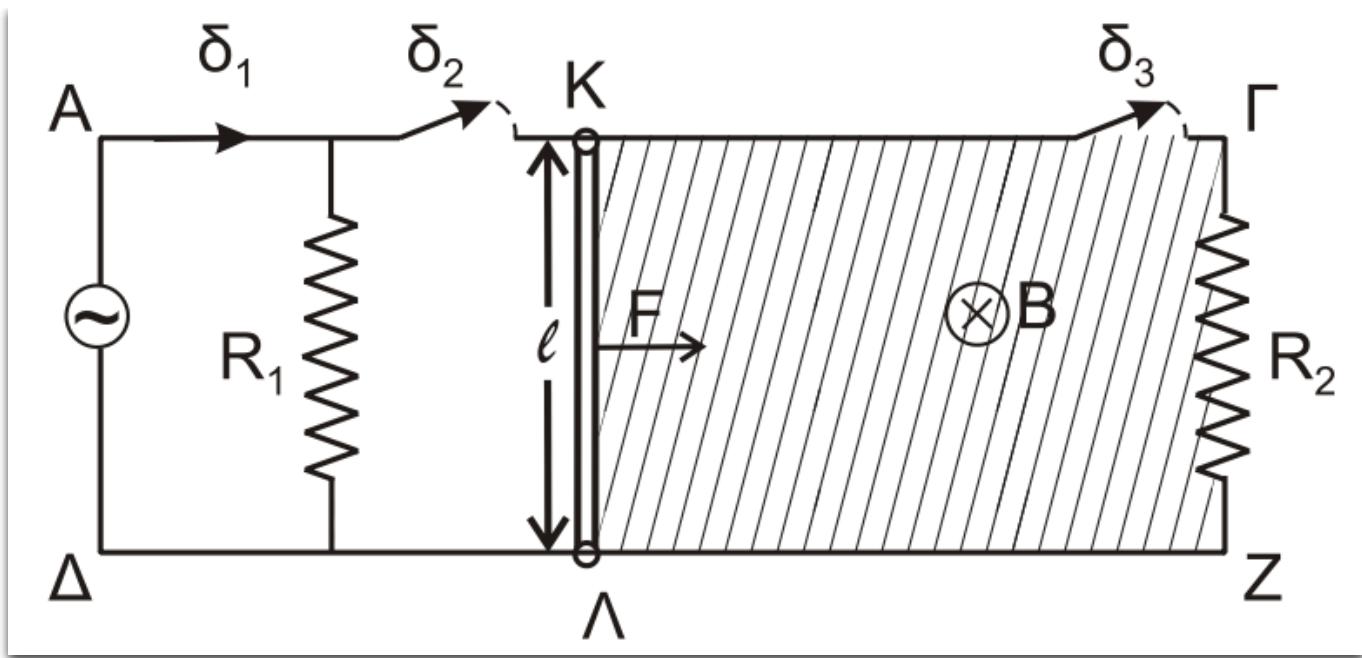
και μετά τις πράξεις

$$\frac{K_{\sigma\nu\sigma}}{K_1} = \frac{1}{6}$$

άρα σωστό το *iii*

Θέμα Γ

Π1-(6)



$\alpha) \underline{\tau\rho\delta\pi\circ\varsigma}$

$$\bar{P} = I_{\varepsilon\nu}^2 \cdot R_1 \Rightarrow I_{\varepsilon\nu} = \sqrt{\frac{\bar{P}}{R_1}} \Rightarrow I_{\varepsilon\nu} = \sqrt{2}A$$

$$V_{\varepsilon\nu} = I_{\varepsilon\nu} \cdot R_1 \Rightarrow V_{\varepsilon\nu} = 6\sqrt{2} \text{ Volt}$$

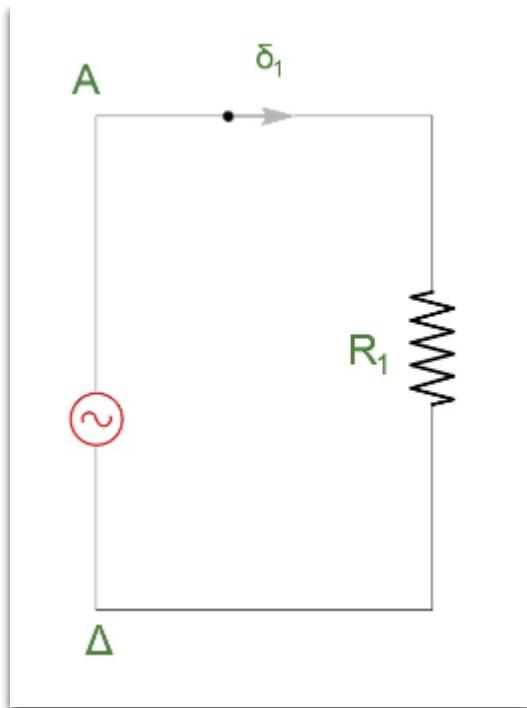
$$V_{\varepsilon\nu} = \frac{V}{\sqrt{2}} \Rightarrow V = V_{\varepsilon\nu}\sqrt{2} \Rightarrow V = 12 \text{ Volt}$$

$\beta) \underline{\tau\rho\delta\pi\circ\varsigma}$

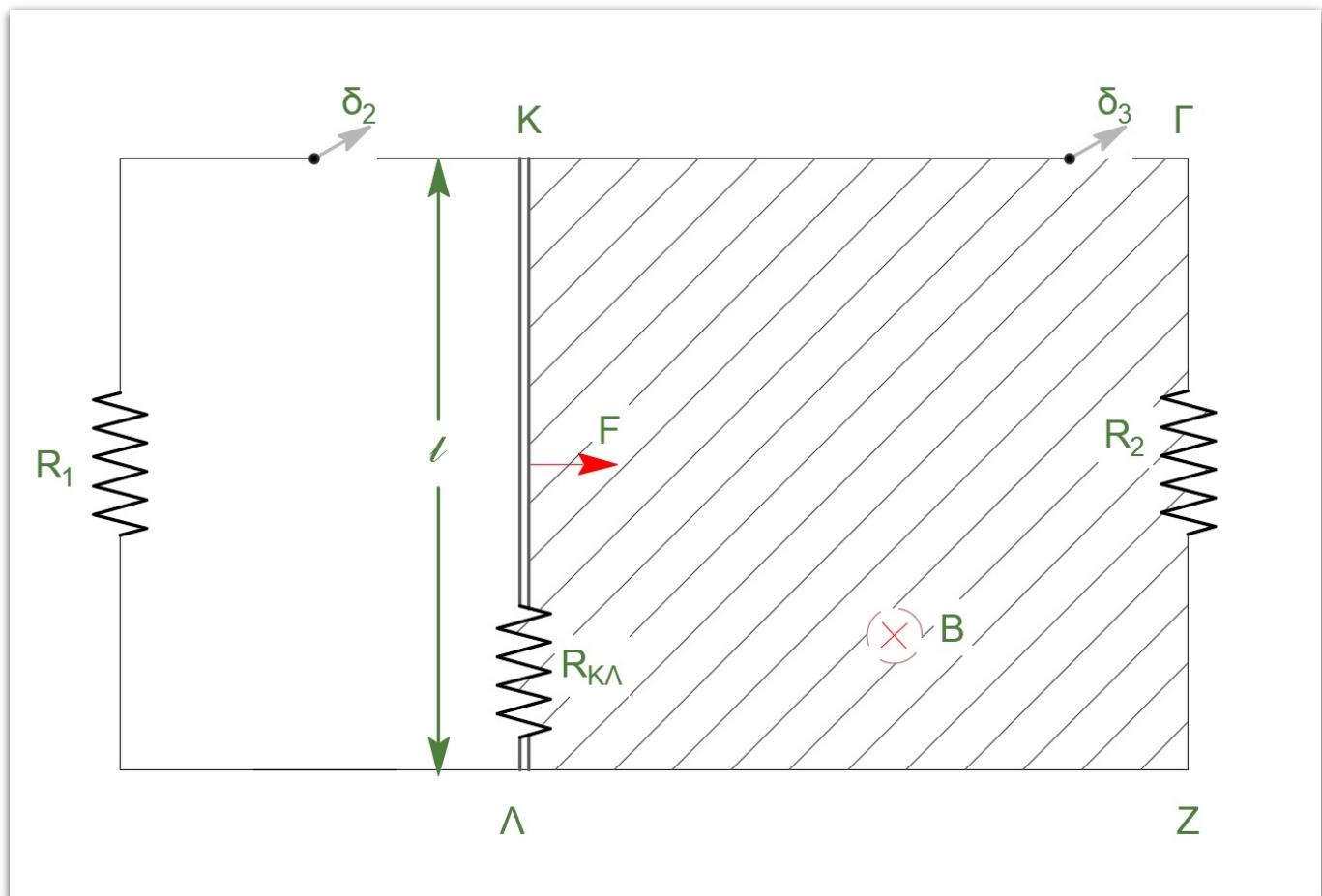
$$\bar{P} = \frac{V_{\varepsilon\nu}^2}{R_1} \Rightarrow V_{\varepsilon\nu} = \sqrt{\bar{P} \cdot R_1} \Rightarrow V_{\varepsilon\nu} = 6\sqrt{2} \text{ Volt}$$

$$V_{\varepsilon\nu} = \frac{V}{\sqrt{2}} \Rightarrow V = V_{\varepsilon\nu}\sqrt{2} \Rightarrow V = 12 \text{ Volt}$$

$$I_{\varepsilon\nu} = \frac{V_{\varepsilon\nu}}{R_1} \Rightarrow I_{\varepsilon\nu} = \sqrt{2}A$$



Γ2-(6)



$$\omega' = 2\omega \Rightarrow \omega' = 100\pi \frac{r}{s}$$

$$V = N\omega BA \Rightarrow V' = N\omega' BA \Rightarrow V' = 2 \cdot V$$

$$v = V' \cdot \eta\mu(\omega't) \Rightarrow v = 24 \cdot \eta\mu(100\pi \cdot t) \quad S.I.$$

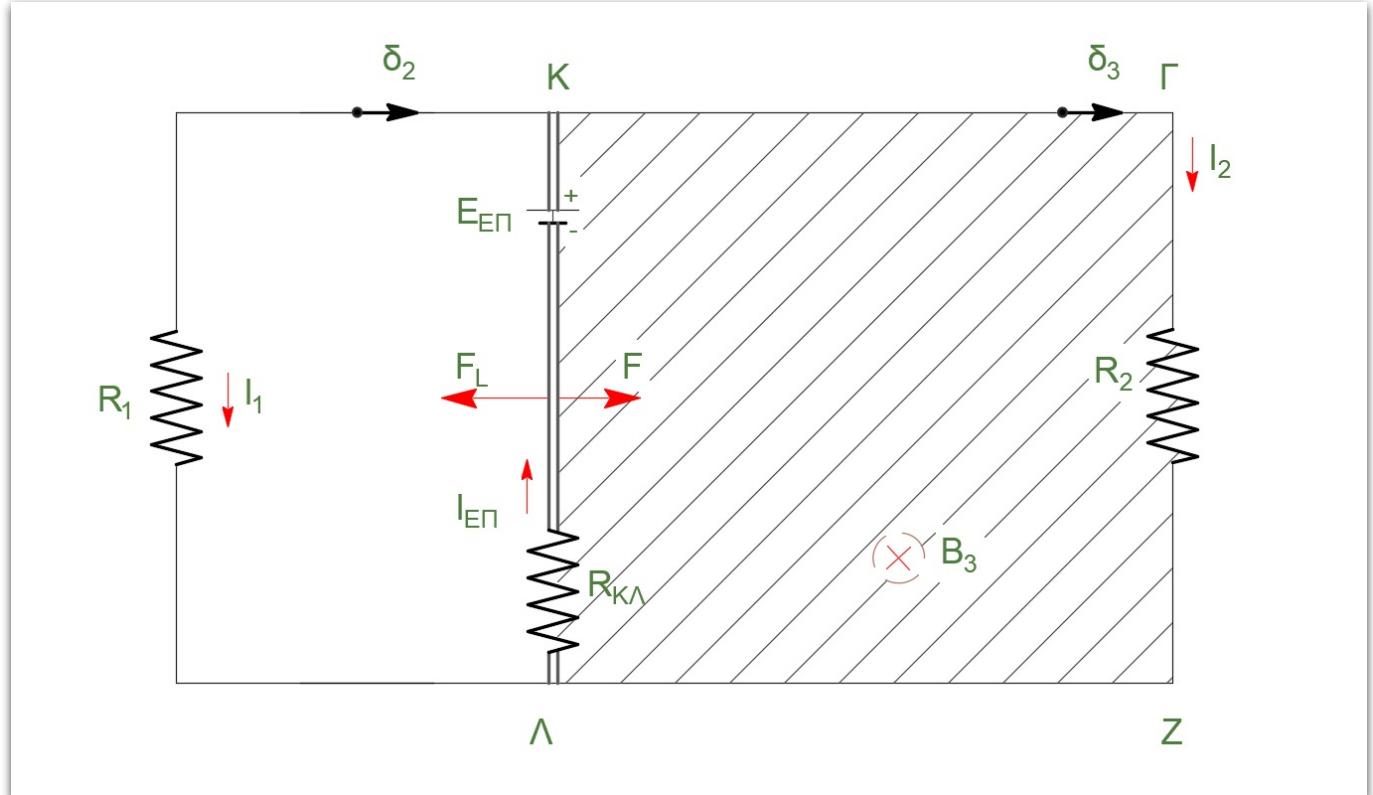
$$I' = \frac{V'}{R_1} \Rightarrow I' = 4A$$

$$i = I' \cdot \eta\mu(\omega't) \Rightarrow i = 4\eta\mu(100\pi t) \quad S.I.$$

$$P_1 = i^2 \cdot R_1 \Rightarrow P_1 = 96\eta\mu^2(100\pi t)^2 \quad S.I.$$

$$t = 5 \cdot 10^{-3}s \Rightarrow P_1 = 96Watt$$

Γ3-(6)



$$t = 0 \quad \dot{\omega}\varsigma \quad t = 2s$$

$$\text{ράβδος ΚΛ} \quad \sum \vec{F} = m \cdot \alpha \Rightarrow \alpha = \frac{F}{m} \Rightarrow \alpha = 1 \frac{m}{s^2}$$

Ομαλά επιπταχυνόμενη κίνηση

$$v_o = \alpha \cdot t \Rightarrow v_o = 2 \frac{m}{s}$$

t=2s

$$E_{\epsilon\pi} = \left| -\frac{\Delta\Phi}{\Delta t} \right| = \left| -\frac{B \cdot \Delta S}{\Delta t} \right| = B \cdot v_o \cdot l$$

$$v_o = \sigma \tau \alpha \theta. \quad \Rightarrow \alpha = 0 \quad \Rightarrow \sum F = 0$$

$$F = F_L \quad F_L = B \cdot I_{\varepsilon\pi} \cdot l \quad I_{\varepsilon\pi} = \frac{E_{\varepsilon\pi}}{R_{o\lambda}}$$

$$\frac{1}{R_\pi} = \frac{1}{R_1} + \frac{1}{R_2} \Rightarrow R_\pi = 2\Omega$$

$$R_{o\lambda} = R_\pi + R_{KA} \Rightarrow R_{o\lambda} = 4\Omega$$

και μετά τις πράξεις έχουμε  $B = 1T$

Γ4-(7)

$\alpha) \underline{\tau\rho\delta\pi\circ\varsigma}$

$$E_{\varepsilon\pi} = B \cdot v_o \cdot l \Rightarrow E_{\varepsilon\pi} = 2Volt$$

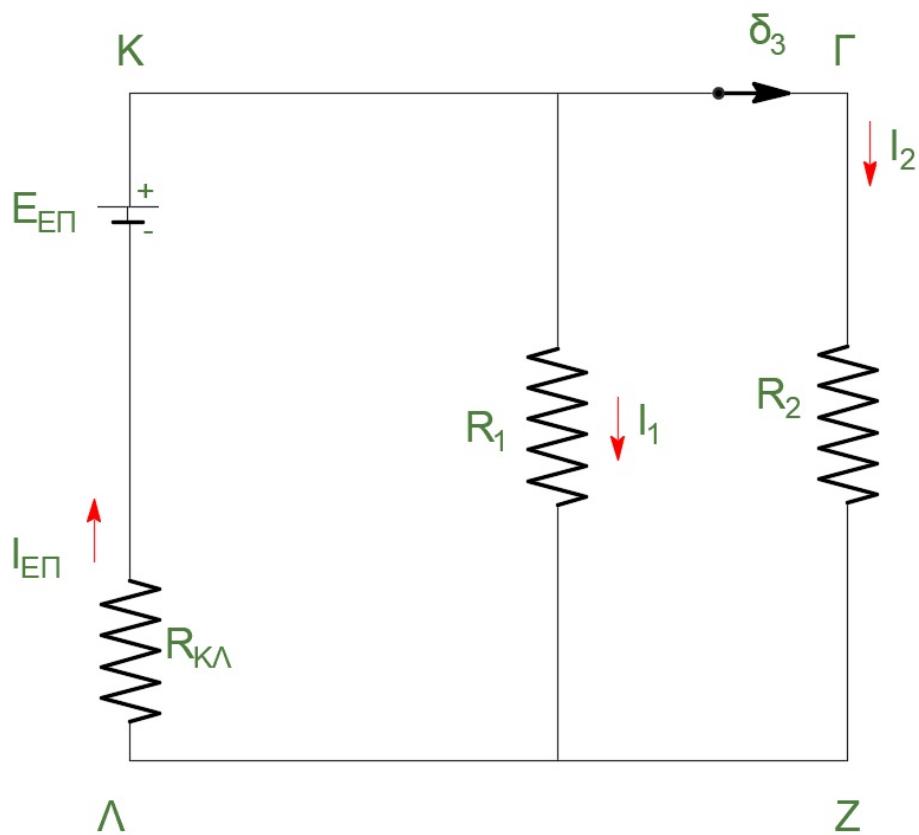
$$E_{\varepsilon\pi} = I_{\varepsilon\pi} \cdot R_{o\lambda} \Rightarrow E_{\varepsilon\pi} = 2Volt$$

$$V_{KA} = I_{\varepsilon\pi} \cdot R_\pi \Rightarrow V_{KA} = 1Volt$$

$$V_{KA} = E_{\varepsilon\pi} - I_{\varepsilon\pi} \cdot R_{KA} \Rightarrow V_{KA} = 1Volt$$

$$I_2 = \frac{V_{KA}}{R_2} \Rightarrow I_2 = \frac{1}{3}A$$

$$Q_2 = I_2^2 \cdot R_2 \cdot \Delta t \Rightarrow Q_2 = 1Joule$$



$$\beta) \underline{\tau \rho \delta \pi o \varsigma}$$

$$\Theta.\text{M.K.E} (t_1 = 2s \rightarrow t_2 = 5s)$$

$$\Delta K = \Sigma W \Rightarrow K_{\tau\varepsilon\lambda} - K_{\alpha\rho\chi} = W_F + W_{F_L}$$

$$\Delta x = v_o \cdot \Delta t \Rightarrow \Delta x = 6m$$

$$0 = F \cdot \Delta x + W_{F_L} \Rightarrow W_{F_L} = -3 \text{ Joule}$$

$$Q_{o\lambda} = |W_{F_L}| \Rightarrow Q_{o\lambda} = 3 \text{ Joule}$$

$$Q_{o\lambda} = Q_1 + Q_2 + Q_{KA}$$

$$Q = I^2 \cdot R \cdot \Delta t \Rightarrow Q = \frac{V^2}{R} \cdot \Delta t$$

$$\frac{Q_1}{Q_2} = \frac{R_2}{R_1} \Rightarrow \frac{Q_1}{Q_2} = \frac{1}{2}$$

$$Q_{KA} = I_{\varepsilon\pi}^2 \cdot R_{KA} \cdot \Delta t \quad Q_{1,2} = I_{\varepsilon\pi}^2 \cdot R_\pi \cdot \Delta t$$

$$\frac{Q_{KA}}{Q_{1,2}} = \frac{R_{KA}}{R_\pi} \Rightarrow \frac{Q_{KA}}{Q_{1,2}} = 1$$

και μετά τις πράξεις  $Q_2 = 1 Joule$

$$t_o = 0 \rightarrow t_1 = 2s$$

$$\Delta x_1 = \frac{1}{2} \cdot \alpha \cdot t_1^2 \Rightarrow \Delta x_1 = 2m$$

$$t_1 = 2s \rightarrow t_2 = 5s$$

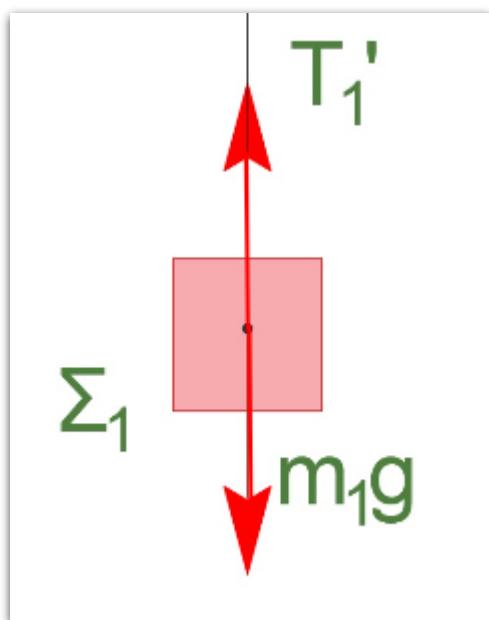
$$\Delta x_2 = v_o \cdot \Delta t \Rightarrow \Delta x_2 = 6m$$

$$W_F = F \cdot (\Delta x_1 + \Delta x_2) \Rightarrow W_F = 4 Joule$$

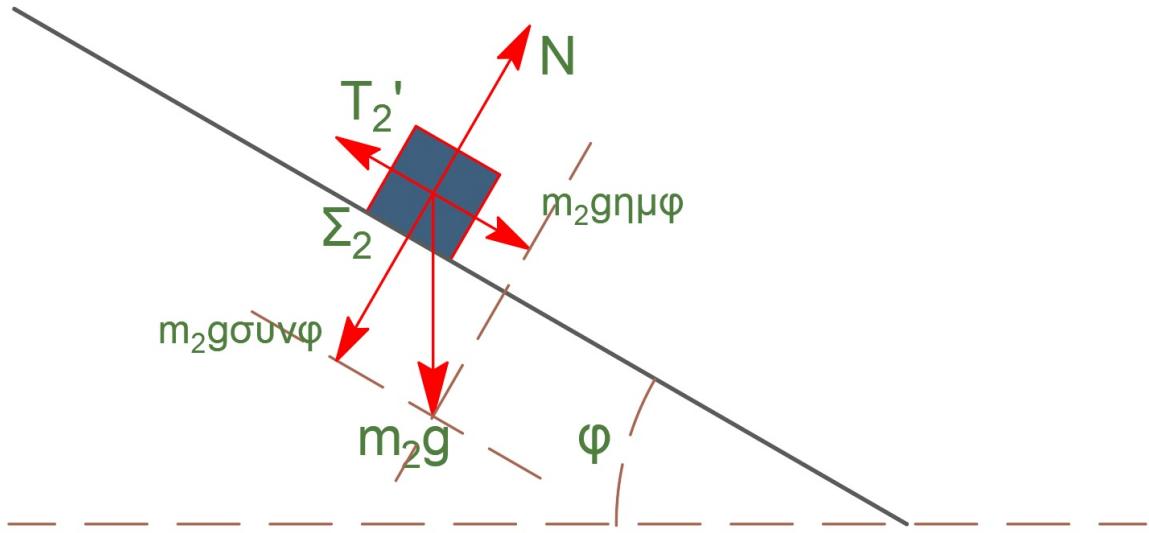
$$\Pi(\%) = \frac{Q_2}{W_F} \cdot 100\% \Rightarrow \Pi(\%) = 25\%$$

Θέμα 4

Δ1-(7)

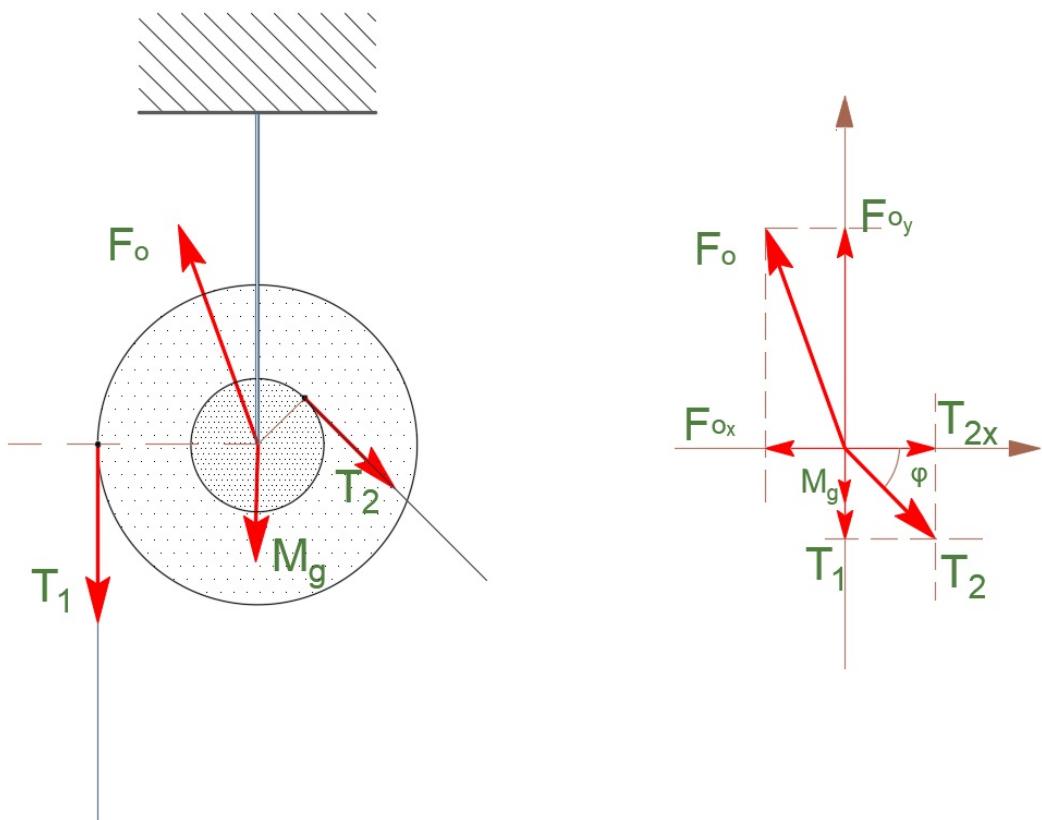


$$m_1 : \text{ισορροπία} \quad \Sigma \vec{F} = \vec{0} \Rightarrow m_1 \cdot g = T_1'$$



$$m_2 : \text{ισορροπία} \quad \sum \vec{F}_x = \vec{0} \Rightarrow m_2 \cdot g \cdot \eta \mu \varphi = T'_2$$

α) τρόπος



$$\text{τροχαλία T: ισορροπία} \quad \sum \vec{\tau}_{(o)} = \vec{0}$$

$$\vec{\tau}_{T_1} + \vec{\tau}_{T_2} = \vec{0} \Rightarrow T_1 \cdot r_1 = T_2 \cdot r_2 \Rightarrow T_1 = \frac{T_2}{2}$$

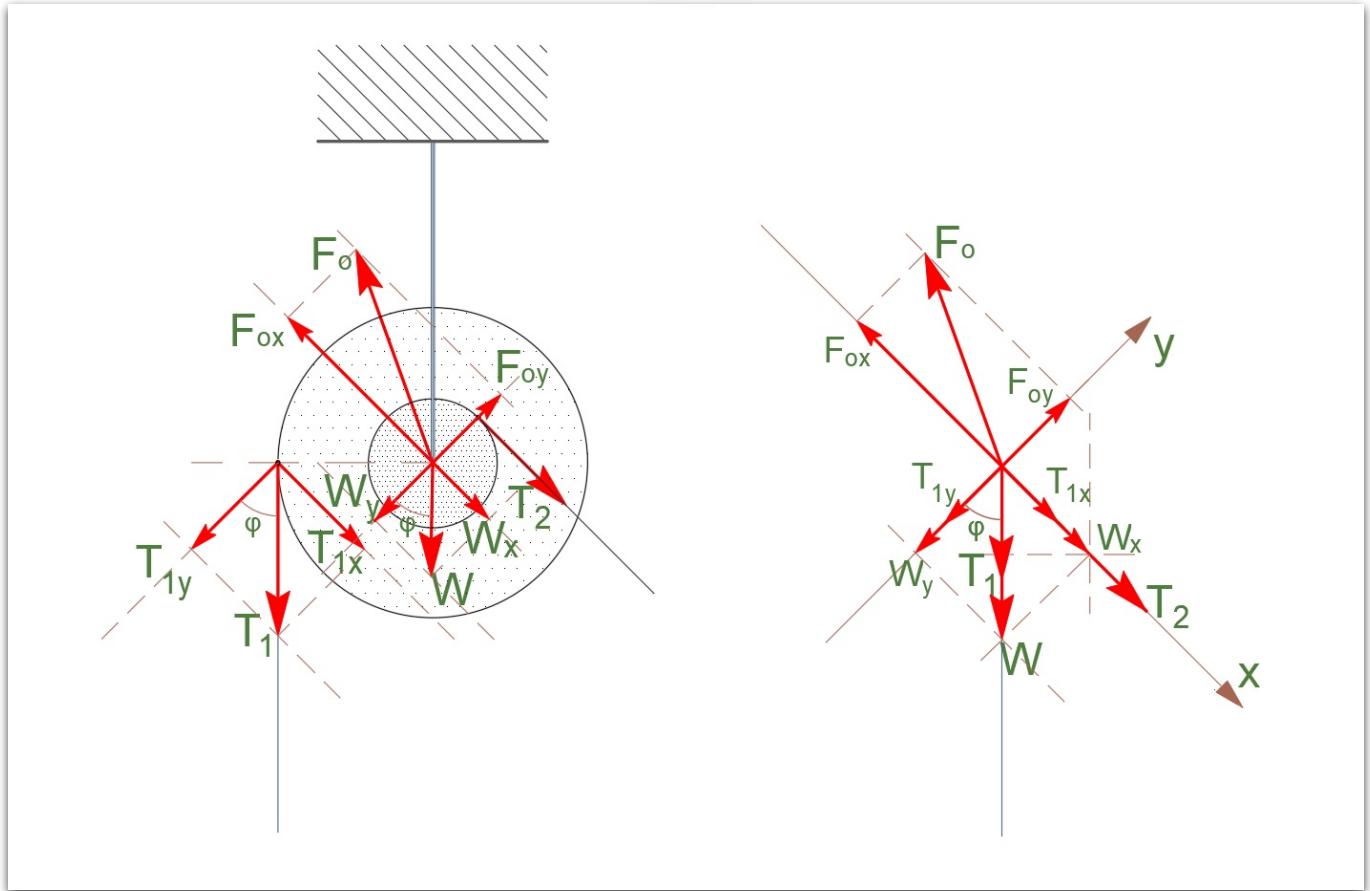
τροχαλία Τ: ισορροπία  $\Sigma \vec{F}_x = \vec{0}$

$$F_{ox} = T_{2x} \Rightarrow F_{ox} = T_2 \cdot \sigma v \nu \varphi$$

τροχαλία Τ: ισορροπία  $\Sigma \vec{F}_y = \vec{0}$

$$F_{oy} = T_1 + M \cdot g + T_2 \cdot \eta \mu \varphi$$

β) τρόπος



τροχαλία Τ: ισορροπία  $\Sigma \vec{\tau}_{(o)} = \vec{0}$

$$\vec{\tau}_{T_1} + \vec{\tau}_{T_2} = \vec{0} \Rightarrow T_1 \cdot r_1 = T_2 \cdot r_2 \Rightarrow T_1 = \frac{T_2}{2}$$

τροχαλία Τ: ισορροπία  $\Sigma \vec{F}_x = \vec{0}$

$$T_{1x} + W_x + T_2 = F_{ox} \Rightarrow T_1 \cdot \eta \mu \varphi + M \cdot g \cdot \eta \mu \varphi + T_2 = F_{ox}$$

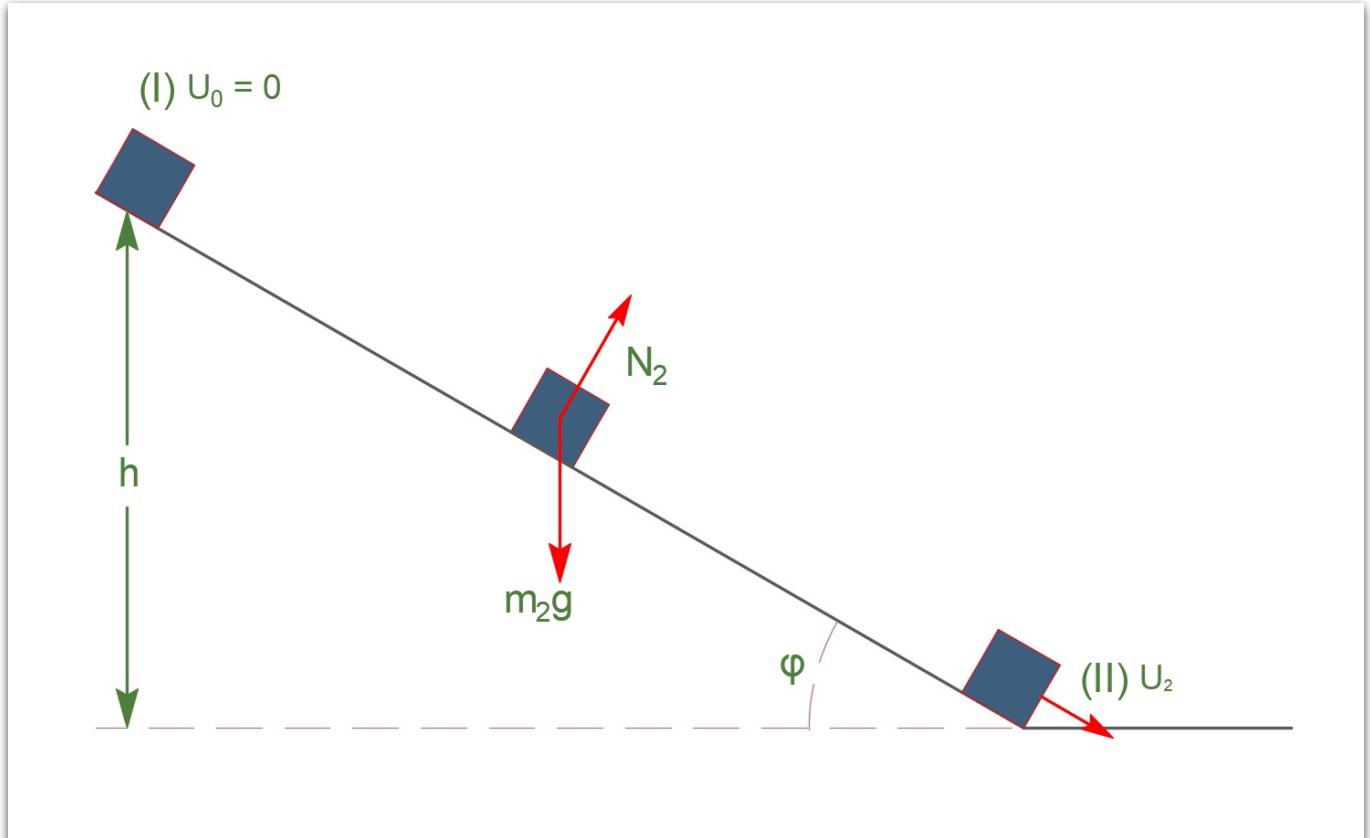
τροχαλία Τ: ισορροπία  $\Sigma \vec{F}_y = \vec{0}$

$$F_{oy} = T_{1y} + W_y \Rightarrow F_{oy} = T_1 \cdot \sigma v v \varphi + M \cdot g \cdot \sigma v v \varphi$$

και μετά τις πράξεις  $m_1 = 1.5kg$   $F_{ox} = 24N$  και  $F_{oy} = 48N$

$$F_o = \sqrt{F_{ox}^2 + F_{oy}^2} \Rightarrow F_o = 24\sqrt{5}N$$

**Δ2-(5)**



$\alpha) \underline{\tau\rho\delta\pi\circ\varsigma}$

$\Sigma_2 : A. \Delta. M. E. (I \rightarrow II)$

$$E_{Mhx}^{(I)} = E_{Mhx}^{(II)} \Rightarrow K^{(I)} + U^{(I)} = K^{(II)} + U^{(II)}$$

$$m_2 \cdot g \cdot h = \frac{1}{2} \cdot m_2 \cdot v_2^2 \Rightarrow v_2 = \sqrt{2 \cdot g \cdot h} \Rightarrow v_2 = 6 \frac{m}{s}$$

$\beta) \underline{\tau\rho\delta\pi\circ\varsigma}$

$\Sigma_2 : \Theta. M. K. E. (I \rightarrow II)$

$$\Delta K = \Sigma W \Rightarrow K^{\tau\varepsilon\lambda} - K^{\alpha\rho\chi} = W_B + W_{N_2}$$

$$W_B = B \cdot h \Rightarrow W_B = m_2 \cdot g \cdot h$$

$$\frac{1}{2} \cdot m_2 \cdot v_2^2 - 0 = m_2 \cdot g \cdot h + 0$$

$$m_2 \cdot g \cdot h = \frac{1}{2} \cdot m_2 \cdot v_2^2 \Rightarrow v_2 = \sqrt{2 \cdot g \cdot h} \Rightarrow v_2 = 6 \frac{m}{s}$$

$\gamma) \underline{\tau\rho\delta\pi\varsigma}$

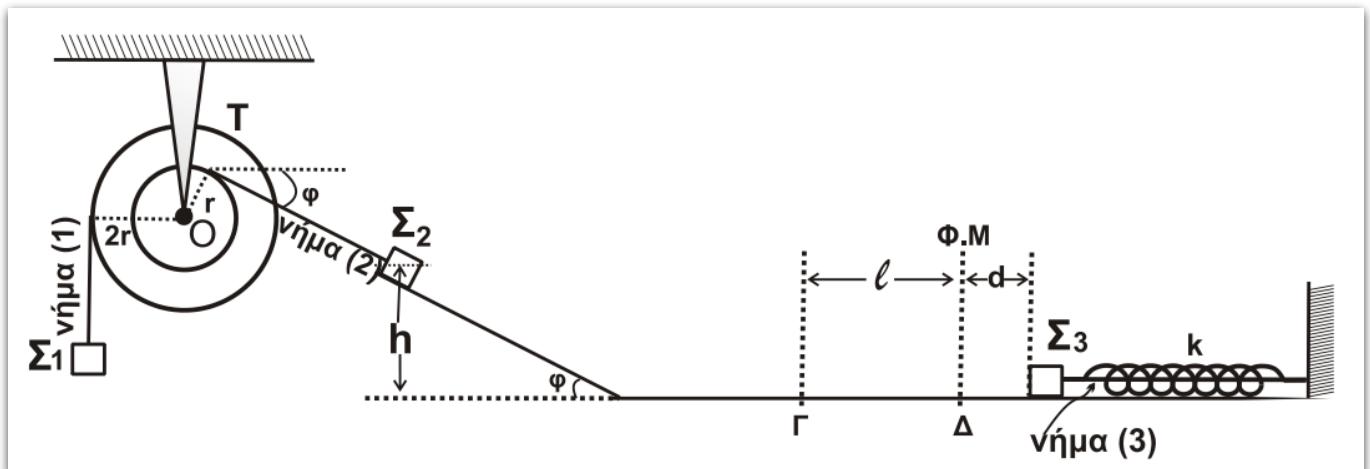
$\Sigma_2$  : εξισώσεις κίνησης

$$\eta\mu\varphi = \frac{h}{x} \Rightarrow x = \frac{h}{\eta\mu\varphi}$$

$$\alpha = \frac{\Sigma F}{m_2} \Rightarrow \alpha = \frac{W_x}{m_2} \Rightarrow \alpha = g \cdot \eta\mu\varphi$$

$$x = \frac{1}{2} \cdot \alpha \cdot t^2 \Rightarrow t = \sqrt{\frac{2x}{\alpha}} \Rightarrow t = \sqrt{\frac{2h}{g \cdot \eta\mu^2\varphi}}$$

$$v = \alpha \cdot t \Rightarrow v_2 = \sqrt{2 \cdot g \cdot h} \Rightarrow v_2 = 6 \frac{m}{s}$$



$\Sigma_2 : (\Gamma \rightarrow \Delta) \quad E.O.K. \Delta x = v_2 \cdot \Delta t$

$$\Delta t = \frac{l}{v_2} \Rightarrow \Delta t = 0.314s$$

$\Sigma_3 : \quad (A.\Theta. \rightarrow \Theta.I.)$

$$\Delta t = \frac{T}{4} \Rightarrow T = 0.4\pi$$

$\alpha) \underline{\tau\rho\delta\pi\varsigma}$

$$T = 2\pi \cdot \sqrt{\frac{m_3}{k}} \Rightarrow k = 125 \frac{N}{m}$$

$\beta) \underline{\tau\rho\delta\pi\varsigma}$

$$\omega = \frac{2\pi}{T} \Rightarrow \omega = 5 \frac{r}{s}$$

$$k = m_3 \cdot \omega^2 \Rightarrow k = 125 \frac{N}{m}$$

$\gamma$ ) τρόπος

$$t = \frac{\pi}{10}, \quad v = v_{max}, \quad \varphi_0 = \frac{3\pi}{2} rad$$

$$v = v_{max} \cdot \sigma v \nu (\omega t + \varphi_0) \Rightarrow v_{max} = v_{max} \cdot \sigma v \nu (\omega \cdot \frac{\pi}{10} + \frac{3\pi}{2})$$

$$\sigma v \nu (\omega \cdot \frac{\pi}{10} + \frac{3\pi}{2}) = \sigma v \nu 0 \Rightarrow \omega \cdot \frac{\pi}{10} + \frac{3\pi}{2} = 2\kappa\pi \pm 0, \quad \kappa \in \mathbb{Z}$$

$$\kappa = 1 \quad \omega \cdot \frac{\pi}{10} = \frac{\pi}{2} \Rightarrow \omega = 5 \frac{r}{s}$$

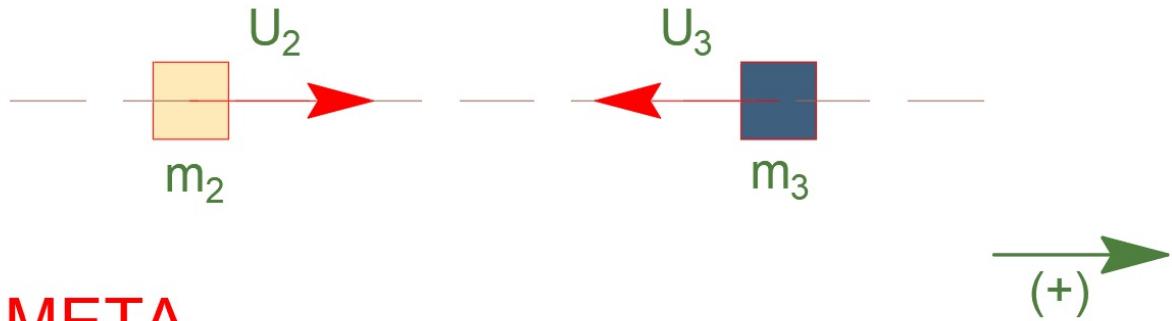
$$k = m_3 \cdot \omega^2 \Rightarrow k = 125 \frac{N}{m}$$

**Δ3-(5)**

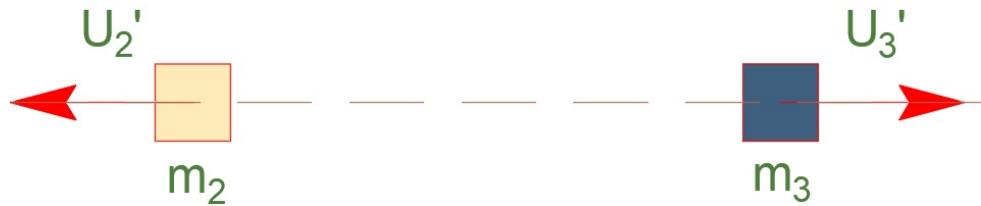
$$\Theta. I. \equiv \Theta. \Phi. M. \Rightarrow v_3 = v_{max} = A \cdot \omega \Rightarrow v_3 = 1 \frac{m}{s}$$

Κεντρική ελαστική κρούση, ίσες μάζες ανταλλαγή ταχυτήτων

## ΠΡΙΝ



## ΜΕΤΑ



$$v'_3 = v_2 \Rightarrow v_3 = 6 \frac{m}{s} \quad (\delta\varepsilon\xi\dot{\iota}\dot{\alpha})$$

$$v'_3 = A' \cdot \omega \Rightarrow A' = 1.2m$$

$$\left. \begin{array}{l} t_o = 0 \\ x = 0 \\ v'_3 < 0 \end{array} \right\} x = A \cdot \eta\mu(\omega t + \varphi_o)$$

$$0 = \eta\mu\varphi_o \Rightarrow \eta\mu\varphi_o = \eta\mu 0$$

$$\varphi_o = 2 \cdot k \cdot \pi + 0 \Rightarrow \varphi_o = 0 \text{ rad} \quad \alpha\pi\sigma\rho\rho\pi\tau\tau\sigma\alpha \quad v'_3 < 0$$

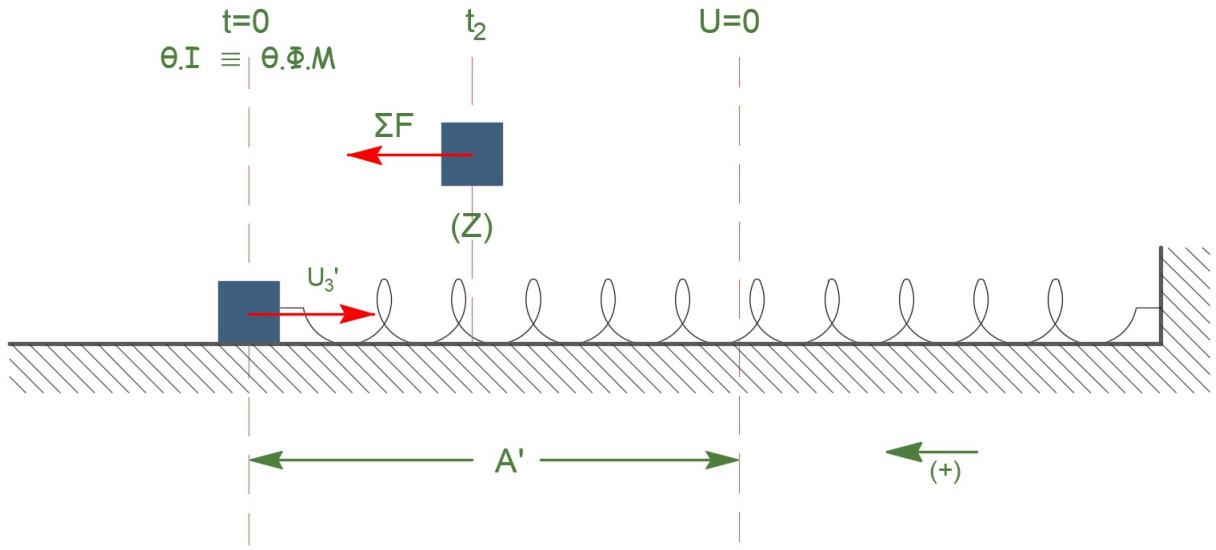
$$x = 1.2 \cdot \eta\mu(5t + \pi) \quad S.I.$$

**Δ4-(6)**

$$t_2 : \quad K = 8 \cdot U \quad E_{\tau\alpha\lambda} = K + U \quad U = \frac{1}{2} \cdot k \cdot x^2$$

Από Α.Δ.Ε.Τ. μετά τις πράξεις έχουμε:  $x = \pm 0.4m$

$$x_Z = -0.4m$$



$\alpha)$  τρόπος

$$\Sigma \vec{F} = \frac{\Delta \vec{p}}{\Delta t} = -D \cdot \vec{x}$$

$$\frac{\Delta p}{\Delta t} = +50 \text{ kg} \cdot \text{m} \cdot \text{s}^{-2}$$

$\beta)$  τρόπος

$$\frac{dp}{dt} = \frac{d}{dt}(mv) = m \cdot \frac{dv}{dt} = m \cdot \alpha = -m \cdot \omega^2 \cdot x$$

$$\frac{dp}{dt} = -m_3 \cdot \omega^2 \cdot x_Z \Rightarrow \frac{\Delta p}{\Delta t} = +50 \text{ kg} \cdot \text{m} \cdot \text{s}^{-2}$$

$$t_2 : K = 8 \cdot U \quad E_{\tau\alpha\lambda} = K + U \quad K = \frac{1}{2} \cdot m \cdot v^2$$

Από Α.Δ.Ε.Τ. μετά τις πράξεις έχουμε:  $v = \sqrt{32} \frac{\text{m}}{\text{s}}$

$\alpha)$  τρόπος

$$|\frac{\Delta K}{\Delta t}| = |\frac{\Delta W}{\Delta t}| = |\Sigma F \cdot v \cdot \sigma v \nu \varphi|$$

και μετά τις πράξεις  $\frac{\Delta K}{\Delta t} = 200\sqrt{2} \frac{\text{Joule}}{\text{s}}$

$\beta)$  τρόπος

$$\frac{dK}{dt} = \frac{d}{dt} \left( \frac{1}{2} mv^2 \right) = \frac{1}{2} m \frac{d}{dt} (v^2) = \frac{1}{2} m \cdot 2v \frac{dv}{dt}$$

$$\frac{dK}{dt} = m \cdot v \cdot \alpha = -m_3 \cdot v \cdot \omega^2 \cdot x_Z$$

και μετά τις πράξεις  $\frac{\Delta K}{\Delta t} = 200\sqrt{2} \frac{\text{Joule}}{\text{s}}$

### Δ5-(3)

Κεντρική ελαστική κρούση, ίσες μάζες ανταλλαγή ταχυτήτων

$$v'_2 = v_3 \Rightarrow v'_2 = 1 \frac{m}{s}$$

**Θ. I.  $\equiv$  Θ. Φ. M.**, άρα για πρώτη φορά μετά την κρούση το  $\Sigma_3$  διέρχεται από την Θ.Φ.Μ. σε χρόνο:

$$\Delta t' = \frac{T}{2} \Rightarrow \Delta t' = 0.2\pi s$$

$$\Sigma_2 : E.O.K. \quad x = v'_2 \cdot \Delta t' \Rightarrow x = 0.628m$$

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