

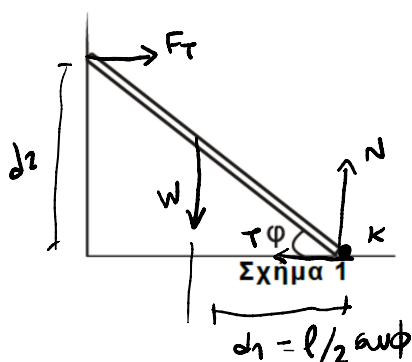
$A_1 \rightarrow \gamma$

$A_2 \rightarrow \delta$

$A_3 \rightarrow \gamma$

$A_4 \rightarrow \beta$

$A_5 \rightarrow \zeta, \wedge, \Sigma, \zeta, \wedge$



$$\sum F_x = 0 \Rightarrow \dots F_T = T \quad (1)$$

$$\sum F_y = 0 \Rightarrow \dots W = N \quad (2)$$

$$\sum \tau_K = 0 \Rightarrow \vec{\tau}_W + \vec{\tau}_{F_T} = 0 \Rightarrow \vec{\tau}_W = -\vec{\tau}_{F_T} \Rightarrow$$

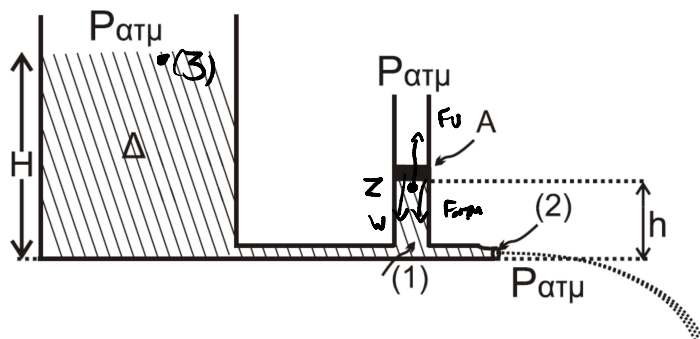
$$W \cdot d_1 = F_T \cdot d_2$$

$$W \cdot \frac{1}{2} l \cos \phi = F_T \cdot l \sin \phi \Rightarrow F_T = \frac{W}{2 \tan \phi}$$

Η τριβή είναι στατική $\rightarrow T \leq \mu N$ οριακή $\mu = \frac{T}{N} = \frac{W}{2 \tan \phi \cdot W}$

$$\mu_{op} = \frac{1}{2 \tan \phi} \Rightarrow \boxed{\tan \phi = \frac{1}{2 \mu}} \quad \text{Σωστό η (ii)}$$

B2



$$\Sigma \text{το έμβηδο } \Sigma F = 0 \Rightarrow W + F_{\alpha\tau\mu} = F_U \Rightarrow \frac{W}{A} + P_{\alpha\tau\mu} = P_Z \quad (1)$$

$$\text{Από την ισορροπία του πνεύματος στο σωλήνα } P_1 = P_Z + \rho g h \Rightarrow P_Z = P_1 - \rho g h \quad (2)$$

$$\text{Από (1), (2)} \quad \frac{W}{A} + P_{\alpha\tau\mu} = P_1 - \rho g h \quad (3).$$

$$\text{Από την εξίσωση Bernoulli (3)} \rightarrow (2) \rightarrow \cancel{\frac{1}{2}\rho u_3^2} + \cancel{P_3} + \rho g h = \cancel{\frac{1}{2}\rho u_2^2} + \cancel{\rho g h_0} + \overbrace{P_{\alpha\tau\mu}}^{P_2}$$

$$u_2^2 = 2gh \quad (4)$$

$$\text{Εξίσωση συνέχειας: } A_2 \cdot u_2 = A_1 \cdot u_1 \Rightarrow u_1 = \frac{A_2}{A_1} u_2 = \frac{1}{2} u_2 \quad (5)$$

$$\text{Με Bernoulli (1} \rightarrow 2\text{): } P_1 + \frac{1}{2}\rho u_1^2 + \cancel{\rho g h_1} = P_2 + \frac{1}{2}\rho u_2^2 + \cancel{\rho g h_2} \Rightarrow P_1 = P_{\alpha\tau\mu} - \frac{1}{2}\rho(u_2^2 - u_1^2)$$

$$P_1 = P_{\alpha\tau\mu} + \frac{1}{2}\rho(u_2^2 - \frac{1}{4}u_2^2) = P_{\alpha\tau\mu} + \frac{1}{2}\rho \frac{3}{4}u_2^2$$

$$P_1 = P_{\alpha\tau\mu} + \frac{3}{8}\rho 2gh = P_{\alpha\tau\mu} + \frac{3}{4}\rho gh.$$

$$\text{Αντικαθιστώντας στην (3)} \quad \frac{W}{A} + \cancel{P_{\alpha\tau\mu}} = \cancel{P_{\alpha\tau\mu}} + \frac{3}{4}\rho gh - \rho gh \frac{1}{4} = \frac{2}{4}\rho gh$$

$$W = \frac{\rho g h A}{2} \quad (i)$$

(B3) 1η κρούση: ΑΔΟ $\vec{P}_{\alpha\tau\mu} = \vec{P}_{\tau\alpha\alpha} \Rightarrow \vec{P}_1 = \vec{P}_1' + \vec{P}_2'$

$$\text{Ανάλυση σε δύο άξονες} \quad m_1 u_1 = m_2 u_2' \sin 30^\circ + 0 \Rightarrow u_2' \sin 30^\circ = \frac{u_1}{2}$$

$$0 = m_1 u_1' + m_2 u_2' \cos 30^\circ \Rightarrow u_2' \cos 30^\circ = -\frac{u_1'}{2}$$

$$\text{Από } u_2' \sin 30^\circ = \frac{u_1}{2} \Rightarrow \frac{u_2'}{2} = \frac{u_1}{2} \Rightarrow u_2' = u_1$$

$$u_2' \cos 30^\circ = -\frac{u_1'}{2} \Rightarrow \frac{u_2'}{2} \cdot \frac{\sqrt{3}}{2} = -\frac{u_1'}{2} \Rightarrow u_1' = -\frac{\sqrt{3}}{2} u_2'$$

$$\text{Πλάγια κρούση: } \vec{P}_{\alpha\tau\mu} = \vec{P}_{\tau\alpha\alpha} \Rightarrow m_1 \cdot u_1' = (m_1 + m_3) v \Rightarrow v = \frac{m u}{2m} = \frac{u}{2}$$

$$K_{\text{εξ}} = \frac{1}{2} 2m v^2 = m \frac{u^2}{4} = m \frac{u_1^2}{12}$$

$$\therefore K_{\text{εξ}} = \frac{m u_1^2}{12} = \frac{1}{12} \quad (\dots)$$

$$\Rightarrow \frac{k_2}{k_1} = \frac{m_1^2 \cancel{v}}{12 m_1 \cancel{v}} = \frac{1}{6}$$

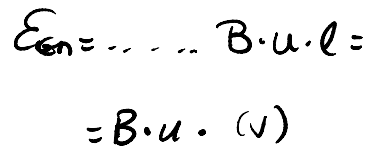
$$^{\circ}(\vec{n})$$
$$P = I_{\text{eff}}^2 \cdot R_1 \Rightarrow 12 = I_{\text{eff}}^2 \cdot 6 \Rightarrow I_{\text{eff}}^2 = 2 \Rightarrow \underline{I_{\text{eff}} = \sqrt{2} \text{ A}}$$

Ex 2

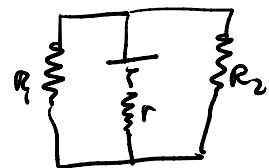
$$\frac{V_{\max}'}{V_{\max}} = \frac{N \cdot \omega' \cdot B \cdot A}{N \cdot \omega \cdot B \cdot A} \Rightarrow V_{\max}' = 2 \cdot 12 = 24 \text{ V.} \quad \omega' = 2\omega = 100 \pi \text{ rad/s}$$

$$\Rightarrow P = 96 \eta \mu^2 (100 \times 5 \cdot 10^{-3}) = 96 \eta \mu^2 \eta/2 = \underline{\underline{96W}}$$

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$$I = \frac{Bu}{2+2} = \frac{Bu}{4}$$



$$F_{\text{red}} = B T I = B \xrightarrow{B u} = \underline{B^2 u}$$

$$F_{\text{top}} = B I l = B \frac{B u}{4} = \frac{B^2 u}{4}$$

$$\Sigma \text{ τα άνω ταχύτητα } \Sigma F = 0 \Rightarrow F_{\text{top}} = F \Rightarrow \frac{B^2 u}{4} = 0,5 \Rightarrow B^2 u = 2$$

Όπως μάλιστα να φτάσει το δίκτυο έχω επιταχυνόμενα κίνηση:

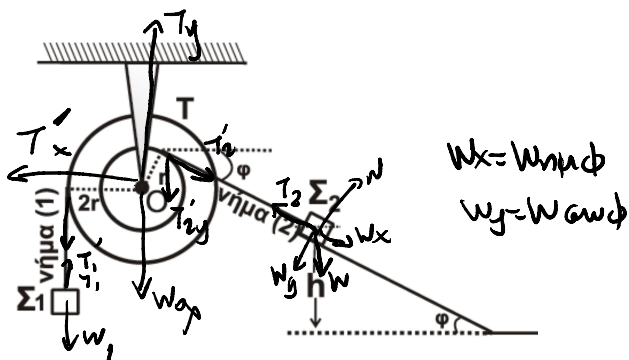
$$F = ma \Rightarrow 0,5 = 0,5a \Rightarrow a = 1 \text{ m/s}^2 \text{ και } u = a \cdot t = 2 \text{ m/s}$$

$$\text{Άρα } B^2 u = 2 \Rightarrow B^2 = 1 \Rightarrow \boxed{B = 1 \text{ T}}$$

$$\textcircled{14} \quad \begin{array}{l} \text{Από } 0 \rightarrow 2 \text{ sec} \quad W_F = F \cdot \Delta x = 0,5 \cdot \frac{1}{2} a \cdot \Delta t^2 = 0,5 \cdot \frac{1}{2} \cdot 1 \cdot 4 = 1 \text{ J} \\ 2 \rightarrow 5 \text{ sec} \quad W_F = F \cdot \Delta x' = 0,5 \cdot u \cdot \Delta t = 0,5 \cdot 2 \cdot 3 = 3 \text{ J} \end{array} \quad \left. \vphantom{\begin{array}{l} W_F = 1 \text{ J} \\ W_F = 3 \text{ J} \end{array}} \right\} W_F = 4 \text{ J}$$

$$Q = \frac{V_{r2}^2}{R_2} t = \frac{V_{\text{κ1}}^2}{R_2} t = \frac{(E - I \cdot R_{\text{κ}})^2}{R_2} t = \frac{(2 - 0,5 \cdot 2)^2}{3} \cdot 3 = \frac{3}{3} \text{ J}$$

$$\eta \% = \frac{Q}{W_F} \cdot 100 = \frac{1}{4} \cdot 100 = \frac{100}{4} = 25 \%$$



Ισορροπία Σ2

$$\Sigma F_x = 0 \Rightarrow W_x = T_2 \Rightarrow m_2 g \eta \mu \phi = T_2 \quad (1)$$

Ισορροπία Σ1

$$\Sigma F = 0 \quad m_1 g = T_1 \quad (2)$$

Ισορροπία τροχαλίας

$$\Sigma \tau_0 = 0 \Rightarrow T_2 r = T_1 r \Rightarrow T_1 = T_2 \quad (3)$$

Α. ρ.

$$\sum T_0 = 0 \Rightarrow T_2 \neq T_1 \text{ εφ} \Rightarrow T_1 = \frac{v}{2} (3)$$

Επειδή υπάρχει αβάρη επί εκκρεμίας: $(T) = (T_1')$, $(T_2) = (T_2')$

$$\text{Αρα } m_1 g = \frac{m_2 g \eta \mu \phi}{2} \Rightarrow m_1 = \frac{5 \cdot 0,6}{2} = \frac{3}{2} \Rightarrow \underline{m_1 = 1,5 \text{ kg}}$$

$$\text{Αναλύω την } T_2': T_2' y = T_2' \cdot \eta \mu \phi = 30 \cdot 0,6 = 18 \text{ N}$$

$$T_2' x = T_2' \cdot \sigma \omega \phi \Rightarrow 30 \cdot 0,8 = 24 \text{ N.}$$

$$T_2' = m_2 g \eta \mu \phi = 50 \cdot 0,6 = 30 \text{ N}$$

$$\text{Ισορροπία προχαλίας } \sum F_x = 0 \Rightarrow T' = T_2' x = 24 \text{ N.}$$

$$\sum F_y = 0 \Rightarrow W_{\text{εφ}} + T_1' - T_2' y = T_y \Rightarrow 15 + 15 + 18 = T_y$$

$$30 + 18 = T_y \Rightarrow T_y = 48 \text{ N}$$

$$\text{Αρα } T = \sqrt{T_x^2 + T_y^2} = \sqrt{24^2 + 48^2} = 24\sqrt{5} \text{ N}$$

(Δ2)

AAT

$T_0 \text{ } \Sigma_3$ συγκρατείται μέχρι από $\Delta t = \frac{T}{4}$

$T_0 \text{ } \Sigma_1$ κάνει την απόσταση l στον ίδιο χρόνο

$$\text{Αρα } l = v \cdot t \Rightarrow t = \frac{l}{v}$$

$$\text{Βρίσκω } v: \text{Θα κτ } k_{\text{εφ}} - k_{\text{εφ}}^0 = W_{\text{εφ}} \Rightarrow \frac{1}{2} m v^2 = m g h \Rightarrow v^2 = 2 g h \Rightarrow v = \sqrt{2 \cdot 10 \cdot 1,8}$$

$$\underline{v = 6 \text{ m/s}}$$

$$\text{Αρα } t = \frac{30}{5 \cdot 6} = \frac{30}{30} = \frac{1}{10} \text{ sec.} \quad \text{όμως } t = \frac{T}{4} \Rightarrow \frac{n}{10} = \frac{T}{4}$$

$$\Rightarrow \frac{n}{10} = \frac{2\pi}{4\pi} \sqrt{\frac{m_3}{k}} \Rightarrow \frac{1}{25} = \frac{m_3}{k} \Rightarrow k = 5 \cdot 25 = 125 \text{ N/m}$$

Δ3 Τα δύο σώματα έχουν την ίδια μάζα, άρα ανταλλάσσουν ταχύτητες, οπότε $u_3' = v_2 = 6 \text{ m/s}$

$$u_3' = u_{\max} = \omega A \Rightarrow A = \frac{6}{\sqrt{25}} = \frac{6}{5} = 1,2 \text{ m}$$

$$x = A \eta_{\mu}(\omega t + \phi_0) = 1,2 \eta_{\mu}(5t + \pi) \text{ (SI) δίνει την } t=0 \longrightarrow$$

Δ4 $\frac{dP}{dt} = \sum F = -Dx$

$$E_{\text{ολ}} = K + U \Rightarrow E_2 = 8U + U \Rightarrow 6A = 9U \Rightarrow \frac{1}{2}DA^2 = 9 \frac{1}{2}Dx^2 \Rightarrow x^2 = \frac{A^2}{9} \Rightarrow x = \pm \frac{A}{3} \Rightarrow x = -\frac{A}{3} = -\frac{1,2}{3} = -0,4 \text{ m}$$

$$\frac{dP}{dt} = -125 \cdot \left(-\frac{A}{3}\right) = +125 \cdot 0,4 = 50 \text{ N}$$

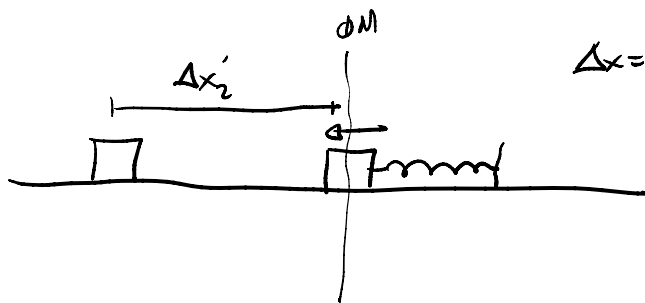
Αντίστοιχα, $\left| \frac{dK}{dt} \right| = \sum F \cdot u \xleftarrow{\text{με αντίθετη...}} = 50 \cdot u = 50 \cdot 4\sqrt{2} = 200\sqrt{2} \text{ J/s}$

Για να βρω την U θα κάνω ΑΔΕΥ: $\frac{1}{2}DA^2 = \frac{1}{2}mU^2 + \frac{1}{2}Dx^2 \Rightarrow U^2 = \frac{D}{m}(A^2 - x^2)$
 $\Rightarrow U^2 = \frac{125}{5}(1,2^2 - 0,4^2) = \frac{125}{5} \cdot 1,28 = \frac{160}{5} \Rightarrow U = \sqrt{\frac{160}{5}} = 4\sqrt{2} \text{ m/s}$

Δ5 Η χρονική διαρκεία είναι $t = \frac{T}{2} = \frac{2\pi}{\omega} \sqrt{\frac{5}{125}} = \frac{\pi}{5} \text{ sec.}$

Το $\bar{x}_2$ έχει διανύσει απόσταση $\Delta x_2 = v_2' \cdot t = 1 \cdot \frac{\pi}{5} = \frac{\pi}{5} \text{ m}$

όμως $|v_2'| = v_3 = \omega \cdot d = 5 \cdot 0,2 = 1 \text{ m/s}$



$$\Delta x = \frac{11}{5} m = \frac{3,14}{5} m = 0,628m$$

