ΠΑΝΕΛΛΗΝΙΕΣ ΕΞΕΤΑΣΕΙΣ
ΗΜΕΡΗΣΙΟΥ ΚΑΙ ΕΣΠΕΡΙΝΟΥ ΓΕΝΙΚΟΥ ΛΥΚΕΙΟΥ
ΤΡΙΤΗ 22 ΙΟΥΝΙΟΥ 2021
ΕΞΕΤΑΖΟΜΕΝΟ ΜΑΘΗΜΑ:

ΦΥΣΙΚΗ ΠΡΟΣΑΝΑΤΟΛΙΣΜΟΥ

Ε Ν Δ Ε Ι Κ Τ Ι Κ Ε Σ Α Π Α Ν Τ Η Σ Ε Ι Σ Θ Ε Μ Α Τ Ω Ν

ΘΕΜΑ Α

Α1. γ

Α2. δ

Α3. γ

Α4. Β

Α5. **α** – Σ
β – Λ
γ – Σ
δ – Σ
ε – Λ

ΘΕΜΑ Β

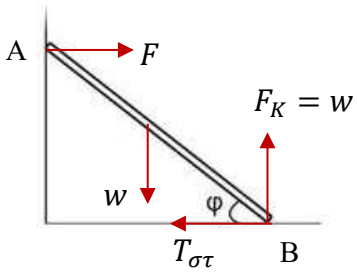
Β1 – ii)

$\Sigma F_y = 0 \Longrightarrow F_K = w$

$\Sigma F_x = 0 \Longrightarrow F = T_{\sigma\tau}$

$\Sigma\tau_B = 0 \Longrightarrow w\frac{\ell}{2}\sigma\upsilon\nu\varphi - F\ell\eta\mu\varphi = 0$ ή

$F = \frac{w}{2}\cdot\frac{1}{\varepsilon\varphi\varphi} = T_{\sigma\tau}$



$T_{\sigma\tau} \le T_{o\rho} \Longrightarrow \frac{w}{2}\cdot\frac{1}{\varepsilon\varphi\varphi} \le \mu w \Longrightarrow \varepsilon\varphi\varphi \ge \frac{1}{2\mu} \Longrightarrow \varepsilon\varphi\varphi_{max} = \frac{1}{2\mu}$

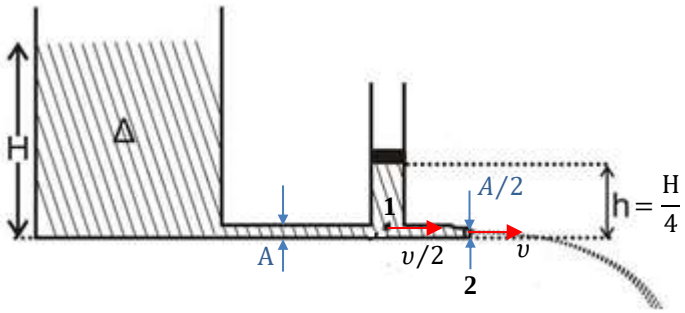
Β2 – i)

$\upsilon = \sqrt{2gH}$

Εξίσωση Bernoulli:

$P_1 + \frac{1}{2}\rho\left(\frac{\upsilon}{2}\right)^2 = P_{at} + \frac{1}{2}\rho\upsilon^2$

$P_1 = P_{at} + \frac{1}{2}\rho\frac{3}{4}2gH \Longrightarrow$



$$P_1 = P_{at} + \frac{3}{4}\rho g H \quad (2)$$

Αλλά $P_1 = P_{at} + \rho g\frac{H}{4} + \frac{w}{A} = P_{at} + \frac{3}{4}\rho g H$

$$\frac{w}{A} = \frac{1}{2}\rho g H \Longrightarrow w = \frac{A}{2}\rho g H$$

Β3 – iii)

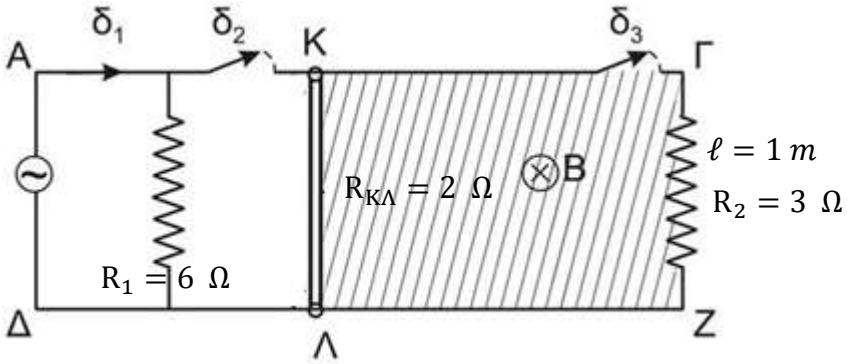
Έκκεντρη ελαστική κρούση: $P_{x,\pi} = P_{x,\mu} \Longrightarrow m\upsilon_1 = 2m\upsilon_2' \sigma\upsilon\nu 30$ ή $\upsilon_2' = \frac{\upsilon_1}{\sqrt{3}}$ (1)

$$P_{y\pi} = P_{y\mu} \Longrightarrow 0 = m\upsilon_1' - 2m\upsilon_2' \eta\mu 30^o \Longrightarrow \upsilon_1' = \frac{\upsilon_1}{\sqrt{3}} \quad (2)$$

Πλαστική κρούση: $m_1\upsilon_1' = (m_1 + m_3)V \Longrightarrow V = \frac{\upsilon_1}{2\sqrt{3}}$

$$\text{και } \frac{K_{\sigma\upsilon\sigma}}{K_{\alpha\rho}} = \frac{\frac{1}{2}2mV^2}{\frac{1}{2}m\upsilon_1^2} \Longrightarrow \frac{K_{\sigma\upsilon\sigma}}{K_{\alpha\rho}} = \frac{1}{6}$$

ΘΕΜΑ Γ



$m = 0{,}5\ kg$

$\upsilon = V\eta\mu 50\pi t$

Γ1) $P_1 = I_{\varepsilon\nu_1}^2 R_1 \Longrightarrow I_{\varepsilon\nu_1} = \sqrt{2}\ A \Longrightarrow I_o = \sqrt{2}\cdot\sqrt{2}\ A = 2\ A$

$V = I_o R_1 \Longrightarrow V_o = 12\ V$

Γ2) $\upsilon' = V'\eta\mu(\omega' t)$

$V' = 2\omega BA = 24\ V$

$\omega' = 100\pi\ rad/s$

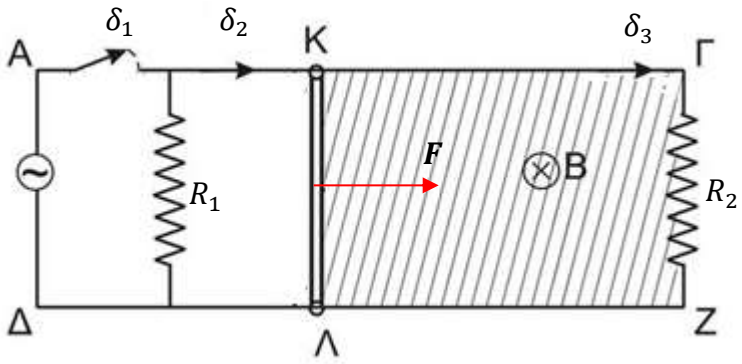
$\left.\begin{array}{l}\upsilon' = 24\eta\mu 100\pi t \text{ και} \\ i = 4\eta\mu 100\pi t\end{array}\right\}$ (S.I.)

Συνεπώς $P = iv' \Longrightarrow P = 96\eta\mu^2 100\pi t \ \ (S.I.)$

$t = 5 \cdot 10^{-3}\ s \Longrightarrow P = 96\,\eta\mu^2 100\pi \cdot 5 \cdot 10^{-3}\ W$ ή

$P = 96\eta\mu^2 \dfrac{\pi}{2} \Longrightarrow P = 96\ W$

Γ3)



$\alpha = \dfrac{F}{m} = 1\ \ m/s^2$

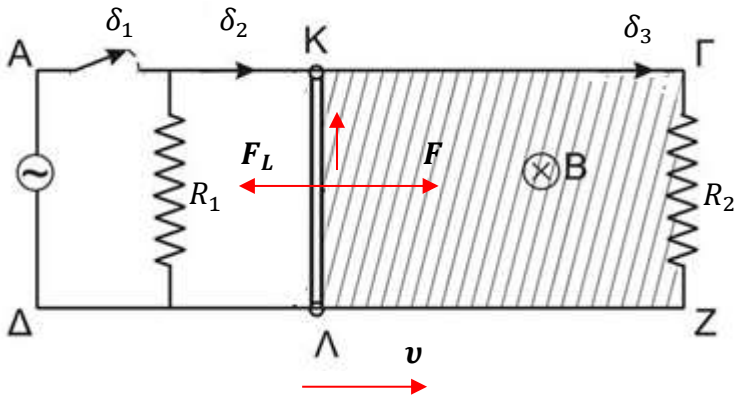
$t = 2\ s \Longrightarrow \upsilon = 2\ \ m/s$

$v = \sigma\tau\alpha\theta. \Longrightarrow \Sigma F = 0 \Longrightarrow F - F_L = 0 \Longrightarrow F = BI\ell$

$I = \dfrac{\mathcal{E}_{\varepsilon\pi}}{R_{o\lambda}} = \dfrac{B\upsilon\ell}{R_{o\lambda}}$ όπου $R_{o\lambda} = R_{K\Lambda} + \dfrac{R_1 R_2}{R_1 + R_2} = 4\ \Omega$

Συνεπώς: $\dfrac{B^2\upsilon\ell^2}{R_{o\lambda}} = F \Longrightarrow B^2 = \dfrac{0{,}5 \cdot 4}{2 \cdot 1}\ T \Longrightarrow B = 1\ T$

Γ4)



$W_F = F \cdot x$ ή $W_F = F\left(\dfrac{1}{2}\alpha\Delta t_1^2 + \upsilon\Delta t\right)$ ή $W_F = 0{,}5(2+6)\ J = 4\ J$

Η ΗΕΔ στον αγωγό:

$$\mathcal{E}_{\varepsilon\pi} = B\upsilon\ell = 2\ V$$

και το ρεύμα στον αγωγό (ΚΛ):

$$I = \frac{\mathcal{E}_{\varepsilon\pi}}{R_{o\lambda}} \Longrightarrow I = \frac{2\ V}{4\ \Omega} = 0{,}5\ A$$

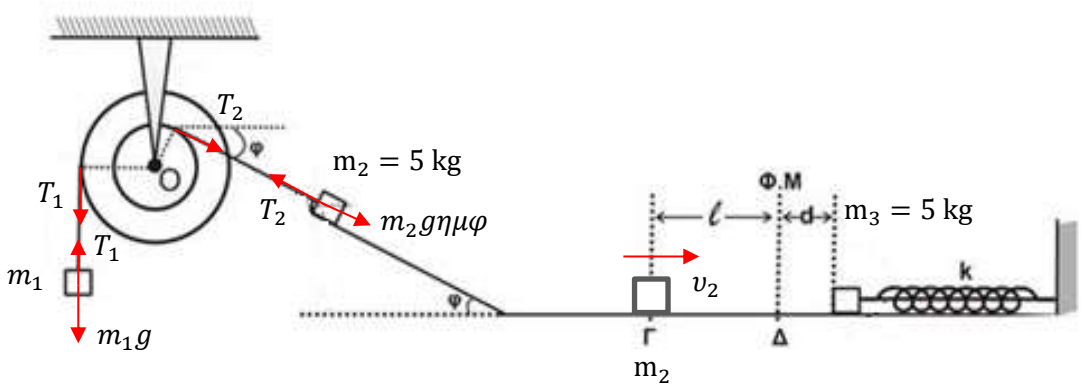
Η τάση $V_{K\Lambda} = \mathcal{E} - IR_{K\Lambda} \Longrightarrow V_{K\Lambda} = 1\ V$

Στον αντιστάτη R_2: $I_2 = \frac{V_2}{R_2} = \frac{1}{3}\ A$ και

$$Q_2 = I_2^2 Rt \Longrightarrow Q_2 = \frac{1}{3} \cdot 3 \cdot 3\ J = 1\ J$$

Έτσι $\frac{Q_2}{W} = \frac{1}{4} = 0{,}25$ ή 25%

ΘΕΜΑ Δ



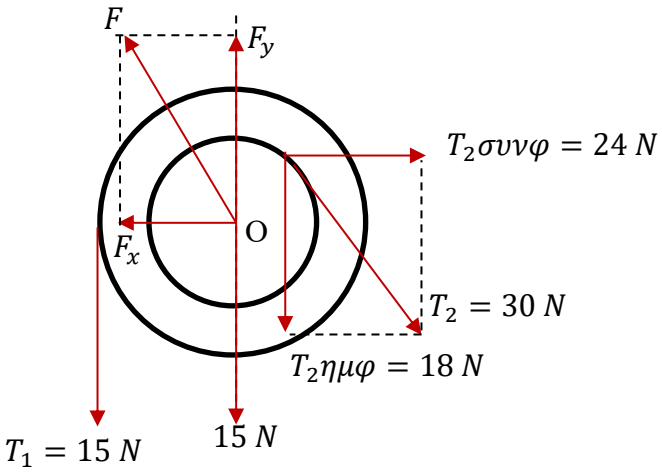
Δ1.α) Από την ισορροπία της τροχαλίας:

$\Sigma T_O = 0 \Longrightarrow T_1 \cdot 2r - T_2 r = 0$ ή

$m_1 g \cdot 2 = m_2 g\eta\mu\varphi$ ή

$$m_1 = \frac{m_2\eta\mu\varphi}{2} \Longrightarrow \boxed{m_1 = 1{,}5\ kg}$$

β)



$\Sigma F_x = 0 \Longrightarrow F_x = 24\ N$

$\Sigma F_y = 0 \Longrightarrow F_y = 48\ N$

$\vec{F} = \vec{F_x} + \vec{F_y} \Longrightarrow F = \sqrt{F_x^2 + F_y^2} \Longrightarrow F = 24\sqrt{5}\ N$

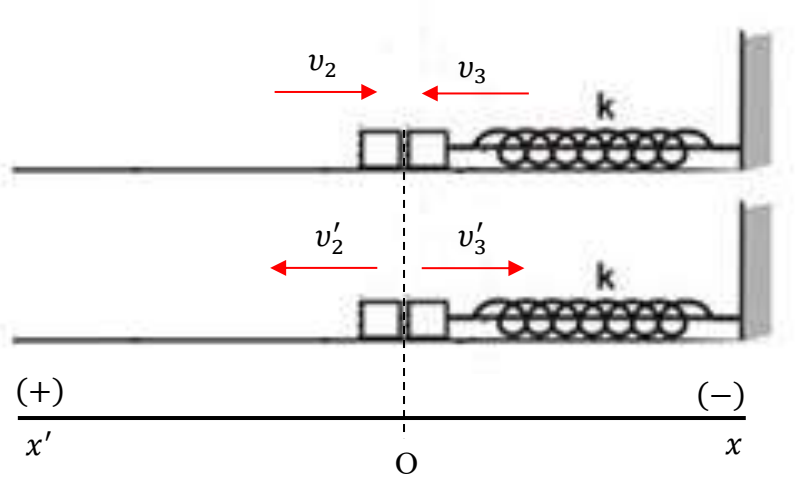
Δ2. $A.\Delta.M.E. \Longrightarrow m_2 gh = \frac{1}{2} m_2 \upsilon_2^2 \Longrightarrow \upsilon_2 = \sqrt{2gh} \Longrightarrow \upsilon_2 = 6\ \ m/s$

$\Delta t_1 = \Delta t_2 \Longrightarrow \frac{\ell}{\upsilon_2} = \frac{1}{4}\ T$ ή

$\frac{\ell}{\upsilon_2} = \frac{1}{4} 2\pi \sqrt{\frac{m_3}{k}} \Longrightarrow$ στο σύστημα S.I.

$\frac{3\pi}{5 \cdot 6} = \frac{\pi}{2} \sqrt{\frac{5}{k}} \Longrightarrow k = 125\ \ N/m$

Δ3.



Πριν από την κρούση: $\upsilon_2 = -6\ \ m/s$

$\upsilon_3 = 1\ \ m/s$

Αφού $m_1 = m_2$ και η κρούση είναι κεντρική – ελαστική:

$\upsilon_2' = \upsilon_3 = 1\ \ m/s$ και $\upsilon_3' = \upsilon_2 = -6\ \ m/s$

Για το σώμα Σ_3: $t = 0,\ x = 0$ και $\upsilon_2 = -6\ \ m/s$

Άρα: $x = A\eta\mu(\omega t + \varphi_o)$ με $\omega = \sqrt{\frac{k}{m_3}} = 5\ \ rad/s,\ \ A = \frac{|\upsilon_3'|}{\omega} = 1{,}2\ \ m$ και

$\varphi_o = \pi\ \ rad$

$\boxed{x = 1{,}2\ \eta\mu(5t + \pi)}$ (S.I.)

Δ4. $K + U = E \Longrightarrow U = E \Longrightarrow \frac{1}{2} kx^2 = \frac{1}{2} kA^2 \Longrightarrow x = \pm\frac{A}{3} = \pm 0{,}4\ \ m$

Για πρώτη φορά $x = -0{,}4\ m$ τότε:

$$\frac{dP}{dt} = F = -kx \Longrightarrow \frac{dP}{dt} = 50 \ \ kgm/s^2$$

$$\upsilon = \pm\omega\sqrt{A^2 - x^2} \Longrightarrow \upsilon = \pm 5\sqrt{1{,}2^2 - 0{,}4^2} \ \ m/s \ \ \text{ή} \ \ \upsilon = \pm 4\sqrt{2} \ \ m/s$$

$$\left|\frac{dK}{dt}\right| = |F\upsilon| \Longrightarrow \frac{dK}{dt} = 200\sqrt{2} \ \ J/s$$

Δ5. Τη χρονική στιγμή $t = \frac{1}{2}T = \frac{\pi}{5}$ s:

$$x_2' = \upsilon_2' t = -\frac{\pi}{5} \ \ m$$

$$x_3' = 0$$

$$\Delta x = x_3' - x_2' = \frac{\pi}{5} \ \ m$$