

(Ενδεικτικές απαντήσεις)

ΘΕΜΑ Α

- A1. → γ
A2. → α
A3. → γ
A4. → δ
A5.
α → Σωστό
β → Λάθος
γ → Σωστό
δ → Σωστό
ε → Λάθος

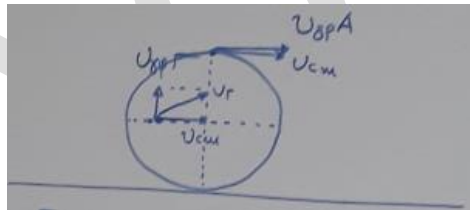
ΘΕΜΑ Β

B1 → (iii)

$$u_A = 2u_{cm}$$

$$u_{\Gamma} = \sqrt{u_{cm}^2 + \frac{u_{cm}^2}{4}} \Rightarrow u_{\Gamma} = \frac{\sqrt{5}}{2} u_{cm}$$

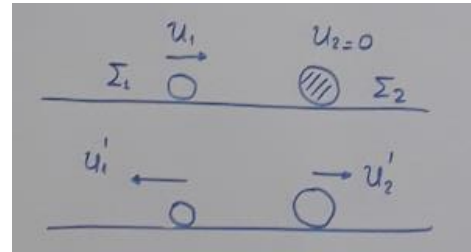
$$\frac{u_{\Gamma}}{u_A} = \frac{\frac{\sqrt{5}}{2} u_{cm}}{2u_{cm}} = \frac{\sqrt{5}}{4}$$



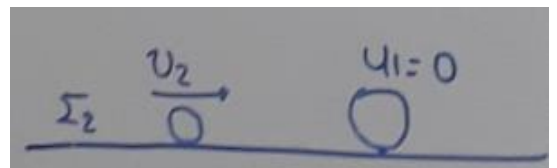
B2 → (ii)

$$u'_2 = \frac{2m_1}{m_1 + m_2} u_1$$

$$\Pi_1 = \frac{\frac{1}{2} m_2 \cdot \frac{4m_1^2}{(m_1 + m_2)^2} u_1^2}{\frac{1}{2} m_1 \cdot u_1^2} \cdot 100 \Rightarrow \Pi_1 = \frac{m_2 \cdot m_1 \cdot 4}{(m_1 + m_2)^2} \cdot 100$$

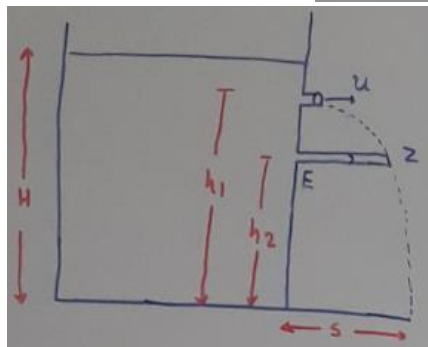


$$u'_1 = \frac{2m_2 u_2}{m_1 + m_2} \text{ και } \Pi_2 = \frac{\frac{1}{2} m_1 \frac{4m_2^2 \cdot u_2^2}{(m_1 + m_2)^2}}{\frac{1}{2} m_2 u_2^2} \cdot 100$$



$$\Pi_2 = \frac{4m_1 \cdot m_2}{(m_1 + m_2)^2} \cdot 100$$

B3 → (i)



$u = \sqrt{2g(H - h_1)}$ ταχύτητα εξόδου

$$t_k = \sqrt{2 \frac{h_1}{g}} \text{ χρόνος κίνησης μέχρι το έδαφος άρα, } S = \sqrt{2g(H - h_1) \frac{2h_1}{g}} = \sqrt{4(H - h_1)h_1} \quad (1) \text{ βεληνεκές.}$$

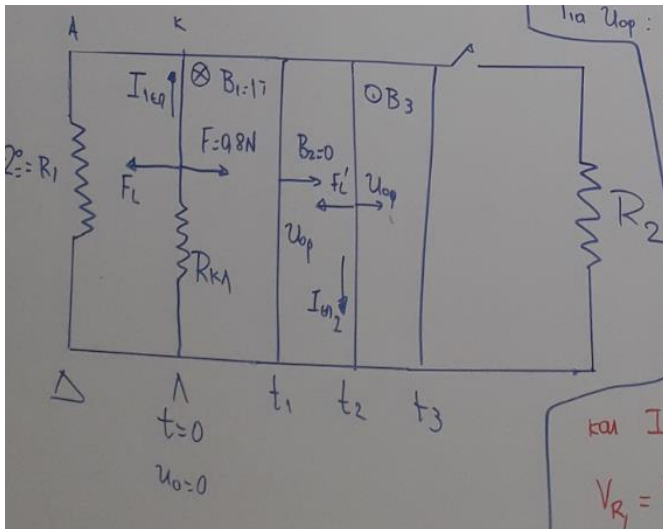
Ο χρόνος για να φτάσει στο z

$$t'_k = \sqrt{\frac{2(h_1 - h_2)}{g}} \text{ και } (EZ) = \sqrt{2g(H - h_1)} \cdot \sqrt{\frac{2(h_1 - h_2)}{g}} \Rightarrow \frac{S}{2} = \sqrt{4(H - h_1) \cdot (h_1 - h_2)} \quad (2)$$

$$\left(\frac{1}{2}\right) \Rightarrow 2 = \sqrt{\frac{4(H - h_1)h_1}{4(H - h_1)(h_1 - h_2)}} \Rightarrow 4 = \frac{h_1}{h_1 - h_2} \Rightarrow 4h_1 - 4h_2 = h_1 \Rightarrow 3h_1 = 4h_2 \Rightarrow 3h_1 = 4 \cdot \frac{21H}{32} \Rightarrow h_1 = \frac{7H}{8}$$

Η παροχή: $\Pi = A \cdot u \Rightarrow \Pi = A \cdot \sqrt{2g \left(H - \frac{7H}{8}\right)} \Rightarrow \Pi = A \cdot \sqrt{2g \frac{H}{8}} \Rightarrow \Pi = \frac{A}{2} \sqrt{g \cdot H}$

ΘΕΜΑ Γ



Γ1. Αρχικά ο αγωγός κάνει επιταχυνόμενη κίνηση γιατί $\Sigma \vec{F} \uparrow \vec{u}$ με $\vec{a} \neq \text{σταθ}$ αφού αυξάνεται η F_L λόγω της αύξησης της \vec{u} οπότε $\Sigma \vec{F} \neq 0$

Όταν $\Sigma \vec{F} = 0 \Rightarrow \vec{F}_L + \vec{F} = 0 \Rightarrow B_1 I_{\text{επ1}} \cdot l = F \Rightarrow B_1 \frac{B_1 \cdot u_{op} \cdot l}{R_1 + R_{\kappa\lambda}} \cdot l = F \Rightarrow \frac{1 \cdot 1 \cdot u_{op} \cdot 1}{2 + 3} = 0,8 \Rightarrow u_{op} = 4 \text{ m/sec}$

Γ2. Όταν εισέλθει στο B_3 και θα έχει u_{op} θα δέχεται δύναμη Laplace αντίρροπη της u_{op} . Άρα, θα πρέπει $\vec{F}'_{\text{εξ}} \uparrow \vec{u}_{op}$.

$$\Sigma \vec{F} = 0 \Rightarrow F'_{\text{εξ}} = F'_L \Rightarrow F'_{\text{εξ}} = B_3 I'_{\text{επ}} \cdot l \Rightarrow F'_{\text{εξ}} = B_3 \cdot \frac{B_3 \cdot u_{op} \cdot l}{R_1 + R_{\kappa\lambda}} \cdot l \Rightarrow F'_{\text{εξ}} = \frac{1 \cdot 1 \cdot u \cdot 1 \cdot 1}{2 + 3} = 0,8 \text{ N}$$

Γ3. Αφού $u_{op} = \text{σταθ} \Rightarrow I_{\text{επ}} = \text{σταθ}$

$$I_{\text{επ}} = \frac{E_{\text{επ}}}{R_{\text{ολ}}} = \frac{B_3 \cdot u_{op} \cdot l}{R_1 + R_{\kappa\lambda}} = \frac{1 \cdot 4 \cdot 1}{2 + 3} = 0,8 \text{ A}$$

Φορτίο: $\Delta q = I_{\text{επ}} \cdot \Delta t \Rightarrow 0,2 = 0,8 \Delta t \Rightarrow \Delta t = 0,25 \text{ s}$

Η θερμότητα Joule: $Q = I_{\text{επ}}^2 \cdot R_{\text{ολ}} \cdot \Delta t = 0,8^2 \cdot 5 \cdot 0,25 \Rightarrow Q = 0,8 \text{ J}$

Γ4.

$$\frac{1}{R_{1\sigma}} = \frac{1}{R_1} + \frac{1}{R_2} \Rightarrow \frac{1}{R_{1\sigma}} = \frac{R_1 + R_2}{R_1 \cdot R_2} \Rightarrow R_{1\sigma} = \frac{2 \cdot 2}{2+2} = 1\Omega \text{ \u0391\u03c1\u03b1, } I_{\varepsilon\pi} = \frac{B_3 \cdot u'_{op} \cdot \ell}{R_{\sigma\lambda}}$$

$$\Gamma\iota\alpha \ u_{op} : \Sigma F = 0 \Rightarrow F' = F'_L \Rightarrow F' = B_3 \cdot \frac{B_3 \cdot u'_{op} \cdot \ell}{R_{\sigma\lambda}} \Rightarrow$$

$$\Rightarrow 0,8 = \frac{1 \cdot 1 \cdot u'_{op} \cdot 1 \cdot 1}{4} \Rightarrow u'_{op} = 3,2 \text{ m/sec}$$

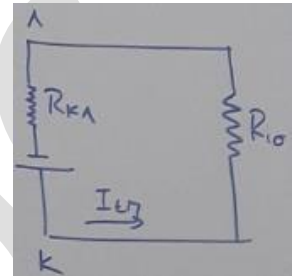
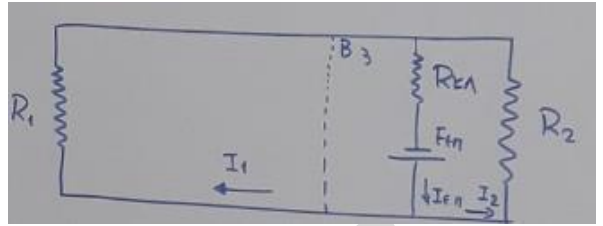
$$V_{\text{K}\Lambda} = I_{\varepsilon\pi} \cdot R_{1\sigma} = 0,8 \text{ Volt}$$

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$$V_{\text{K}\Lambda} = E_{\varepsilon\pi} - I_{\varepsilon\pi} \cdot R_{\text{K}\Lambda} \text{ \u03ba\u03b1\u03b9}$$

$$I_{\varepsilon\pi} = 0,8 \text{ A} \Rightarrow I_1 + I_2 = 0,8$$

$$V_{R_1} = V_{R_2} \Rightarrow I_1 \cdot R_1 = I_2 \cdot R_2 \Rightarrow I_1 = I_2 \left. \vphantom{I_1 = I_2} \right\} \Rightarrow I_1 = I_2 = 0,4 \text{ A}$$



\u0398\u0395\u039c\u0391 \u0394

\u03941. \u0397 \u03c4\u03c1\u03bf\u03c7\u03b1\u03bb\u03b9\u03b1 \u03b9\u03c3\u03bf\u03c1\u03c1\u03bf\u03c0\u03b5\u03b9:

$$\Sigma \vec{T} = 0 \Rightarrow \vec{T}_{W_2} + \vec{T}_{T_1} = 0 \Rightarrow W_2 \cdot R = T_1' \cdot r \Rightarrow m_2 g R = T_1' \cdot \frac{R}{2} \Rightarrow T_1' = 2 \cdot 3 \cdot 10 \Rightarrow T_1' = 60 \text{ N}$$

\u0397 \u03c1\u03b1\u03b2\u03b4\u03bf\u03c2 \u0391\u0393 \u03b9\u03c3\u03bf\u03c1\u03c1\u03bf\u03c0\u03b5\u03b9:

$$\Sigma \vec{T}_{(A)} = 0 \Rightarrow \vec{T}_{W_p} + \vec{T}_{T_1} + \vec{T}_N = 0 \Rightarrow -M \cdot g \cdot \frac{1}{2} \cdot \sigma \nu \nu 45 + T_1 \cdot \left(\frac{1}{2} + \frac{1}{6} \right) \cdot \eta \eta 45 + N \cdot \ell \cdot \eta \mu 45 = 0 \Rightarrow$$

$$\Rightarrow -Mg + T_1 \left(\frac{1}{2} + \frac{1}{6} \right) + N = 0 \Rightarrow N = 50 - 40 \Rightarrow \boxed{N = 10 \text{ N}}$$

\u03942. \u03a3\u03c4\u03b7 \u0398.1: $\Sigma X = 0 \Rightarrow \dots \Delta \ell_{01} = 0,05 \text{ m}$ (\u03c4\u03c7\u03b1\u03b9\u03b1 \u03b8\u03b5\u03c3\u03b7 \u03bc\u03b5\u03c4\u03ac \u03c4\u03b7\u03bd \u03ba\u03c1\u03bf\u03c5\u03c3\u03b7)

\u03a3\u03c4\u03b7 \u0398.2: $\Sigma X = 0 \Rightarrow \dots \Delta \ell_{02} = 0,2 \text{ m}$

$$\u03b1\u03c1\u03b1 \ X = 0,15 \text{ m \u03ba\u03b1\u03b9 \u03b1\u03c0\u03cc \u0391\u0394\u0395\u03a4} \ \frac{1}{2} DX^2 + \frac{1}{2} (m_1 + m_2) u_\Sigma^2 = \frac{1}{2} DA^2 \Rightarrow 100 \cdot 0,15^2 + 4 \cdot \frac{9}{4^2} \cdot 3 = 100A^2 \dots A = 0,3 \text{ m}$$

\u03943. \u0393\u03b9\u03b1 $t = 0$ $\left\{ \begin{array}{l} x = -0,15 \text{ m} \\ u > 0 \end{array} \right.$

$$\u03b1\u03c1\u03b1 \ -0,15 = 0,3 \cdot \eta \mu \varphi_0 \dots \varphi_0 = 2\kappa\pi + \frac{7\pi}{6} \ \u03b7 \ \varphi_0 = 2\kappa\pi + \pi - \frac{7\pi}{6} \ \u03b1\u03c1\u03b1 \ \u03b3\u03b9\u03b1 \ \kappa = 0 \ \varphi_0 = \frac{7\pi}{6} \text{ rad, } \varphi_0 = -\frac{\pi}{6} < 0 \ \u03ba\u03b9 \ \u03b3\u03b9\u03b1$$

$$\kappa = 1 \ \varphi_0 > 2\pi \ \u03ba\u03b9 \ \varphi_0 = 11\frac{\pi}{6} \ (\u03b4\u03b5\u03ba\u03c4\u03b7 \ \u03b3\u03b9\u03b1\u03c4\u03b9 \ \u03b5\u03c7\u03b5\u03b9 \ \sigma\u03bd\nu\phi_0 < 0)$$

$$\omega = \sqrt{\frac{K}{m_1 + m_2}} \Rightarrow \omega = \sqrt{\frac{100}{4}} = 5 \text{ rad/s} \ \u03b1\u03c1\u03b1 \ x = 0,3 \cdot \eta \mu \left(5t + 11\frac{\pi}{6} \right) \ \text{S.I.}$$

\u03944. \u03a0\u03bb\u03ac\u03b3\u03b9\u03b1 \u03ba\u03c1\u03bf\u03c5\u03c3\u03b7 \dots \u03b1\u03bd\u03b1\u03bb\u03cd\u03c9 \u03c4\u03b7 u_2 \u03ba\u03b9 \u03b1\u03c0\u03cc \u03b1.\u03b4.\u03b1. (x):

$$m_2 u_{2x} + 0 = (m_1 + m_2) \cdot u_\Sigma \Rightarrow m_2 u_2 \cdot \eta \mu 30 = (m_1 + m_2) \cdot u_\Sigma \Rightarrow u_2 = 2\sqrt{3} \text{ m/s} \ \u03ba\u03b9 \ \mu\u03b5 \ \Theta \text{MKE}$$

$$\frac{1}{2} m_2 u_2^2 - 0 = +m_2 \cdot g \cdot h \Rightarrow h = 0,6 \text{ m}$$

$$\u03945. \left. \begin{array}{l} (F_{\varepsilon\lambda})_{\text{max}} = K \cdot \Delta \ell_{\text{max}} \Rightarrow (F_{\varepsilon\lambda})_{\text{max}} = K \cdot (\Delta \ell_{02} + A) \\ (F_{\varepsilon\pi})_{\text{max}} = K \cdot A \end{array} \right\} \Rightarrow \frac{F_{\varepsilon\lambda, \text{max}}}{F_{\varepsilon\pi, \text{max}}} = \frac{0,2 + 0,3}{0,3} = \frac{5}{3}$$