(Ενδεικτικές απαντήσεις)

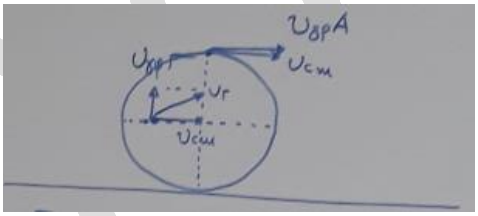
ΘΕΜΑ Α

Α1. → γ
Α2. → α
Α3. → γ
Α4. → δ
Α5.

α → Σωστό
β → Λάθος
γ → Σωστό
δ → Σωστό
ε → Λάθος

ΘΕΜΑ Β

Β1 → (iii)

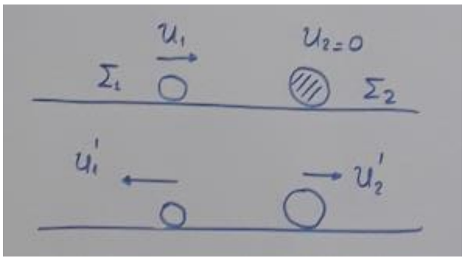


$$u_A = 2u_{cm}$$

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

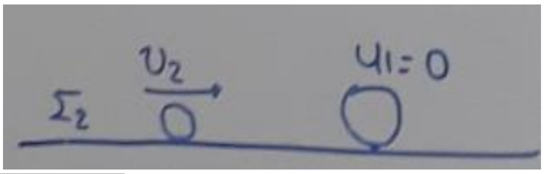
$$\frac{u_\Gamma}{u_A} = \frac{\frac{\sqrt{5}}{2} u_{cm}}{2u_{cm}} = \frac{\sqrt{5}}{4}$$

Β2 → (ii)



$$u_2' = \frac{2m_1}{m_1 + m_2} u_1$$

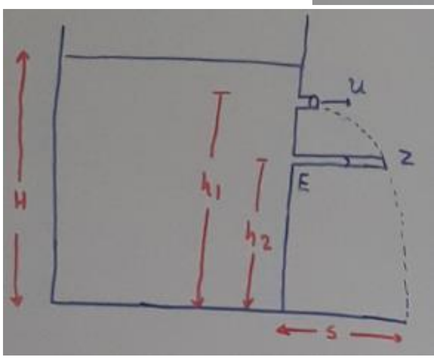
$$\Pi_1 = \frac{\frac{1}{2} m_2 \cdot \frac{4m_1^2}{(m_1+m_2)^2} u_1^2}{\frac{1}{2} m_1 \cdot u_1^2} \cdot 100 \Rightarrow \Pi_1 = \frac{m_2 \cdot m_1 \cdot 4}{(m_1+m_2)^2} \cdot 100$$



$$u_1' = \frac{2m_2 u_2}{m_1 + m_2} \text{ και } \Pi_2 = \frac{\frac{1}{2} m_1 \frac{4m_2^2 \cdot u_2^2}{(m_1+m_2)^2}}{\frac{1}{2} m_2 u_2^2} \cdot 100$$

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

Β3 → (i)



$u=\sqrt{2g(H-h_1)}$ ταχύτητα εξόδου

$t_\kappa=\sqrt{2\dfrac{h_1}{g}}$ χρόνος κίνησης μέχρι το έδαφος άρα, $S=\sqrt{2g(H-h_1)\dfrac{2h_1}{g}}=\sqrt{4(H-h_1)h_1}$ (1) βεληνεκές.

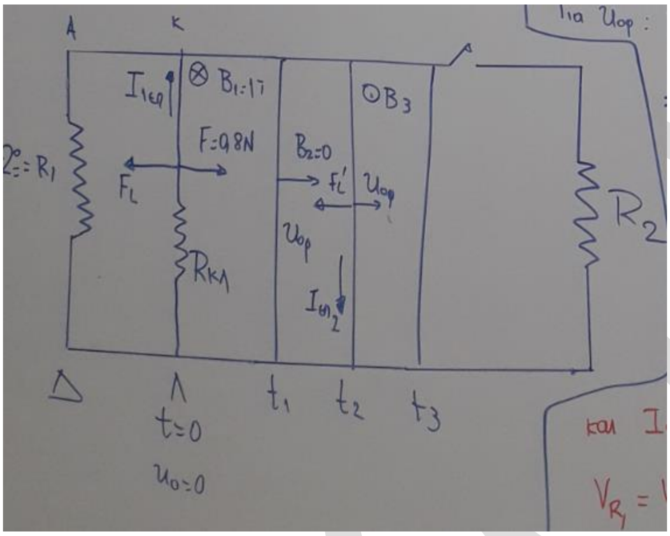
Ο χρόνος για να φτάσει στο z

$t'_\kappa=\sqrt{\dfrac{2(h_1-h_2)}{g}}$ και $(EZ)=\sqrt{2g(H-h_1)}\cdot\sqrt{\dfrac{2(h_1-h_2)}{g}}\Rightarrow\dfrac{S}{2}=\sqrt{4(H-h_1)\cdot(h_1-h_2)}$ (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: $\Pi=A\cdot u\Rightarrow\Pi=A\cdot\sqrt{2g\left(H-\dfrac{7H}{8}\right)}\Rightarrow\Pi=A\cdot\sqrt{2g\dfrac{H}{8}}\Rightarrow\Pi=\dfrac{A}{2}\sqrt{g\cdot H}$

ΘΕΜΑ Γ



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

Όταν $\Sigma\vec{F}=0\Rightarrow\vec{F}_L+\vec{F}=0\Rightarrow B_1 I_{\text{ΕΠ}_1}\cdot\ell=F\Rightarrow B_1\dfrac{B_1\cdot u_{o\rho}\cdot\ell}{R_1\cdot R_{\text{ΚΛ}}}\cdot\ell=F\Rightarrow\dfrac{1\cdot1\cdot u_{o\rho}\cdot1}{2+3}=0{,}8\Rightarrow u_{o\rho}=4\,{}^{m}\!/\!_{\sec}$

Γ2. Όταν εισέλθει στο Β3 και θα έχει $u_{o\rho}$ θα δέχεται δύναμη Laplace αντίρροπη της $u_{o\rho}$. Άρα, θα πρέπει $\vec{F}_{\varepsilon\xi}{}'\uparrow\uparrow\vec{u}_{o\rho}$.

$$\Sigma\vec{F}=0\Rightarrow F'_{\varepsilon\xi}=F'_L\Rightarrow F'_{\varepsilon\xi}=B_3 I'_{\varepsilon\pi}\cdot\ell\Rightarrow F'_{\varepsilon\xi}=B_3\cdot\frac{B_3\cdot u_{o\rho}\cdot\ell}{R_1+R_{\text{ΚΛ}}}\cdot\ell\Rightarrow F'_{\varepsilon\xi}=\frac{1\cdot1\cdot u\cdot1\cdot1}{2+3}=0{,}8N$$

Γ3. Αφού $u_{o\rho}=\sigma\tau\alpha\theta\Rightarrow \text{I}_{\varepsilon\pi}=\sigma\tau\alpha\theta$

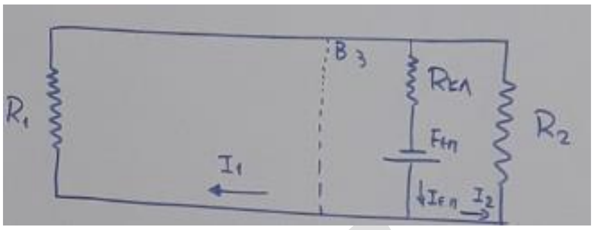
$$I_{\varepsilon\pi}=\frac{E_{\varepsilon\pi}}{R_{\text{ΟΛ}}}=\frac{B_3\cdot u_{o\rho}\cdot\ell}{R_1+R_{\text{ΚΛ}}}=\frac{1\cdot4\cdot1}{2+3}=0{,}8A$$

Φορτίο: $\Delta q=I_{\varepsilon\pi}\cdot\Delta t\Rightarrow 0{,}2=0{,}8\Delta t\Rightarrow\Delta t=0{,}25s$.

Η θερμότητα Joule: $Q=I_{\varepsilon\pi}^2\cdot R_{\text{ΟΛ}}\cdot\Delta t=0{,}8^2\cdot5\cdot0{,}25\Rightarrow Q=0{,}8J$.

Γ4.

$$\frac{1}{R_{1\sigma}} = \frac{1}{R_1}+\frac{1}{R_2} \Rightarrow \frac{1}{R_{1\sigma}} = \frac{R_1+R_2}{R_1\cdot R_2} \Rightarrow R_{1\sigma} = \frac{2\cdot 2}{2+2} = 1\Omega \text{ άρα, } I_{\varepsilon\pi} = \frac{B_3\cdot u'_{o\rho}\cdot \ell}{R_{o\lambda}}$$



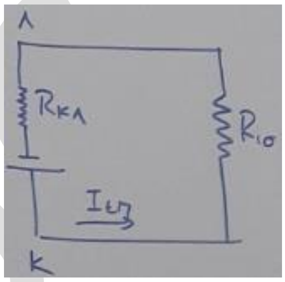
Για $u_{o\rho}: \Sigma F = 0 \Rightarrow F' = F'_L \Rightarrow F' = B_3\cdot \frac{B_3\cdot u'_{o\rho}\cdot \ell}{R_{O\Lambda}}\cdot \ell \Rightarrow$

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

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

ή

$V_{K\Lambda} = E_{\varepsilon\pi} - I_{\varepsilon\pi}\cdot R_{K\Lambda}$ και



$$\left.\begin{aligned} I_{\varepsilon\pi} = 0,8A \Rightarrow I_1 + I_2 = 0,8 \\ V_{R_1} = V_{R_2} \Rightarrow I_1\cdot R_1 = I_2\cdot R_2 \Rightarrow I_1 = I_2 \end{aligned}\right\} \Rightarrow I_1 = I_2 = 0,4A$$

ΘΕΜΑ Δ

Δ1. Η τροχαλία ισορροπεί:

$$\Sigma\vec{T} = 0 \Rightarrow \vec{T}_{W_2} + \vec{T}_{T'_1} = 0 \Rightarrow W_2\cdot R = T'_1\cdot r \Rightarrow m_2 g R = T'_1\cdot \frac{R}{2} \Rightarrow T'_1 = 2\cdot 3\cdot 10 \Rightarrow T'_1 = 60N$$

Η ράβδος ΑΓ ισορροπεί:

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

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

Δ2. Στη Θ.Ι$_1$: $\Sigma X = 0 \Rightarrow ...\Delta\ell_{01} = 0,05m$ (τυχαία θέση μετά την κρούση)

Στη Θ.Ι$_2$: $\Sigma X = 0 \Rightarrow ...\Delta\ell_{02} = 0,2m$

άρα X = 0,15m και από ΑΔΕΤ $\frac{1}{2}DX^2 + \frac{1}{2}(m_1+m_2)u_\Sigma^2 = \frac{1}{2}DA^2 \Rightarrow 100\cdot 0,15^2 + 4\cdot \frac{9}{4^2}\cdot 3 = 100A^2 ... A = 0,3m$

Δ3. Για t = 0: x = -0,15m, υ > 0

άρα $-0,15 = 0,3\cdot \eta\mu\varphi_0 ... \varphi_0 = 2\kappa\pi + \frac{7\pi}{6}$ ή $\varphi_0 = 2\kappa\pi + \pi - \frac{7\pi}{6}$ άρα για κ = 0 $\varphi_0 = \frac{7\pi}{6} rad$, $\varphi_0 = -\frac{\pi}{6} < 0$ και για κ = 1 $\varphi_0 > 2\pi$ και $\varphi_0 = 11\frac{\pi}{6}$ (δεκτή γιατί έχει συνφ$_0$ < 0)

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

Δ4. Πλάγια κρούση … αναλύω τη u_2 και από α.δ.ο. (x):

$m_2 u_{2x} + 0 = (m_1+m_2)\cdot u_\Sigma \Rightarrow m_2 u_2\cdot \eta\mu 30 = (m_1+m_2)\cdot u_\Sigma \Rightarrow u_2 = 2\sqrt{3}\, m/s$ και με ΘΜΚΕ

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

Δ5.
$$\left.\begin{aligned} (F_{\varepsilon\lambda})_{\max} = K\cdot \Delta\ell_{\max} \Rightarrow (F_{\varepsilon\lambda})_{\max} = K\cdot(\Delta\ell_{02} + A) \\ (F_{\varepsilon\pi})_{\max} = K\cdot A \end{aligned}\right\} \Rightarrow \frac{F_{\varepsilon\lambda,\max}}{F_{\varepsilon\pi,\max}} = \frac{0,2+0,3}{0,3} = \frac{5}{3}$$