ΑΠΑΝΤΗΣΕΙΣ ΘΕΜΑΤΩΝ ΦΥΣΙΚΗΣ

ΘΕΜΑ Α

Α1 γ

Α2 α

Α3 γ

Α4 δ

Α5 α Σ β Λ γ Σ δ Σ ε Λ

ΘΕΜΑ Β

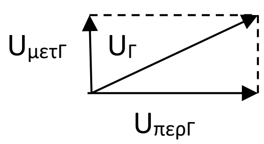
Β1. Απάντηση iii)

<u>απόδειξη</u>

κ.χ.ο. $\overrightarrow{v_{max}} = \overrightarrow{0} \Leftrightarrow \overrightarrow{v_{μετ}} + \overrightarrow{v_{περ}} = \overrightarrow{0} \Leftrightarrow \overrightarrow{v_{μετ}} = -\overrightarrow{v_{περ}} \Leftrightarrow |\overrightarrow{v_{μετ}}|=|\overrightarrow{v_{περ}}| \Leftrightarrow Vcm = \omega R$

σημείο Α $\overrightarrow{v_A} = \overrightarrow{v_{μετ_A}} + \overrightarrow{v_{περ_A}} \Leftrightarrow |\overrightarrow{v_A}| = v_{cm} + \omega_R = 2v_{em}$

σημείο Γ $\overrightarrow{v_Γ} = \overrightarrow{v_{μετ_Γ}} + \overrightarrow{v_{περ_Γ}} \Leftrightarrow \overrightarrow{v_Γ} = \overrightarrow{v_{μετ_Γ}} + \overrightarrow{v_{περ_Γ}} \Leftrightarrow |\overrightarrow{v_Γ}| = \sqrt{{v_{cm}}^2 - \left(\omega\frac{R}{2}\right)^2 =}$ $\sqrt{{v_{cm}}^2 + \frac{{v_{cm}}^2}{4}} =$ $\sqrt{\frac{5{v_{cm}}^2}{4}} = \frac{\sqrt{5}}{2}v_{cm}$

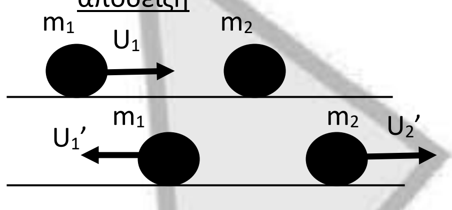


Άρα $\frac{|\overrightarrow{v_Γ}|}{|\overrightarrow{v_A}|} = \frac{\frac{\sqrt{5}}{2}v_{cm}}{2v_{ecm}} = \frac{\sqrt{5}}{4}$

Β2

Απάντηση ii)

<u>απόδειξη</u>

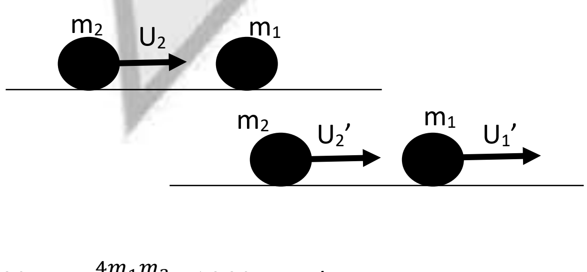


1η περίπτωση

$v_2' = \frac{am_1}{m_1+m_2} \ v_1$

$Π_1 = \frac{K_2'}{K_1}100\% = \frac{\frac{1}{2}m_2{v_2'}^2}{\frac{1}{2}m_1{v_1}^2}100\% = \frac{m_2\frac{4{m_2}^2}{(m_1+m_2)^2}{v_1}^2}{m_1{v_1}^2}100\% = \frac{4m_1m_2}{(m_1+m_2)^2}100\%$

2η περίπτωση



$v_1' = \frac{2m_2}{m_1+m_2}v_2$

$Π_2 = \frac{K_1'}{K_2}100\% \Leftrightarrow$ Π2= $\frac{\frac{1}{2}m_1\frac{4{m_2}^2}{(m_1+m_2)^2}{v_2}^2}{\frac{1}{2}m_2{v_2}^2}100\% = \frac{4m_1m_2}{(m_1+m_2)^2}100\%$ Άρα $Π_1 = Π_2$

B3

Απάντηση i)

<u>απόδειξη</u>

Εξίσωση Bernoulli

Εξ. Επιφάνεια , 0

$$P\alpha\tau\mu + \frac{1}{2}qv^2 + pg\,H = P\alpha\tau\mu + \frac{1}{2}pv_1{}^2 + \rho g\,h, \Leftrightarrow \frac{1}{2}pv_1{}^2 = \rho g(H-h_1) \Leftrightarrow v_1{}^2 = 2g(H-h_1)(1)$$

Οριζόντια βολή

$$\begin{cases} s = v_1 \cdot t\pi\tau, \Leftrightarrow t\pi\tau = \frac{s}{v_1} \\ h_1 = \frac{1}{2}gt^2\pi\tau \end{cases} \Leftrightarrow h_1 = \frac{1}{2}g\frac{s^2}{v_1{}^2} \Leftrightarrow 2v_1{}^2h_1 = gs^2 \Leftrightarrow 2\cdot 2g(H-h_1)h_1 = gs^2 \Leftrightarrow 4h_1(H-h_1) = s^2(2)$$

Σημείο Ζ

$$\begin{cases} x_z = \frac{s}{2} \\ y_z = h_1 - h_2 = h_1 - \frac{21H}{32} \end{cases} \Leftrightarrow \begin{cases} \text{όμως } x_z = u_1 \cdot t_1 \\ y_z = \frac{1}{2}gt_1{}^2 \end{cases} \Leftrightarrow y_z = \frac{1}{2}g\cdot\frac{x_z{}^2}{v_1{}^2} \Leftrightarrow 2v_1{}^2 \cdot Y_z = g\cdot x_z{}^2 \Leftrightarrow$$

$$\overset{(1)}{\Leftrightarrow} 2\cdot 2g(H-h_1)\left(h_1 - \frac{21H}{32}\right) = g\cdot\frac{s^2}{4} \Leftrightarrow 16(H-h_1)\left(h_1 - \frac{21H}{32}\right) = s^2 \quad (3)$$

Από (3), (2) $\Leftrightarrow 4h_1(H-h_1) = 16(H-h_1)\left(h_1 - \frac{21H}{32}\right) \Leftrightarrow h_1 = 4h_1 - 4\frac{21H}{32} \Leftrightarrow \frac{21H}{8} = 3h_1 \Leftrightarrow h_1 = \frac{7H}{8}$

Τελικά $m_{\varepsilon\iota\sigma} = m_{\varepsilon\xi} \Leftrightarrow \frac{dm_{\varepsilon\iota\sigma}}{dt} = \frac{dm_{\varepsilon\xi}}{dt} \Leftrightarrow \rho\frac{dv_{\varepsilon\iota\sigma}}{dt} = \rho\frac{dv_{\varepsilon\xi}}{dt} \Leftrightarrow \Pi_{\varepsilon\iota\sigma} = \Pi_{\varepsilon\xi} \Leftrightarrow$

$$\Pi = A\cdot v_1 = A\cdot\sqrt{2g(H-h_1)} = A\cdot\sqrt{2g\left(H-\frac{7H}{8}\right)} \Leftrightarrow \Pi = A\cdot\sqrt{2g\left(\frac{H}{8}\right)} \Leftrightarrow \Pi = \frac{A}{2}\sqrt{gH}$$

ΘΕΜΑ Γ

Λείπει σχήμα

$$E_{\varepsilon\pi} = -N\frac{d\varphi}{dt} \Leftrightarrow |E_{\varepsilon\pi}| = N\left|\frac{d\varphi}{dt}\right| \underset{df/dt>0}{\overset{\phi\uparrow}{=\!=}} \frac{d\varphi}{dt} = (B_1\cdot l\cdot x)' = B_1 l\frac{dx}{dt} = Bvl$$

$$I_{\varepsilon\pi} = \frac{E_{\varepsilon\pi}}{R_{o\lambda}} = \frac{Bvl}{R_{o\lambda}}, F_i = B_i l\eta\mu\frac{\pi}{2} = \frac{B_1{}^2vl^2}{R_{n\pi}+R_1}$$

$\Sigma\vec{F} = m\cdot\vec{a} \Leftrightarrow |\vec{F}| - |\vec{F_2}| = m|\vec{a}| \Leftrightarrow |\vec{F}| - \frac{B_1{}^2vl^2}{R_{n\pi}+R_1} = ma$ *Ευθεία Μετακίνηση επιταχυνόμενη κίνηση με α↓ καθώς u↑*

Για α = ο $m/s^2 \to v = v_{o\rho}$

Οπότε $|\vec{F}| = \frac{B_1{}^2vl^2}{R_{n\pi}+R_1} \Leftrightarrow v_{o\rho} = \frac{|\vec{F}|(R_{n\pi}+R_1)}{B_1{}^2l^2} \Leftrightarrow v_{o\rho} = \frac{\frac{0{,}8\cdot(3+2)}{1\cdot 1}m}{s} = \frac{4m}{s \Leftrightarrow v_{o\rho}} = 4m/s$

Γ2

$t_1 \to καταργείται\, η\, \vec{F}, \overrightarrow{F_2} = \vec{0} \to \overrightarrow{F_{2x}0}$

Ευθεία ομαλή κίνηση με $v_{ορ} = 4m/s$

Αρκεί $\Sigma\vec{F} = \vec{0} \Leftrightarrow |\overrightarrow{F_1}| = |\overrightarrow{F_{2x}}| \Leftrightarrow |\overrightarrow{F'}| = B_3 \frac{B_3 v_{ορ} \cdot l \cdot}{R_{n\pi}+R_1}\, l = \frac{{B_3}^2 v_{ορ} l^2}{R_{n\pi}+R_1} = \frac{1\cdot4\cdot1}{5} N \Leftrightarrow |\overrightarrow{F'}| = 0{,}8N$

Διεύθυνση x'x , φορά δεξιά

Γ3

Νόμος Nenmann

$|Q_{cn}| = N\left|\frac{\Delta\Phi}{Rg}\right| \Leftrightarrow \frac{B_3 \cdot l \cdot \Delta X}{R_{n\pi}+R_1} = |l_{cn}| \Leftrightarrow \Delta X = \frac{(R_{n\pi}+R_1)|Q_{cn}|}{B_3 \cdot l} = \frac{5\cdot 0{,}2}{1\cdot 1} = 1m$

$v_{ορ}\, σταθ \to i_{επ} = \frac{B_3 v_{ορ} \cdot l}{R_{n\pi}+R_1} = \frac{4}{5}A = 0{,}8 = σταθ$

$Q_{Rολ} = {i_{επ}}^2 \cdot (R_{n\pi} + R_1)\Delta t = {i_{επ}}^2 \cdot (R_{n\pi} + R_1)\frac{\Delta x}{v_{ορ}} =$

$= 0{,}64 \cdot 5\frac{1}{4}j = 0{,}16 \cdot 5j = 0{,}8j$

Γ4

δ κλειστό

ισοδύναμη κίνηση

$i = l_1 + l_2$

$V_{n\pi} = B_3 vl - i \cdot R_{n\pi} = i_1 R_1 = i_{1=2} R_2$

$R_1 //R_2 \to R_{1,2} = \frac{R_1 R_2}{R_1+R_2} = \frac{2\cdot2}{2+2}\Omega = 1\Omega$

$$Rολ = R_{n\pi} + R_{1,2} = 4\Omega$$

$i_{ολ} = \frac{E_{επ}}{R_{ολ}} = \frac{B_3 v_{ορ} \cdot l}{R_{ολ}}\, , F_{1,3} = \frac{B^2 v_3 l^2}{R_{ολ}}$

Για α'=0 $m/s^2 \to v_{ορ}'$

$\Sigma\vec{F} = m \cdot \vec{a} \Leftrightarrow |\overrightarrow{F'}| - |\overrightarrow{F_{2,3}}| = m|\vec{a}'| \Leftrightarrow |\overrightarrow{F'}| - \frac{B^2 v_3 l^2}{R_{ολ}} = m|\vec{a}'| \qquad |\vec{a}'| \Leftrightarrow\ m/s^2\ = v_{ορ}'$

$\Leftrightarrow |\overrightarrow{F'}| = \frac{{B_3}^2 v_{ορ}' l^2}{R_{ολ}} \Leftrightarrow v_{ορ}' = \frac{R_{ολ} \cdot |\overrightarrow{F'}|}{{B_3}^2 l^2} v_{ορ}' = 4 \cdot 0{,}8 \frac{m}{s} = 3{,}2m/s$

Επομένως

$$V_{ολ} = \frac{E_{επ}}{R_{ολ}} = \frac{B_3 v_{ορ'} \cdot l}{R_{ολ}} = \frac{1 \cdot 3{,}2 \cdot 1}{4} A = 0{,}8A$$

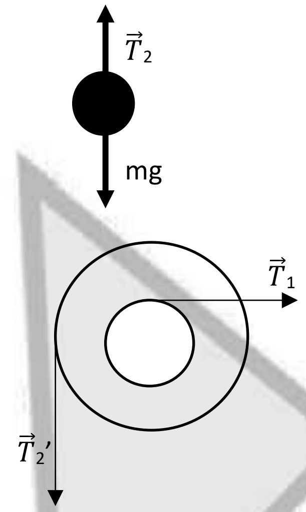
Συνεπώς

$V_{n\pi} = B_3 v_{ορ'} \cdot l - i_{ολ} R_{n\pi} = 1 \cdot 3{,}2 \cdot 1 - 0{,}8 \cdot 3 = (3{,}2 - 2{,}4)v = 0{,}8V$

Οπότε $\iota_1 = \frac{V_{n\pi}}{R_1} = \frac{0.8}{2} A = 0{,}4A$

$\iota_2 = \frac{V_{n\pi}}{R_2} = \frac{0.8}{2} A = 0{,}4A$

ΘΕΜΑ Δ



Δ₁

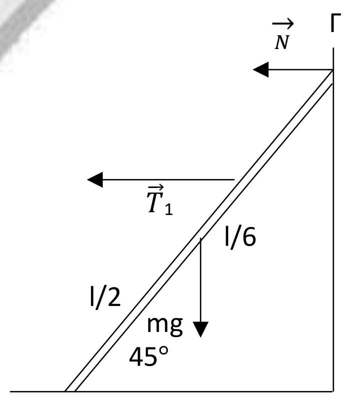
$\Sigma\vec{F} = \vec{0} \Leftrightarrow |\overrightarrow{T_2}| = m = m_2 g = 30N$

$\Sigma\vec{\tau} = \vec{0} \Leftrightarrow \dots \Leftrightarrow T_1 \cdot r = T_2 \cdot 2r \Leftrightarrow T_1 = 2T_2 = 60N$

Η ράβδος ισορροπεί $\Sigma\overrightarrow{z_{(A)}} = \vec{0} \Leftrightarrow \dots \Leftrightarrow$

$\Leftrightarrow + T_1 \cdot \frac{2l}{3} \eta\mu\theta - Mg \cdot \frac{l}{2} \sigma\upsilon\nu 45° + N_\Gamma \cdot l\eta\mu 45° = 0$

$l\eta\mu 45° = \sigma\upsilon\nu 45° \quad N_\Gamma = \frac{Mg}{2} - \frac{2T_1}{3} \Leftrightarrow N_\Gamma = \left(50 - \frac{2 \cdot 60}{3}\right) N \Leftrightarrow N_\Gamma = 10N$



Δ₂

$\Theta I_1 \rightarrow \Sigma\vec{F} = \vec{0} \Leftrightarrow K\Delta l_1 = m_1 g\eta\mu\varphi \Leftrightarrow \Delta l_1 = \frac{m_1 g\eta\mu\varphi}{K} = 0{,}05m$

$\Theta I_{2o\lambda} \rightarrow \Sigma\vec{F} = K\Delta l_2 = (m_1 + m_2) g\eta\mu\varphi \Leftrightarrow \Delta l_2 = \frac{(m_1+m_2) g\eta\mu\varphi}{K} = 0{,}2m$

$x_{\alpha\rho\chi} = -(\Delta l_2 - \Delta l_1) = -0{,}15\,m = -\frac{15}{100} m = -\frac{3}{20} m$

$v_{\alpha\rho\chi} = v_K = \frac{5\sqrt{3}}{4} m/s$

ΑΔΕΤ

$K + v = E_l \Leftrightarrow \frac{1}{2}(m_1 + m_2) v_K{}^2 + \frac{1}{2}\Delta x^2{}_{\alpha\rho\chi} = \frac{1}{2}\Delta A^2 \Leftrightarrow \frac{1}{2}\Delta A^2 = \frac{1}{2}\frac{(m_1 + m_2)}{\Delta} v_K{}^2 + \frac{1}{2}\Delta x^2{}_{\alpha\rho\chi}$

$\Leftrightarrow A = \sqrt{\frac{m_1+m_2}{K} \cdot v_K{}^2 + x^2{}_{\alpha\rho\chi}} \Leftrightarrow A = \sqrt{\frac{4}{100} \cdot \frac{9 \cdot 3}{16} + \frac{9}{400}}\; m \Leftrightarrow A = \sqrt{\frac{36}{400}} \Leftrightarrow A = \frac{6}{20} m \Leftrightarrow A = 0{,}3m$

Δ₃

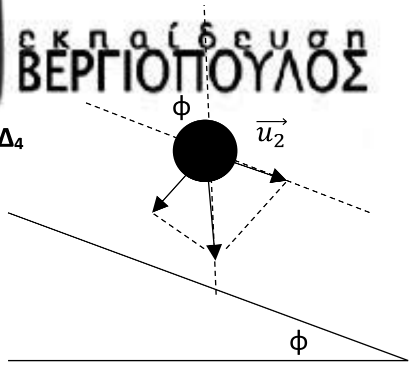
$$\left.\begin{matrix} x(0) = -\frac{A}{2} \\ v(0) > 0 \end{matrix}\right\} \Leftrightarrow \left.\begin{matrix} A\eta\mu\varphi_0 = -\frac{A}{2} \\ \omega A\sigma\upsilon\nu\varphi_0 > 0 \end{matrix}\right\} \Leftrightarrow$$

$$\Leftrightarrow \left.\begin{matrix} \eta\mu\varphi_0 = -\frac{1}{2} \\ \sigma\upsilon\nu\varphi_0 > 0 \end{matrix}\right\} \xLeftrightarrow{\varphi_{0\lambda}\,[0,2\pi)} \varphi_0 = 2\pi - \frac{\pi}{6} \Leftrightarrow \varphi_0 = \frac{11\pi}{6}$$

Δ=K=$(m_1 + m_2)\omega^2 \Leftrightarrow \quad \omega = \sqrt{\frac{K}{m_1+m_2}} = 5r/s$

$$x(+) = 0{,}3\eta\mu\left(5 + -\frac{11\pi}{6}\right), (SI)$$

Δ4



$$|v_{2y}| = |\overrightarrow{v_2}|\sigma\upsilon\nu\varphi$$

$$|\overrightarrow{v_{2x}}| = |\overrightarrow{v_2}|\eta\mu\varphi$$

ΑΔΟ x’x (Η στο κεκλυμένο επίπεδο)

$$\ldots \Leftrightarrow m_2\overrightarrow{v_2}\eta\mu\varphi = (m_1 + m_2)\overrightarrow{v_K} \Leftrightarrow |\overrightarrow{v_2}| = \frac{(m_1+m_2)|\overrightarrow{v_2}|}{m_2\eta\mu\varphi} = \frac{4\cdot\frac{3\sqrt{3}}{4}}{3\frac{1}{2}} = 2\sqrt{3}\, m/s$$

$$\overrightarrow{v_2} = \begin{cases} \mu\acute{\varepsilon}\tau\rho o\ 2\sqrt{3}m/s \\ \delta\iota\varepsilon\acute{\upsilon}\theta\upsilon\nu\sigma\eta\ y'y \\ \varphi o\rho\acute{\alpha}\ \sigma\tau o\ \sigma\chi\acute{\eta}\mu\alpha \end{cases}$$