ΜΑΘΗΜΑ: Φυσική προσανατολισμού

ΘΕΜΑ Α

Α1. γ

Α2. δ

Α3. γ

Α4. β

Α4. **α.** Λάθος

β. Σωστό

γ. Λάθος

δ. Σωστό

δ. Σωστό

ΘΕΜΑ Β

Β1. 1η ΠΕΡΙΠΤΩΣΗ:

Θ.Σ. $\Sigma F = 0 \Rightarrow F_{ΕΛ} = w \Rightarrow kA_1 = mg \Rightarrow A_1 = \frac{mg}{k}$

2η ΠΕΡΙΠΤΩΣΗ:

Θ.Σ. $\Sigma F = 0 \Rightarrow F_{ΕΛ}{'} + F = w \Rightarrow F_{ΕΛ}{'} = 0$

Άρα η Θ.Φ.Μ. είναι η Θ.Ι.

Ενώ η παλιά Θ.Ι. είναι η Α.Θ. αφού $u = 0$

Άρα $A_1 = A_2$

Σωστή απάντηση είναι η (i)

B2. $\cancel{P_{atm}} + 0 + \rho g H = \cancel{P_{atm}} + \frac{1}{2}\rho u_1^2 + \rho g \frac{5H}{6} \Rightarrow$

$$\Rightarrow \frac{1}{2}\cancel{\rho} u_1^2 = \cancel{\rho} g \frac{H}{6} \Rightarrow u_1^2 = \frac{gH}{3} \Rightarrow u_1 = \sqrt{\frac{gH}{3}}$$

$$\Pi_1 = A\,u_1 = A\sqrt{\frac{gH}{3}}$$

$$\cancel{P_{atm}} + 0 + \rho g H = \cancel{P_{atm}} + \frac{1}{2}\rho u_2^2 + \rho g \frac{H}{3} \Rightarrow$$

$$\Rightarrow \frac{1}{2}\cancel{\rho} u_2^2 = \cancel{\rho} g \frac{2H}{3} \Rightarrow u_2 = 2\sqrt{\frac{gH}{3}}$$

$$u_2 = 2u_1 \Rightarrow \Pi_2 = 2\Pi_1$$

$$\Pi_1 = \frac{V}{\Delta t_1} \qquad \Pi = \Pi_1 + \Pi_2 = 3\Pi_1$$

$$\Pi = \frac{V}{\Delta t_2} \Rightarrow 3\Pi_1 = \frac{V}{\Delta t_2}$$

$$3\frac{V}{\Delta t_1} = \frac{V}{\Delta t_2} \Rightarrow \frac{\Delta t_2}{\Delta t_1} = \frac{1}{3}$$

Σωστή απάντηση είναι η (ii)

B3. $P_1 = m_1 u_1$

$$P_1' = \frac{P_1}{5} \Rightarrow m_1 u_1' = \frac{m_1 u_1}{5} \Rightarrow u_1' = \frac{u_1}{5}$$

$$u_1' = \frac{m_1 - m_2}{m_1 + m_2}u_1 \Rightarrow \frac{u_1}{5} = \frac{m_1 - m_2}{m_1 + m_2}u_1 \Rightarrow 5m_1 - 5m_2 = m_1 + m_2 \Rightarrow$$

$$\Rightarrow 4m_1 = 6m_2 \Rightarrow m_1 = \frac{3}{2}m_2$$

$$u_2' = \frac{2m_1}{m_1 + m_2}u_1 \Rightarrow u_2' = \frac{2\frac{3}{2}m_2}{\frac{3}{2}m_2 + m_2}u_1 = \frac{3m_2}{\frac{5}{2}m_2}u_1 = \frac{6}{5}u_1$$

$$\begin{matrix} K_1 \rightarrow K_2' \\ 100 \rightarrow \Pi\% \end{matrix} \Rightarrow \Pi\% = \frac{\frac{1}{2} m_2 u_2'^2}{\frac{1}{2} m_1 u_1^2} \cdot 100\% \Rightarrow \frac{m_2 \left(\frac{6}{5} u_1\right)^2}{\frac{3}{2} m_2 u_1^2} \cdot 100\% \Rightarrow$$

$$\Rightarrow \Pi\% = \frac{\frac{36}{25}}{\frac{3}{2}} \cdot 100\% = \frac{72}{75} \cdot 100\% = \frac{72 \cdot 4}{3}\% = 96\%$$

Σωστή απάντηση είναι η (iii)

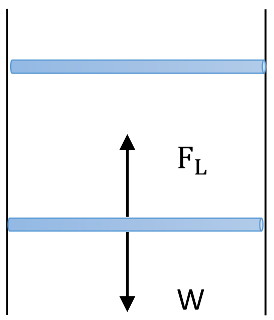
<u>Θέμα Γ</u>

Γ1. Ν. Ohm: $I = \frac{E}{R_{ολ}} = \frac{9}{3} = 3A$

Ισορροπία : $\Sigma F = 0 \Rightarrow W - F_L = 0 \Rightarrow W = F_L \Rightarrow mg = BI\ell \Rightarrow B = 1T$

με κατεύθυνση, σύμφωνα με τον κανόνα των τριών δακτύλων, από τον αναγνώστη προς τη σελίδα.

Γ2.



$$\Sigma F = m \cdot \alpha \Rightarrow w - F_L = m \cdot \alpha \Rightarrow \alpha = \frac{w - F_L}{m}$$

Το είδος της κίνησης είναι: Μη ομαλά επιταχυνόμενη με επιτάχυνση που διαρκώς μειώνεται, λόγω αύξησης της F_L.

$$\Sigma F = 0 \Rightarrow F_L = W \Rightarrow$$

$$\frac{B^2 \cdot \upsilon_{ορ} \cdot \ell^2}{R_{ολ}} = mg \Rightarrow \upsilon_{ορ} = 3 \cdot 4 = 12 m/s$$

$$P_\kappa = \frac{V_\kappa^2}{R_\kappa} \Rightarrow R_\kappa = \frac{V_\kappa^2}{P_\kappa} = \frac{36}{6}\Omega = 6\Omega$$

$$R_{ολ} = \frac{R_1 \cdot R_\Sigma}{R_1 + R_\Sigma} + R_{K\Lambda} = \left(\frac{18}{9} + 2\right)\Omega = 4\Omega$$

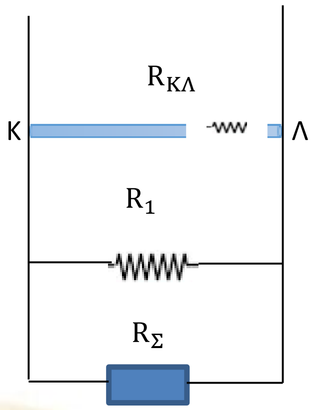
Γ3. $\frac{dp}{dt} = \Sigma F = W \cdot F_L = mg - BI\ell$

$\upsilon = \frac{\upsilon_o}{2} = 6m/s$

$F_L = BI\ell = \frac{B^2 \cdot \upsilon \cdot \ell^2}{R_{ολ}} = \frac{1 \cdot 6 \cdot 1}{4} N = 1,5N$

Γ4. Όταν $\upsilon_{ορ} = 12m/s$

Για να λειτουργεί κανονικά πρέπει $I_κ = I_{επ}$



$P_κ = V_κ \cdot I_κ \Rightarrow I_κ = \frac{P_κ}{V_κ} = 1A$

$E_{επ} = B\upsilon\ell = 1 \cdot 12 \cdot 1 = 12V$

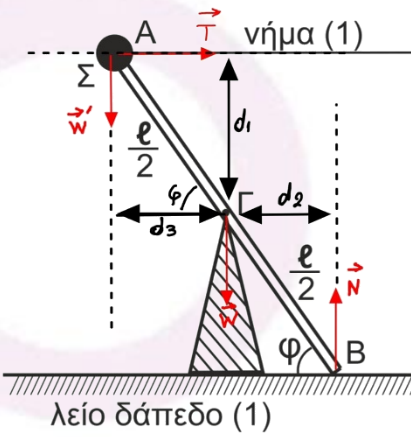
$I_{επ} = \frac{E_{επ}}{R_{ολ}} = \frac{12}{4}A = 3A$

$V_{ΚΛ} = E - Ir = 12 - 3 \cdot 2 = 6V$

Η σύνδεση είναι παράλληλη άρα $V_{ΚΛ} = V_Σ = V_1$

$I = \frac{V_{ΚΛ}}{R_Σ} = \frac{6}{6} = 1A$,άρα θα λειτουργεί κανονικά.

<u>Θέμα Δ</u>



Δ1. $Στ = 0 \Rightarrow -T \cdot d_1 + N \cdot d_2 + W_1 \cdot d_3 = 0 \Rightarrow$

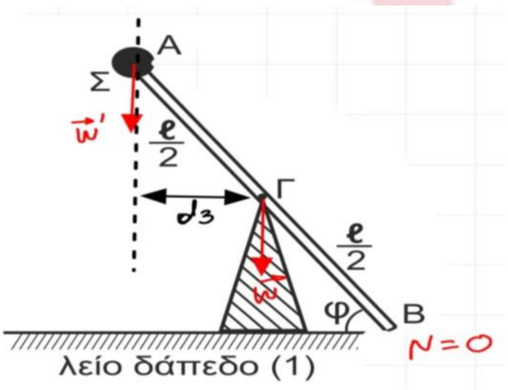
$\Rightarrow -T \cdot \frac{\ell}{2} \cdot ημφ + N \cdot \frac{L}{2} \cdot συνφ + mg \cdot \frac{L}{2} \cdot συνφ = 0$

$\Rightarrow -10{,}5 \ \cdot \frac{2}{2} \cdot 0{,}8 + N \cdot \frac{2}{2} \cdot 0{,}6 + 10 \cdot \frac{2}{2} \cdot 0{,}6 = 0$

$\Rightarrow -8{,}4 + 0{,}6N + 6 = 0 \Rightarrow 0{,}6N = 8{,}4 - 6 \Rightarrow$

$\mathbf{N = 4N}$

Δ2.



$Στ = I \cdot α_{γων}$ (1)

$I_{ΟΛ} = I_ρ + I_m = \frac{1}{12}M_ρ \cdot R^2 + m\left(\frac{\ell}{2}\right)^2 = \frac{1}{12} \cdot 3 \cdot 4 + 1 \cdot 1$

$= 2kg \cdot m^2$

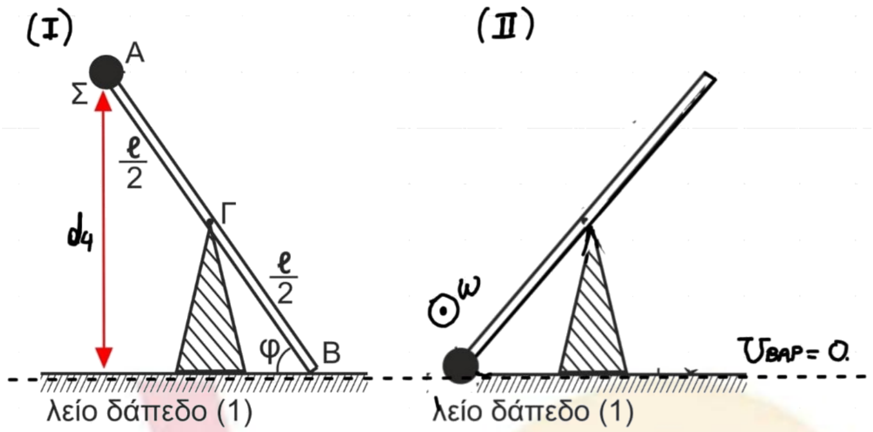
$(1) \Rightarrow W_1 \cdot d_3 = I_{ΟΛ} \cdot α_{γων} \Rightarrow$

$\Rightarrow m_1 g \cdot \frac{\ell}{2} συνφ = I_{ΟΛ} \cdot α_{γων}$

$\Rightarrow 10 \cdot 0{,}6 = 2 \cdot α_{γων} \Rightarrow \ α_{γων} = 3m/s^2$

$\left.\frac{dL}{dt}\right|_M = I_M \cdot α_{γων} = 1 \cdot 3 = 3kg \cdot m^2/s^2$

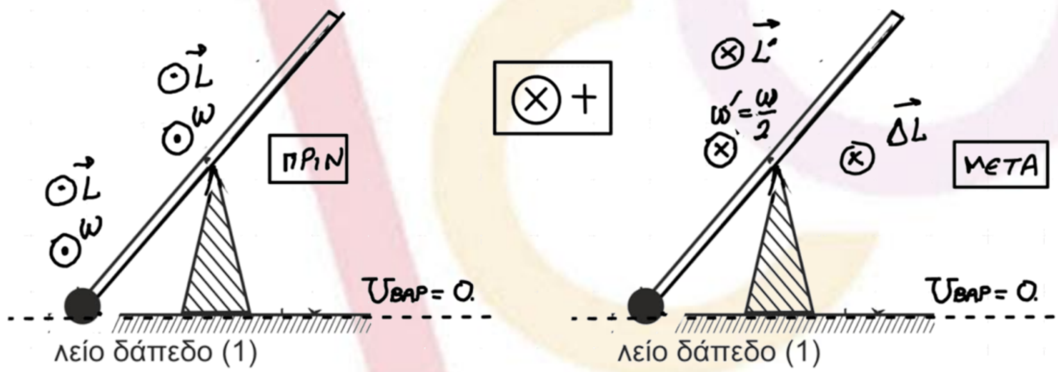
Δ3.



ΘΜΚΕ για το σύστημα:

$$K_{\tau\varepsilon\lambda} - K_{\alpha\rho\chi} = W_{\Sigma F} \Rightarrow \frac{1}{2} \cdot \mathrm{I}_{\Sigma\Upsilon\Sigma} \cdot \omega^2 = W_{W_1} + W_{W_{\rho\alpha\beta\delta}} \Rightarrow$$

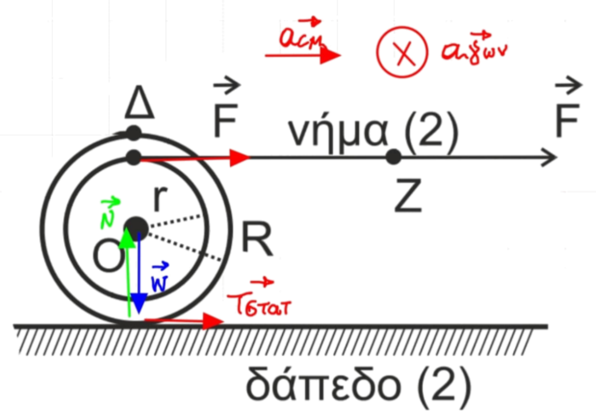
$$\Rightarrow \frac{1}{2} \cdot 2 \cdot \omega^2 = mgd_4 - 0 \Rightarrow \omega^2 = 1 \cdot 10 \cdot 1{,}6 \Rightarrow \omega = 4rad/s$$



$$\Delta \mathrm{L}_{\Sigma\Upsilon\Sigma} = \mathrm{L}_{\mathrm{TE\Lambda}} - \mathrm{L}_{\mathrm{APX}} = \mathrm{I}_{\Sigma\Upsilon\Sigma} \cdot \omega' - (-\mathrm{I}_{\Sigma\Upsilon\Sigma} \cdot \omega) = \mathrm{I}_{\Sigma\Upsilon\Sigma} \cdot \frac{\omega}{2} + \mathrm{I}_{\Sigma\Upsilon\Sigma} \cdot \omega = \mathrm{I}_{\Sigma\Upsilon\Sigma}\left(\omega + \frac{\omega}{2}\right) =$$

$$\mathrm{I}_{\Sigma\Upsilon\Sigma} \cdot \frac{3\omega}{2} = 2 \cdot \frac{3 \cdot 4}{2} = 12\mathrm{kg} \cdot \mathrm{m}^2/\mathrm{s}$$

Δ4. $\Sigma \vec{F}_x = m\cdot\vec{\alpha} \Rightarrow \boxed{F + T_{\sigma\tau} = M\cdot\alpha_{CM}}$ (1)



$$\Sigma\tau_{(O)} = I_{(O)}\cdot\alpha_{\gamma\omega\nu} \Rightarrow \boxed{F\cdot r - T_{\sigma\tau}\cdot R = \frac{1}{2}M_T\cdot R^2\cdot\alpha_{\gamma\omega\nu}} \quad (2)$$

$$(1) \underset{R}{\Rightarrow} F\cdot R + \cancel{T_{\sigma\tau}\cdot R} = M_T\cdot R\cdot\alpha_{CM}$$

$$(2) \Rightarrow F\cdot r - \cancel{T_{\sigma\tau}\cdot R} = \frac{1}{2}M_T\cdot R^2\cdot\alpha_{\gamma\omega\nu}$$

λόγω κ.χ.ο. $\alpha_{CM} = \alpha_{\gamma\omega\nu}\cdot R$ $\Rightarrow$

$$\Rightarrow F(R+r) = M_T\cdot R^2\cdot\alpha_{\gamma\omega\nu} + \frac{1}{2}M_T\cdot R^2\cdot\alpha_{\gamma\omega\nu}$$

$$\Rightarrow 12(0,4+0,3) = \frac{3}{2}M_T\cdot R^2\cdot\alpha_{\gamma\omega\nu} \Rightarrow$$

$$\Rightarrow 12\cdot 0,7 = \frac{3}{2}\cdot 7\cdot\frac{16}{100}\cdot\alpha_{\gamma\omega\nu} \Rightarrow 1,2 = \frac{48}{200}\cdot\alpha_{\gamma\omega\nu} \Rightarrow \alpha_{\gamma\omega\nu} = 5\,\frac{rad}{s^2}$$

$$\alpha_{CM} = \alpha_{\gamma\omega\nu}\cdot R = 5\cdot 0,4 = 2\,\frac{m}{s^2}$$

Δ5. $t_1 = 2s$ $\quad S = \frac{1}{2}\alpha_{CM}\cdot t^2 = \frac{1}{2}\cdot 2\cdot 2^2 = 4\,m$

$W_F = F\cdot S + \tau_F\cdot\theta$

$= F\cdot S + F\cdot r\cdot\theta =$

$= 12\cdot 4 + 12\cdot 0,3\cdot 10 = 48\cdot 36 = 84\,J$

$S = \theta\cdot R$
$4 = \theta\cdot 0,4$
$\theta = 10\,rad$

Επιμέλεια απαντήσεων: Δήμας Ιωάννης, Ποθητάκης Γεώργιος, Σούκουλη Γεωργία, Σπύρου Σταύρος, Φίλιος Χρήστος