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.** $P_1 = m_1 u_1$

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

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

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

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

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

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

Σωστή απάντηση είναι η (iii)

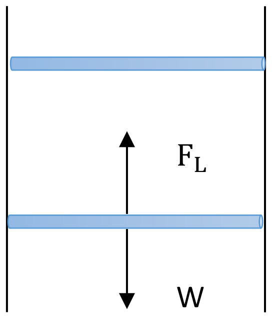
**Θέμα Γ**

**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.**




Το είδος της κίνησης είναι Ευθύγραμμη ομαλά επιταχυνόμενη, λόγω αύξησης της $F_L$.

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

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

$$P_κ = \frac{V_κ^2}{R_κ} \Rightarrow R_κ = \frac{V_κ^2}{P_κ} = \frac{36}{6}\Omega = 9\Omega$$

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

**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 $\upsilon_{o\rho} = 12m/s$

Για να λειτουργεί κανονικά πρέπει $I_\kappa = I_{\varepsilon\pi}$

$P_\kappa = V_\kappa \cdot I_\kappa \Rightarrow I_\kappa = \frac{P_\kappa}{V_\kappa} = 1A$

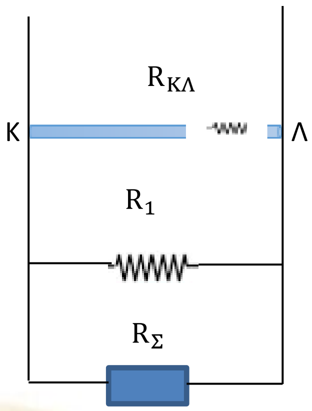
$E_{\varepsilon\pi} = B\upsilon\ell = 1 \cdot 12 \cdot 1 = 12V$

$I_{\varepsilon\pi} = \frac{E_{\varepsilon\pi}}{R_{o\lambda}} = \frac{12}{4}A = 3A$

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

Η σύνδεση είναι παράλληλη άρα $V_{K\Lambda} = V_\Sigma = V_1$

$I = \frac{V_{K\Lambda}}{R_\Sigma} = \frac{6}{6} = 1A$ ,άρα θα λειτουργεί κανονικά.




**Θέμα Δ**

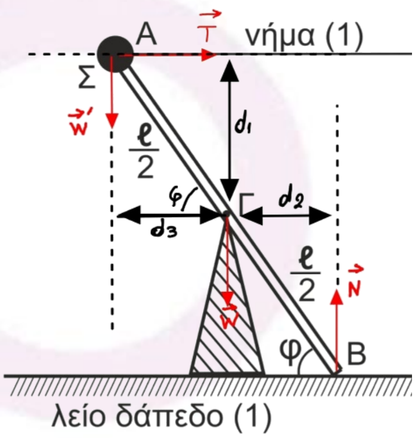
**Δ1:** $\Sigma\tau = 0 \Rightarrow -T \cdot d_1 + N \cdot d_2 + W_1 \cdot d_3 = 0 \Rightarrow$

$\Rightarrow -T \cdot \frac{\ell}{2} \cdot \eta\mu\varphi + N \cdot \frac{L}{2} \cdot \sigma\upsilon\nu\varphi + mg \cdot \frac{L}{2} \cdot \sigma\upsilon\nu\varphi = 0$

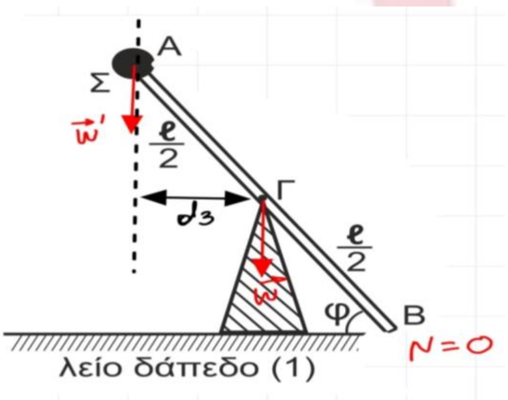
$\Rightarrow -10{,}5 \cdot \frac{2}{2} \cdot 0{,}8 + N \cdot \frac{2}{2} \cdot 0{,}6 + 10 \cdot \frac{2}{2} \cdot 0{,}6 = 0$

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

$\mathbf{N = 4N}$




**Δ2:**




$\Sigma\tau = I \cdot \alpha_{\gamma\omega\nu}$ (1)

$I_{O\Lambda} = I_\rho + I_m = \frac{1}{12}M_\rho \cdot R^2 + m\left(\frac{\ell}{2}\right)^2 = \frac{1}{12} \cdot 3 \cdot 4 + 1 \cdot 1$

$= 2kg \cdot m^2$

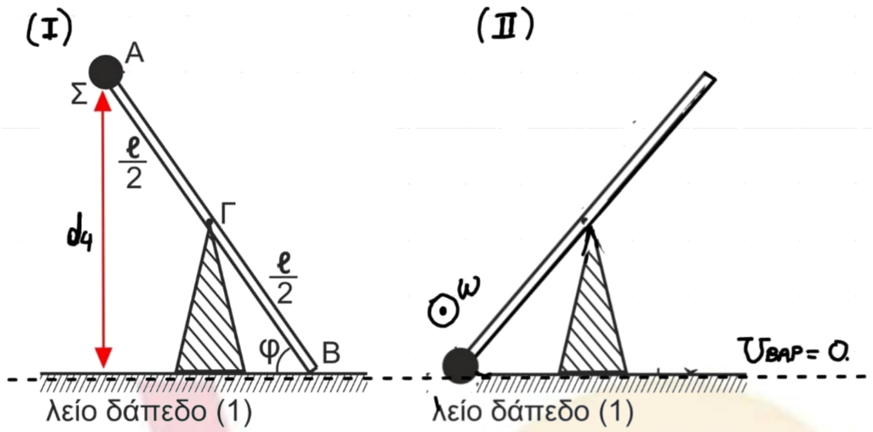
$(1) \Rightarrow W_1 \cdot d_3 = I_{O\Lambda} \cdot \alpha_{\gamma\omega\nu} \Rightarrow$

$\Rightarrow m_1 g \cdot \frac{\ell}{2}\sigma\upsilon\nu\varphi = I_{O\Lambda} \cdot \alpha_{\gamma\omega\nu}$

$\Rightarrow 10 \cdot 0{,}6 = 2 \cdot \alpha_{\gamma\omega\nu} \Rightarrow \alpha_{\gamma\omega\nu} = 3m/s^2$

$\left.\frac{dL}{dt}\right|_M = I_M \cdot \alpha_{\gamma\omega\nu} = 1 \cdot 3 = 3kg \cdot m^2/s^2$

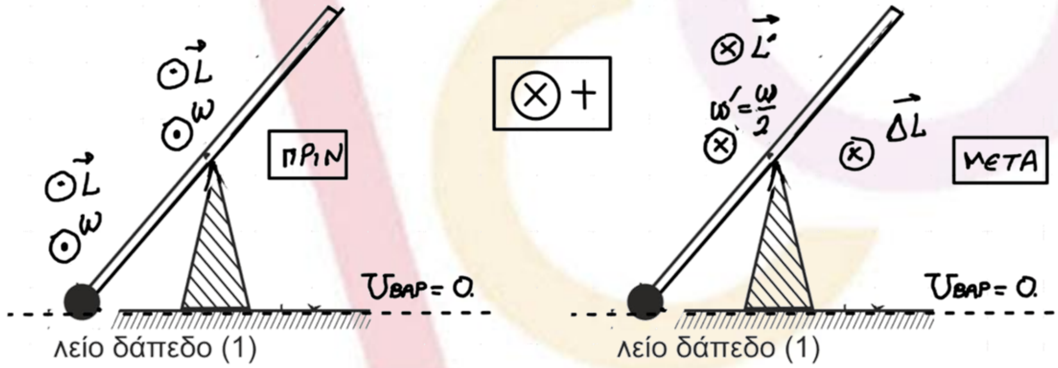
**Δ3:**




ΘΜΚΕ για το σύστημα:

$$K_{τελ} - K_{αρχ} = W_{ΣF} \Rightarrow \frac{1}{2} \cdot I_{ΣΥΣ} \cdot ω^2 = W_{W_1} + W_{W_{ραβδ}} \Rightarrow$$

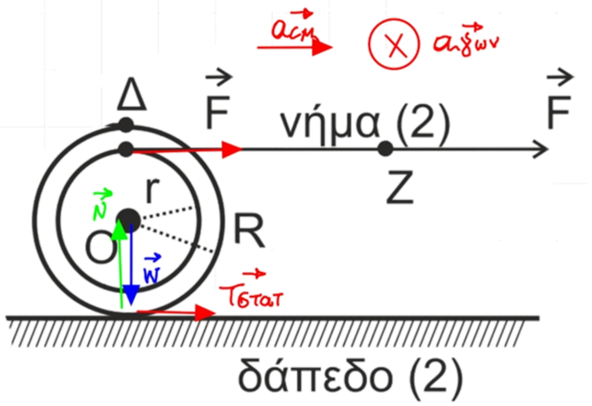
$$\Rightarrow \frac{1}{2} \cdot 2 \cdot ω^2 = mgd_4 - 0 \Rightarrow ω^2 = 1 \cdot 10 \cdot 1{,}6 \Rightarrow v = 4rad/s$$




$$ΔL_{ΣΥΣ} = L_{ΤΕΛ} - L_{ΑΡΧ} = I_{ΣΥΣ} \cdot ω' - (-I_{ΣΥΣ} \cdot ω) = I_{ΣΥΣ} \cdot \frac{ω}{2} + I_{ΣΥΣ} \cdot ω = I_{ΣΥΣ}\left(ω + \frac{ω}{2}\right) =$$

$$I_{ΣΥΣ} \cdot \frac{3ω}{2} = 2 \cdot \frac{3 \cdot 4}{2} = 12 kg \cdot m^2/s$$

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




$$\Sigma\tau_{(O)} = I_{(O)}\cdot\alpha_{γων} \Rightarrow \boxed{F\cdot r - T_{στ}\cdot R = \frac{1}{2}M_T\cdot R^2\cdot\alpha_{γων}} \quad (2)$$

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

λόγω κ.χ.ο. $\alpha_{CM} = \alpha_{γων}\cdot R$ $\Rightarrow$

$$(2) \Rightarrow F\cdot r - \cancel{T_{στ}\cdot R} = \frac{1}{2}M_T\cdot R^2\cdot\alpha_{γων}$$

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

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

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

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

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

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

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

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

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

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