ΠΑΝΕΛΛΗΝΙΕΣ 2022 - ΦΥΣΙΚΗ

ΘΕΜΑ Α

Α1. γ
Α2. δ
Α3. γ
Α4. β

Α5. α Λάθος
β Σωστό
γ Λάθος
δ Σωστό
ε Σωστό

ΠΑΝΕΛΛΗΝΙΕΣ 2022 - ΦΥΣΙΚΗ

ΘΕΜΑ Β

Β1.

Αρχικό πείραμα: Θ.Ι. $K.\Delta l = mg$

$\Delta l = mg/K = A_1$

2ο πείραμα: $\Sigma F = 0$

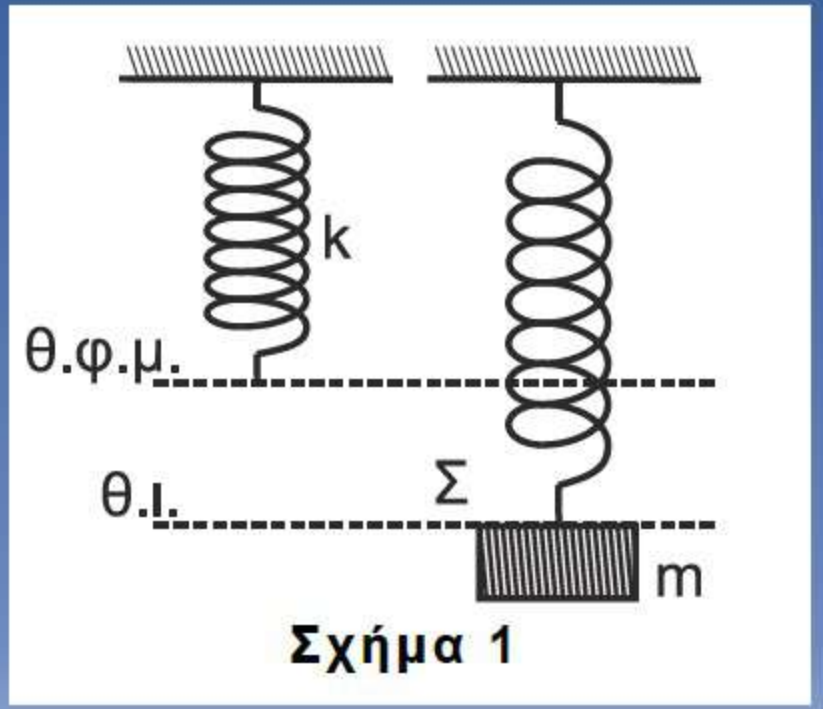
$F + F_{ελ} - mg = 0$

$mg + F_{ελ} - mg = 0 \Leftrightarrow F_{ελ} = 0 \quad x=0$

Θ.Ι. = Θ.φ.μ. $A_2 = \Delta l$

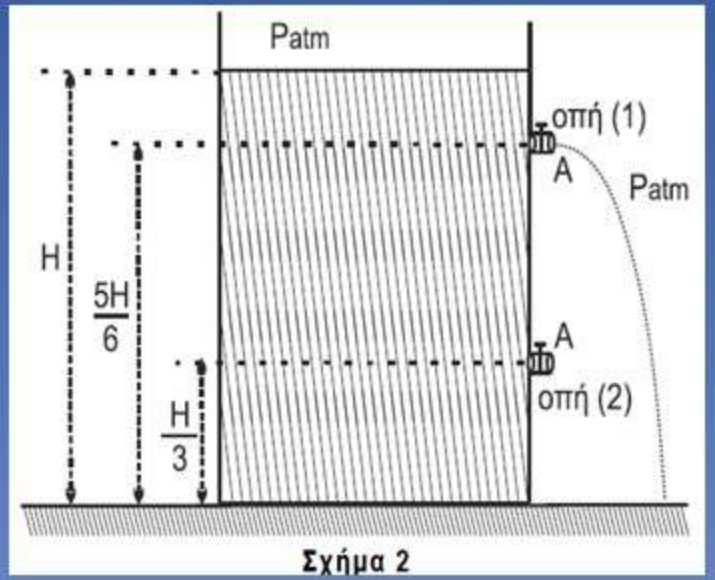
$A_1 = A_2$

Σωστή απάντηση i)



Σχήμα 1

ΠΑΝΕΛΛΗΝΙΕΣ 2022 - ΦΥΣΙΚΗ



Σχήμα 2

B2. $p_{atm} + pgH = \frac{1}{2}p\,u_1^2 + p_{atm} + pg\frac{5H}{6}$

$u_1 = \sqrt{\frac{gH}{3}}$ $\quad \Pi = A \cdot u_1 \Rightarrow \frac{V}{\Delta t_1} = A \cdot u_1$

$\Delta t_1 = \frac{V}{A \cdot u_1}$ (1)

$p_{atm} + pgH = \frac{1}{2}p\,u_2^2 + p_{atm} + pg\frac{H}{3}$

$u_2 = \sqrt{\frac{4gH}{3}}$ $\quad \Pi = \frac{V}{\Delta t_2} \Rightarrow V = \Pi \cdot \Delta t_2 = (Au_1 + Au_2)\Delta t_2$

$\Delta t_2 = \frac{V}{Au_1 + Au_2}$

Διαιρώντας $\frac{u_1}{u_2} = \frac{1}{2} \Rightarrow u_2 = 2u_1$

$$\frac{\Delta t_1}{\Delta t_2} = \frac{Au_1 + Au_2}{Au_1} = \frac{3u_1}{u_1} = 3$$

$$\frac{\Delta t_2}{\Delta t_1} = \frac{1}{3} \text{ (ii)}$$

ΠΑΝΕΛΛΗΝΙΕΣ 2022 - ΦΥΣΙΚΗ

Β3.

$$p_1' = \frac{p_1}{5} \Rightarrow m_1 u_1' = \frac{1}{5} m_1 u_1$$

$$u_1' = \frac{1}{5} u_1 \qquad \frac{(m_1 - m_2)u_1 + 2m_2 u_2}{m_{1+} m_2} = \frac{1}{5} u_1$$

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

$$\Pi = \frac{\frac{1}{2} m_2 u_2'^2}{\frac{1}{2} m_1 u_1^2} 100\% = \ldots = 96\%$$

Σωστή απάντηση iii)

ΠΑΝΕΛΛΗΝΙΕΣ 2022 - ΦΥΣΙΚΗ

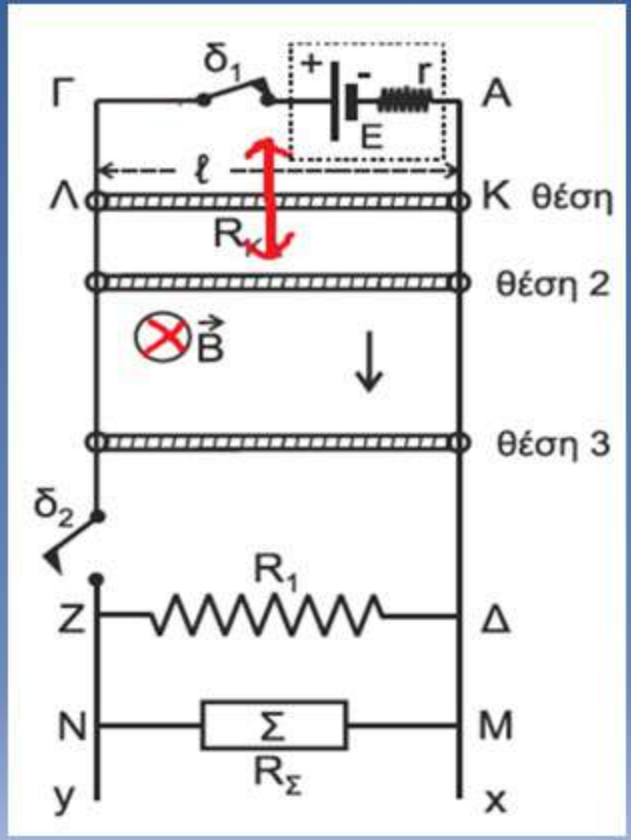
ΘΕΜΑ Γ

Γ1. $mg = FL \Rightarrow mg = B \frac{E}{R+r} * l \Rightarrow B = 1T$

Γ2. $P_{\Sigma} = \frac{V^2}{R} \Rightarrow R_{\Sigma} = 6\ \Omega$

$1 \longrightarrow 3\ mg - \frac{B^2 u l^2}{R_{ολ}} = m\alpha$

επιταχυνόμενη με επιτάχυνση η οποία μειώνεται.



Γ2. συνέχεια

$u_{ορ}$: $\Sigma F = 0 \Leftrightarrow mg = F_L$

$mg = B^2 u_{ορ} l^2$, $R_{ολ} = R_{1,Σ} + R_{ΚΛ} = 2 + 2 = 4\ Ω$

$R_{ολ}$

$U_{ορ} = 12$ m/s

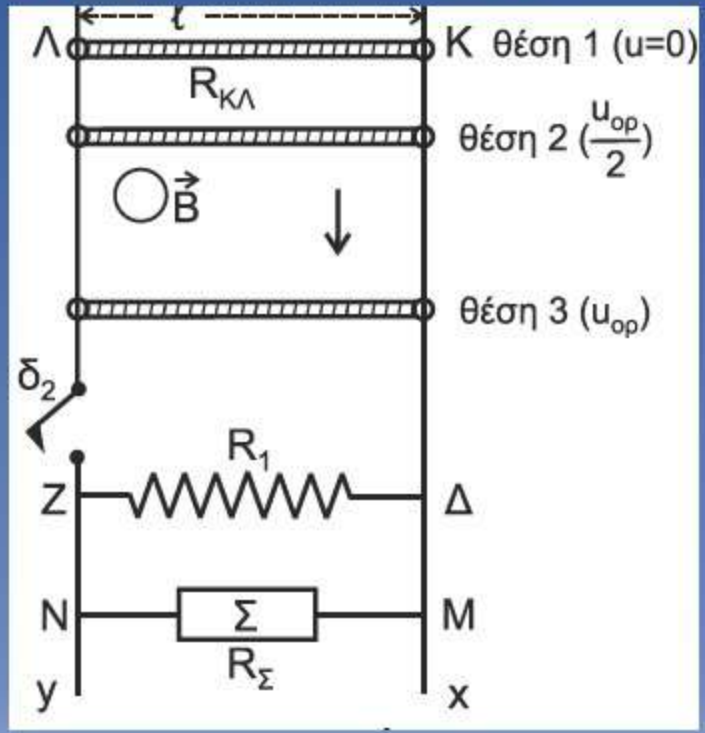
ΠΑΝΕΛΛΗΝΙΕΣ 2022 - ΦΥΣΙΚΗ

Γ3. $\frac{\Delta p}{\Delta t} = \Sigma F = mg - \frac{B^2 \upsilon l^2}{R_{O\Lambda}} = 3 - \frac{1 \cdot 6 \cdot 1}{4} = 1{,}5\ N$

Γ4. $P_K = V_K I_K \Rightarrow I_K = 1\ A$

$I_\Sigma = \frac{V_{K\Lambda}}{R_\Sigma}$, $V_{K\Lambda} = B \upsilon_{op} l - \frac{B \upsilon_{op} l \cdot R_{K\Lambda}}{R_{o\lambda}} = 6\ V$

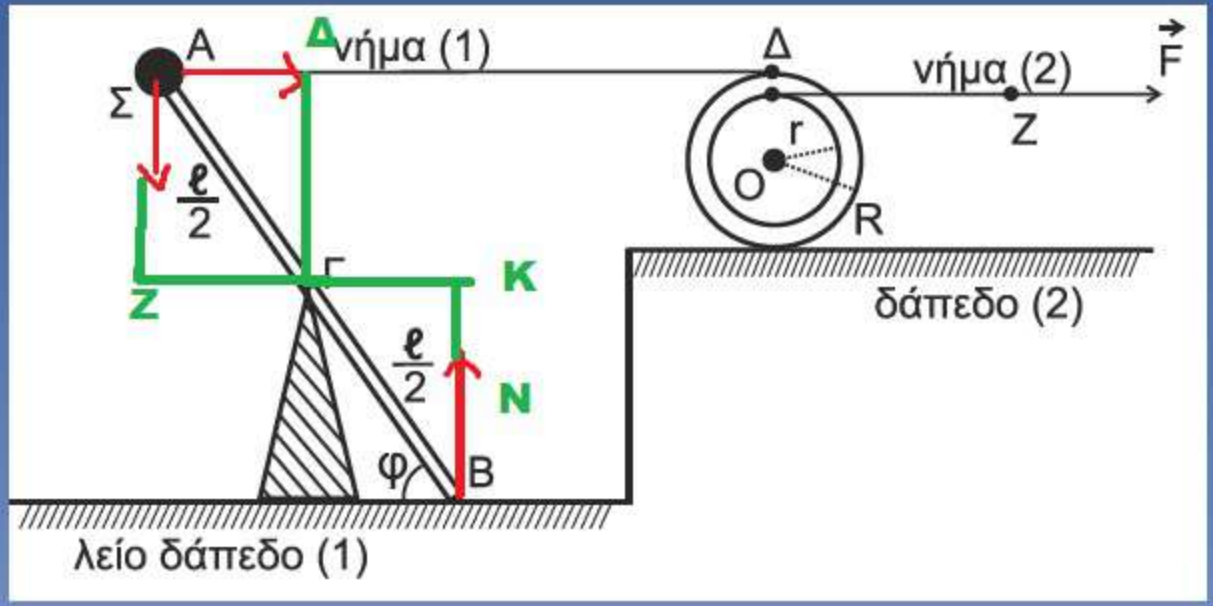
$I_\Sigma = 1\ A$ Λειτουργεί κανονικά



ΠΑΝΕΛΛΗΝΙΕΣ 2022 - ΦΥΣΙΚΗ

ΘΕΜΑ Δ

Δ1



ΠΑΝΕΛΛΗΝΙΕΣ 2022 - ΦΥΣΙΚΗ

Δ1 $\Sigma\tau = 0$ $\quad T_1 \cdot (\Delta\Gamma) - N \cdot (\Gamma K) - mg \cdot (\Gamma Z) = 0 \quad (1)$

$$\sigma\upsilon\nu\varphi = \frac{\Gamma K}{\frac{l}{2}} \Rightarrow (\Gamma K) = 0{,}6$$

$$\eta\mu\varphi = \frac{\Delta\Gamma}{\frac{l}{2}} \Rightarrow (\Delta\Gamma) = 0{,}8$$

$$\sigma\upsilon\nu\varphi = \frac{\Gamma Z}{\frac{l}{2}} \Rightarrow (\Gamma Z) = 0{,}6$$

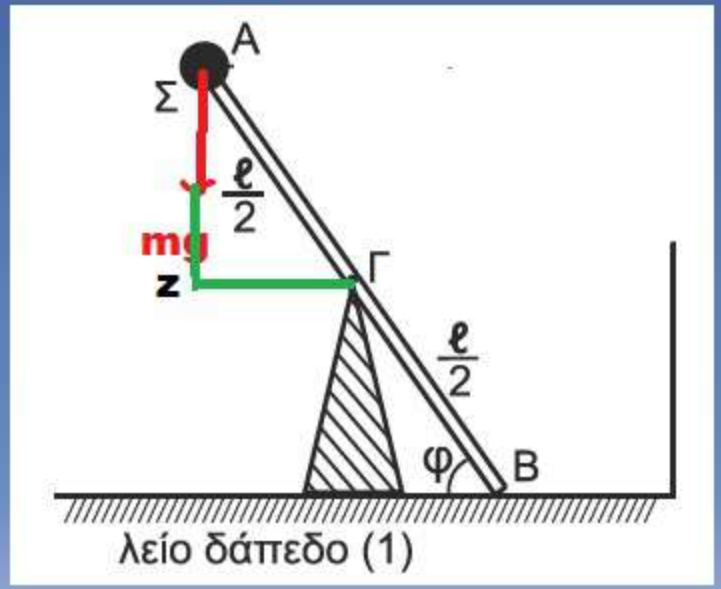
$(1) \quad N = 4\ N$

ΠΑΝΕΛΛΗΝΙΕΣ 2022 - ΦΥΣΙΚΗ

Δ2. $\Sigma_\tau = I_\Sigma \, \alpha_{\gamma\Sigma} \Rightarrow mg(\Gamma Z) = \left(\frac{1}{12}ML^2 + m\frac{l^2}{4}\right)\alpha_\gamma$

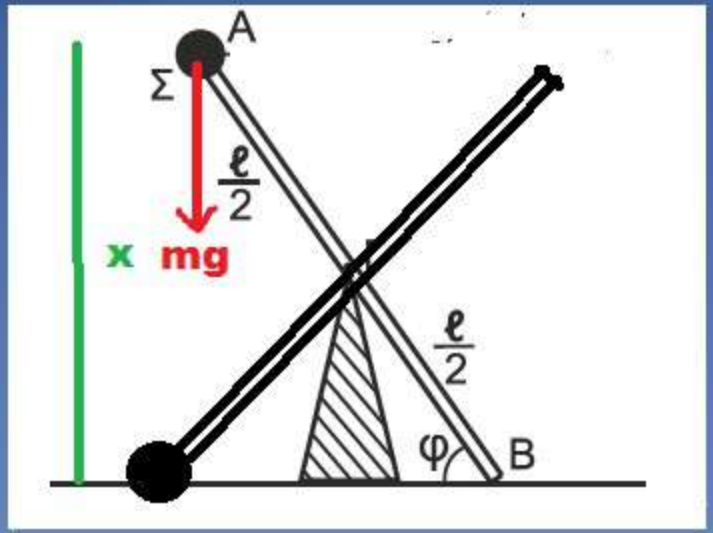
$\alpha_\gamma = 3 \, r/s^2$

$\frac{\Delta L}{\Delta t} p = \frac{1}{12}ML^2\alpha_\gamma = 3 \, Nm$



ΠΑΝΕΛΛΗΝΙΕΣ 2022 - ΦΥΣΙΚΗ

Δ3.



$$\eta\mu\varphi = \frac{x}{L} \Rightarrow x = L\eta\mu\varphi$$

$$mgx = \frac{1}{2} I_\Sigma w^2$$

$$1 \cdot 10 \cdot 0{,}8 \cdot 2 = \frac{1}{2}\left(\frac{1}{12} ML^2 + \frac{ml^2}{4}\right) w^2$$

$$16 = \frac{1}{2}\left(\frac{1}{12} 3 \cdot 4 + 1 \cdot 1\right) w^2 \Rightarrow w = 4\ r/s$$

ΠΑΝΕΛΛΗΝΙΕΣ 2022 - ΦΥΣΙΚΗ

$$\Delta L = L_{\tau\epsilon\lambda} - L_{\alpha\rho\chi}$$

$$= I_{\Sigma}\,\frac{w}{2} + I_{\Sigma}\,w$$

$$= \frac{3}{2} I_{\Sigma}\,w = \frac{3}{2}\left(\frac{1}{12}ML^2 + m\frac{L^2}{4}\right)w$$

$$= 12\,kgm^2/s$$

ΠΑΝΕΛΛΗΝΙΕΣ 2022 - ΦΥΣΙΚΗ

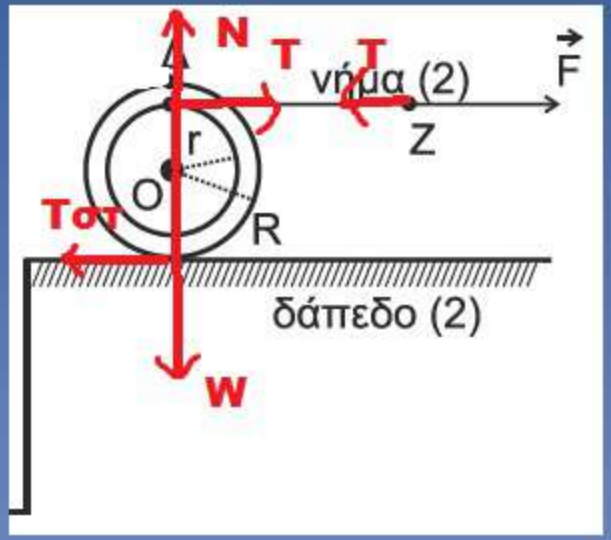
Δ4.

$$T - T_{\sigma\tau} = M_1 \cdot \alpha_{cm} \quad (1)$$

$$T \cdot r + T_{\sigma\tau} \cdot R = \frac{1}{2} M_1 R^2 \alpha_\gamma \quad (2), \quad \alpha_\gamma = \frac{\alpha_{cm}}{R} \quad (3)$$

$$(1), (2), (3): T \cdot r + (T - M_1 \alpha_{cm}) R = \frac{1}{2} M_1 R \alpha_{cm}$$

$$\alpha_{cm} = 2 \ m/s^2$$



Δ5. $W_F = W_T = T \cdot s_{cm} + \tau_T \cdot \theta = T \cdot s_{cm} + T \cdot r \cdot \theta$

$s = \frac{1}{2}\alpha_{cm} t^2 = \ldots = 4\ m$

$\theta = \frac{1}{2}\alpha_\gamma t^2 = \ldots = 10\ rad$

$W_F = 12 \cdot 4 + 12 \cdot 3 \cdot 10^{-1} \cdot 10 = 84\ J$