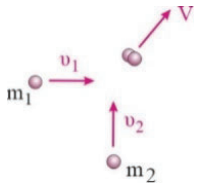
Λύσεις κριτηρίου 9

ΘΕΜΑ Α

Α1. (α) **Α2.** (β) **Α3.** (γ) **Α4.** (δ) **Α5.** α. Σ β. Λ γ. Σ δ. Λ ε. Σ

ΘΕΜΑ Β

Β1. (ii)



$$K_1 = K_2 = K = \frac{1}{2}m_1\upsilon_1^2 = \frac{p_1^2}{2m_1} \Rightarrow p_1^2 = 2Km_1 \,,\; p_2^2 = 2Km_2$$

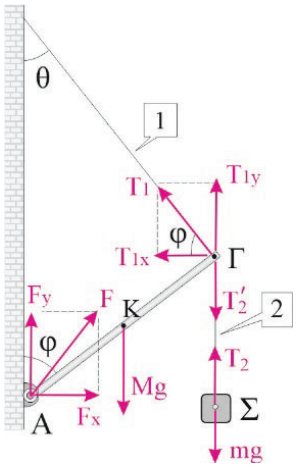
$$\text{ΑΔΟ: } P_{\alpha\rho\chi} = P_{\tau\varepsilon\lambda} \Rightarrow \sqrt{p_1^2 + p_2^2} = (m_1 + m_2)V \Rightarrow$$

$$2Km_1 + 2Km_2 = (m_1 + m_2)^2 V^2 \Rightarrow$$

$$K_{\tau\varepsilon\lambda} = \frac{1}{2}(m_1 + m_2)V^2 = K$$

$$\pi\% = \frac{K_{\alpha\rho\chi} - K_{\tau\varepsilon\lambda}}{K_{\alpha\rho\chi}}100\% = \frac{2K - K}{2K}100\% \Rightarrow \pi\% = 50\%$$

Β2. (i)



$$\Sigma F_{y,\Sigma} = 0 \Rightarrow w_2 = T_2 = mg$$

$$\Sigma\tau_{(A)} = 0 \Rightarrow T_1 L = Mg\frac{L}{2}\eta\mu\varphi + mgL\eta\mu\varphi \Rightarrow T_1 = 0,4Mg + 0,8mg \quad (1)$$

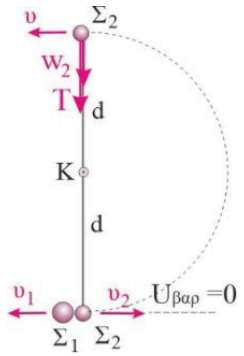
$$\Sigma F_x = 0 \Rightarrow F_x = T_{1x} \quad , \quad F = T_1 \Rightarrow \sqrt{F_x^2 + F_y^2} = \sqrt{T_{1x}^2 + T_{1y}^2} \Rightarrow F_y = T_{1y}$$

$$\Sigma F_y = 0 \Rightarrow F_y + T_{1y} = Mg + mg \Rightarrow 2T_1\eta\mu\varphi = Mg + mg \quad (2)$$

Από τις σχέσεις (1) και (2)

$$2(0,4Mg + 0,8mg)\eta\mu\varphi = Mg + mg \Rightarrow 0,64Mg + 1,28mg = Mg + mg \Rightarrow 9M = 7m$$

Β3. (i)



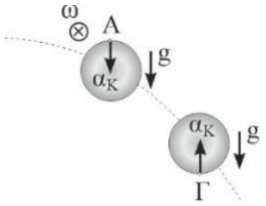
Οριακή ανακύκλωση: Τ=0 , $F_\kappa = w_2 \Rightarrow m_2 g = \frac{m_2\upsilon^2}{d} \Rightarrow \upsilon = \sqrt{gd}$

$$\text{ΑΔΜΕ}: \frac{1}{2}m_2\upsilon'^2_2 = \frac{1}{2}m_2\upsilon^2 + m_2 g2d \Rightarrow \upsilon'_2 = \sqrt{5gd}$$

$$\upsilon'_2 = \frac{2m_1}{m_1 + m_2}\upsilon_0 = \frac{6m_2}{3m_2 + m_2}\upsilon_0 = \frac{3}{2}\upsilon_0$$

$$L = m_2\upsilon d = \frac{m_1}{3}\frac{\upsilon'_2}{\sqrt{5}}d = \frac{m_1}{3}\frac{1,5\upsilon_0}{\sqrt{5}}d = = \frac{m_1\upsilon_0 d\sqrt{5}}{10}$$

ΘΕΜΑ Γ



Γ1. $\upsilon_0 = \omega R \Rightarrow \omega = 10 rad/s$

$$\alpha_{min} = \alpha_\Gamma = \alpha_\kappa - g = \frac{\upsilon_{\gamma\rho}^{\ 2}}{R} - g = \omega^2 R - g \Rightarrow \alpha_{min} = 0 \ ,$$

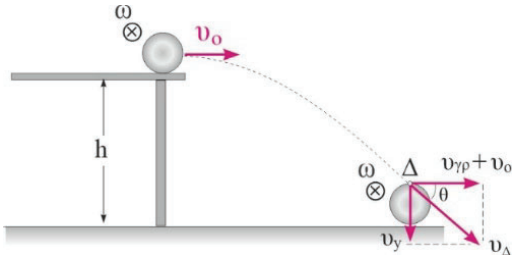
$$\alpha_{max} = \alpha_A = \alpha_\kappa + g = \omega^2 R + g \Rightarrow \alpha_{max} = 20 m/s^2$$

Γ2. $h = \frac{1}{2} g t^2 \Rightarrow t = 0,4s$, $\theta = \omega t = 4 rad$, $N = \frac{\theta}{2\pi} = \frac{2}{\pi}$ στροφές

Γ3. $\upsilon_\Delta = \sqrt{\left(\upsilon_{\gamma\rho} + \upsilon_o\right)^2 + \upsilon_y^{\ 2}} \Rightarrow$

$$\upsilon_\Delta = \sqrt{\left(2\omega R\right)^2 + \left(gt\right)^2} \Rightarrow \upsilon_\Delta = 2\sqrt{5} m/s$$

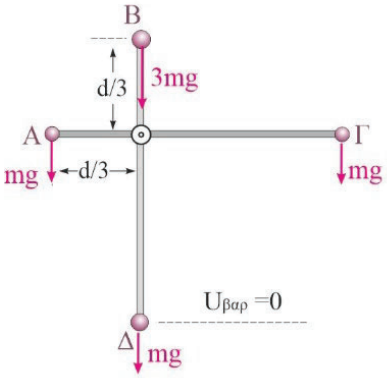
$$\varepsilon\varphi\theta = \frac{\upsilon_y}{2\upsilon_0} = 2 \Rightarrow \theta = 63^0$$



Γ4. $\frac{dU_B}{dt} = -\frac{dw_B}{dt} = -\frac{mgdy}{dt} = -mg\upsilon_y = -mg^2 t \Rightarrow \frac{dU_B}{dt} = -2J/s$

ΘΕΜΑ Δ

Δ1. $\Sigma\tau_{A\Gamma(K)} = mg\frac{2d}{3} - mg\frac{d}{3} = 1Nm$, $\Sigma\tau_{B\Delta(K)} = 0$



Δ2. ΑΔΜΕ :

$$mg\frac{2d}{3} + mg\frac{2d}{3} = mgd + \frac{1}{2}m\upsilon_A^{\ 2} + \frac{1}{2}m\upsilon_\Gamma^{\ 2} \Rightarrow$$

$$g\frac{2d}{3} + g\frac{2d}{3} = gd + \frac{1}{2}\left(\omega\frac{d}{3}\right)^2 + \frac{1}{2}\left(\omega\frac{2d}{3}\right)^2 \Rightarrow$$

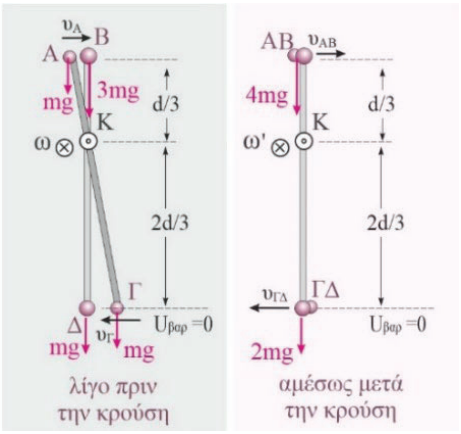
$$\omega = 2 rad/s \ , \ \upsilon_\Gamma = \omega\frac{2d}{3} = 4 m/s$$

Δ3. ΑΔΣ:

$$m\upsilon_A\frac{d}{3}+m\upsilon_\Gamma\frac{2d}{3}=4m\upsilon_{AB}\frac{d}{3}+2m\upsilon_{\Gamma\Delta}\frac{2d}{3}\Rightarrow$$

$$m\omega\left(\frac{d}{3}\right)^2+m\omega\left(\frac{2d}{3}\right)^2=4m\omega'\left(\frac{d}{3}\right)^2+2m\omega'\left(\frac{2d}{3}\right)^2\Rightarrow$$

$$\omega'=\frac{5}{12}\omega=\frac{5}{6}\text{rad/s}$$



Δ4.

$$Q=\frac{1}{2}m\upsilon_A{}^2+\frac{1}{2}m\upsilon_\Gamma{}^2-\left[\frac{1}{2}4m\upsilon_{AB}{}^2+\frac{1}{2}2m\upsilon_{\Gamma\Delta}{}^2\right]\Rightarrow$$

$$Q=\frac{1}{2}m\left(\omega\frac{d}{3}\right)^2+\frac{1}{2}m\left(\omega\frac{2d}{3}\right)^2-\frac{1}{2}4m\left(\omega'\frac{d}{3}\right)^2-\frac{1}{2}2m\left(\omega'\frac{2d}{3}\right)^2\Rightarrow Q=\frac{7}{12}\text{J}$$

Δ5. $t=\frac{T}{2}=\frac{2\pi}{2\omega'}=1,2\pi\text{s}$