ΠΑΝΕΛΛΑΔΙΚΕΣ ΕΞΕΤΑΣΕΙΣ

Γ΄ ΤΑΞΗΣ ΗΜΕΡΗΣΙΟΥ ΓΕΝΙΚΟΥ ΛΥΚΕΙΟΥ

ΤΕΤΑΡΤΗ 12 ΙΟΥΝΙΟΥ 2019

ΕΞΕΤΑΖΟΜΕΝΟ ΜΑΘΗΜΑ: ΦΥΣΙΚΗ ΠΡΟΣΑΝΑΤΟΛΙΣΜΟΥ

ΑΠΑΝΤΗΣΕΙΣ

ΘΕΜΑ Α.

Α1. β

Α2. γ

Α3.α

Α4.γ

Α5. α. Λ

β. Σ

γ. Λ

δ. Σ

ε. Σ

ΘΕΜΑ Β.

Β1. Σωστή απάντηση η ii.

$$f_1 = \frac{u}{u+u_s} f_s = \frac{u}{u+\frac{u}{20}} f_s = \frac{20}{21} f_s$$

$$f_2 = \frac{u}{u+u_s} f_s = \frac{u}{u+\frac{u}{40}} f_s = \frac{40}{41} f_s$$

$$\frac{f_1}{f_2} = \frac{\frac{20}{21}}{\frac{40}{41}} = \frac{41 \cdot 20}{21 \cdot 40} = \frac{41}{42}$$

Β2. Σωστή απάντηση είναι η iii.

$$A_1 = 2A_2 \Rightarrow u_2 = 2u_1 : Be_{(1\to 2)}$$

$$\left.\begin{array}{r} P_1 + \frac{1}{2}\rho u_1^2 = Patm + \frac{1}{2}\rho u_2^2 \\ \text{με } P_1 = Patm + \rho gh \end{array}\right\} \Rightarrow \rho gh + \frac{1}{2}\rho u_1^2 = 4\frac{1}{2}\rho u_1^2 \Rightarrow \rho gh = 3\frac{1}{2}\rho u_1^2 \Rightarrow u_1 = \sqrt{\frac{2}{3}gh}$$

$$u_2 = 2u_1 = 2\sqrt{\frac{2}{3}gh} : \Pi = A_2u_2 = A_2 \cdot 2\sqrt{\frac{2}{3}gh} = A_3u_3 \Rightarrow A_2u_2 = \frac{A_2}{2}u_3 \Rightarrow u_3 = 2u_2 \Rightarrow u_3 = 4\sqrt{\frac{2}{3}gh}$$

$$Be(\varepsilon\pi\iota\varphi \to 3)\ \ Patm+\rho gH+0=Patm+\frac{1}{2}\rho u_3^2+0 \Rightarrow \rho gH=\frac{1}{2}\rho 16\frac{2}{3}gh \Rightarrow \frac{h}{H} = \frac{3}{16}$$

Β3. Σωστή απάντηση είναι η ii.

$$I_0 = \frac{1}{3}M\ell^2 = \frac{1}{3}\cdot 3\cdot 1^2 = 1kg\cdot m^2$$
$$I_0' = I_0 + m\ell^2 = 1 + 1\cdot 1^2 = 2kg\cdot m^2$$

$$\text{ΘΜΚΕ}_{\sigma\tau\rho o\varphi} :\ W\tau_F = K_{\sigma\tau\rho o\varphi} \Rightarrow \tau_F\theta = \frac{1}{2}I_0\omega_0^2 \Rightarrow F\ell\frac{\pi}{2} = \frac{1}{2}I_0\omega_0^2 \Rightarrow \omega_0^2 = \frac{9\pi 1\pi}{1} = 9\pi^2 \Rightarrow \omega_0 = 3\pi \text{ r/s}$$

ΑΔΣτρΟ στην κρούση $I_0\omega_0 + 0 = I_0'\omega \Rightarrow \omega = \dfrac{I_0\omega_0}{I_0'} \Rightarrow \omega = \dfrac{1\cdot 3\pi}{2} = 1{,}5\pi$ r/s

και $\Delta t = \dfrac{\Delta\theta}{\omega} = \dfrac{\frac{\pi}{2}}{\frac{3\pi}{2}} = \dfrac{1}{3}$sec

ΘΕΜΑ Γ.

Γ1.

$$\Delta\ell_1 = \Delta\ell_2$$

$$K\Delta\ell_1 = m_1 g \Rightarrow K = \frac{m_1 g}{\Delta\ell_1} = \frac{10}{5\cdot 10^{-2}} \Rightarrow 200N/m$$

$$A = 2\Delta\ell_1 = 0{,}10m$$

Γ2. στη θέση κρούσης

$$\text{ΑΔΕτ} \Rightarrow K + U = E\tau \Rightarrow \frac{1}{2}MV^2 + \frac{1}{2}K\Delta\ell_2^2 = \frac{1}{2}KA^2$$

$$MV^2 = 3K\Delta\ell_1^2 \Rightarrow V^2 = \frac{3K\Delta\ell_1^2}{M} \Rightarrow V^2 = \frac{3\cdot 2\cdot 10^2 2\cdot 5\cdot 10^{-4}}{2} \Rightarrow V = 0{,}5\sqrt{3}m/s$$

$$\text{Α.Δ.Ο}: m_1u_0 + 0 = M\cdot V \Rightarrow u_0 = \frac{MV}{m_1} = \sqrt{3}m/s$$

$$K_2 = \frac{1}{2}mu^2u_0^2 = \frac{1}{2}\cdot 1\cdot 3 = 1{,}5j$$

Γ3. Με θετική τη φορά προς τα πάνω

$$P_{\pi\rho\iota\nu} = m_2u_0 = +\sqrt{3}kg\frac{m}{s} \quad P_{\mu\varepsilon\tau\acute{\alpha}} = +m_2V = 0{,}5\sqrt{3}\ kg\ m/s$$

$$\Delta P = P_{\mu\varepsilon\tau\acute{\alpha}} - P_{\pi\rho\iota\nu} = -0{,}5\sqrt{3}kg\frac{m}{s} \text{ και } \left|\vec{\Delta P}\right| = 0{,}5\sqrt{3}kg\frac{m}{s}$$

με κατεύθυνση προς τα κάτω

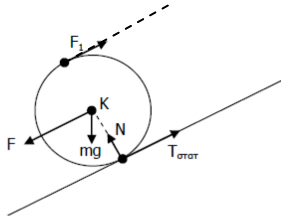
Γ4.

Αφού την $t = 0 \Rightarrow y \neq 0$ υπάρχει αρχική φάση $\omega = \sqrt{\frac{K}{M}} = 10r/s$

$$\left.\begin{array}{l} y = A\eta\mu(\omega t + \varphi_0) \\ u > 0 \end{array}\right\} \Rightarrow \text{την } t=0,\ y = \Delta\ell_2 = \frac{A}{2},\ u>0 \Rightarrow \frac{A}{2} = A\eta\mu\varphi_0 \Rightarrow \varphi_0 = \frac{\pi}{6}$$

$$y = 0{,}1\eta\mu\left(10t + \frac{\pi}{6}\right)$$

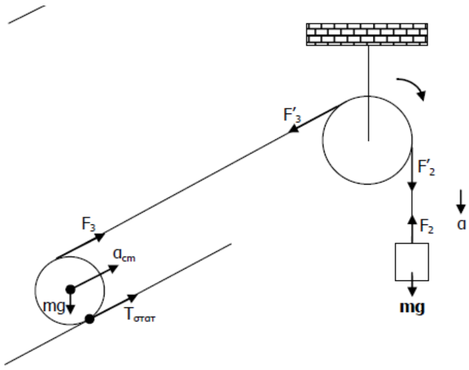
ΘΕΜΑ Δ.



Δ1. $Mg=F_1=20N$

$$\Sigma F x = 0 \Rightarrow F_1 + T_{στατ} = F + Mg\eta\mu\varphi$$

$$\Sigma\tau^{K} = 0 \Rightarrow F_1R - T_{στατ}R=0 \Rightarrow \boxed{F_1=T_{στατ}} \text{ οπότε } \Rightarrow 2F_1\text{-}Mg\eta\mu\varphi=F \Rightarrow F=30N$$



Δ2. $\alpha_{cm}=\alpha_{\varepsilon}=\alpha_{\gamma}R_K$

$\alpha=2\alpha_{cm}$

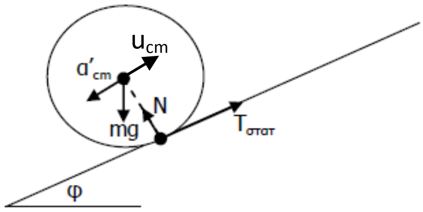
$$mg - F_2 = m\alpha = 2m\alpha_{cm}$$

$$F_2R_T - F_3R_T = \frac{1}{2}mR_T^2 \cdot \frac{\alpha}{R_T} \Rightarrow \boxed{F_2 - F_3 = m\alpha_{cm}}$$

$$\boxed{F_3 + \cancel{T_{στατ}} - mg\eta\mu\varphi=m\alpha_{cm}}$$

$$F_3 \cdot R_K - T_{στατ}R_K = \frac{1}{2}mR_K^2\frac{\alpha_{cm}}{R} \Rightarrow \boxed{F_3 - \cancel{T_{στατ}} = \frac{1}{2}m\alpha_{cm}}$$

$$\left.\begin{array}{r} 2F_3 - mg\eta\mu\varphi=\frac{3}{2}m\alpha_{cm} \\ 2F_2 - 2F_3 = 2m\alpha_{cm} \\ 2mg - 2F_2 = 4m\alpha_{cm} \end{array}\right\} \Rightarrow 2mg - \frac{mg}{2} = 7{,}5m\,\alpha_{cm} \quad 1{,}5\cancel{m}g=7{,}5\cancel{m}\alpha_{cm} \Rightarrow \alpha_{cm} = 2m/s^2 \text{ και } \alpha=2\alpha_{cm}=4m/s^2$$



Δ3. $u_{cm}=\alpha_{cm}t=1m/s$, $\quad \Delta x_{cm} = \frac{1}{2}\alpha_{cm}t^2 = \frac{1}{2}2\frac{1}{4} = 0{,}25m$

Άρα ο κύλινδρος έχει ξεπεράσει το Γ κατά 5cm και συνεχίζει με επιβράδυνση.

α'_{cm} = μέτρο επιβράδυνσης

$$\Sigma F = ma'_{cm} \Rightarrow \boxed{mg\eta\mu\varphi - T_{\sigma\tau\alpha\tau} = ma'_{cm}}$$

$$\Sigma\tau = I\alpha_{\gamma} \Rightarrow T_{\sigma\tau\alpha\tau}R_K = \frac{1}{2}mR_K^2 \cdot \frac{a'_{cm}}{R} \Rightarrow \boxed{T_{\sigma\tau\alpha\tau} = \frac{1}{2}ma'_{cm}} \Rightarrow mg\eta\mu\varphi = \frac{3}{2}ma'_{cm} \Rightarrow a'_{cm} = \frac{2\cdot 10\cdot \frac{1}{2}}{3} = \frac{10}{3}m/s^2$$

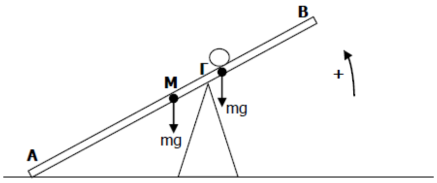
$$t_2^* = \frac{u_{cm}}{a_{cm}} = \frac{1}{\frac{10}{3}} = 0,3s\left[t_2 = t_1 + t_2^* = 0,8s\right]$$

$$\Delta x' = \frac{u_{cm}^2}{2a'_{cm}} = \frac{1}{2\frac{10}{3}} = \frac{3}{2\cdot 10} = 0,15m\ (u=0)$$

Άρα έχει ξεπεράσει το Γ κατά 0,20m.

Δ4. $\Delta X_{o\lambda} = \Delta X_{cm} + \Delta X' = 0,4m$

Δ5. Στην τελική θέση του κυλίνδρου



$$\Sigma\tau^{\Gamma} = \overset{\otimes}{T^{\Gamma}_{mg}} + \overset{\odot}{T^{\Gamma}_{mg_{\sigma\alpha\nu\acute{\iota}\delta\alpha\varsigma}}} = -mg0,2\sigma\upsilon\nu\varphi + mg0,5\sigma\upsilon\nu\varphi > 0$$

Άρα η σανίδα **δεν** ανατρέπεται.