ΦΥΣΙΚΗ ΚΑΤΕΥΘΥΝΣΗΣ
ΠΑΝΕΛΛΗΝΙΕΣ 2010
ΕΝΔΕΙΚΤΙΚΕΣ ΑΠΑΝΤΗΣΕΙΣ

ΘΕΜΑ Α

Α1: β
Α2: γ
Α3: β
Α4: γ
Α5: α – Λ
β - Λ
γ – Σ
δ – Λ
ε - Σ

ΘΕΜΑ Β

Β1. α

$$|r_1 - r_2| = N \cdot \lambda$$

$$\left.\begin{aligned} \upsilon &= \lambda \cdot f \\ \upsilon &= \lambda' \cdot 2f \end{aligned}\right\} \Rightarrow \lambda' = \frac{\lambda}{2}$$

$|r_1 - r_2| = N \cdot \lambda = N \cdot 2\lambda'$ ΕΝΙΣΧΥΣΗ

Β2. α

Αρχική ισορροπία: $\Sigma F = 0 \Rightarrow M \cdot g = k \cdot \Delta l_1 \Rightarrow \Delta l_1 = \dfrac{M \cdot g}{k}$

Στη θέση ισορροπίας: $\Sigma F = 0 \Rightarrow k \cdot \Delta l_2 = (M + m) \cdot g \Rightarrow \Delta l_2 = \dfrac{(M+m) \cdot g}{k}$

$\upsilon = 0$ (ακραία θέση) $\Rightarrow E = \dfrac{1}{2} \cdot k \cdot A^2 = \dfrac{1}{2} \cdot \dfrac{m^2 g^2}{k}$ αφού $A = \Delta l_2 - \Delta l_1 = \dfrac{M \cdot g}{k}$

Β3. β

$$\left.\begin{aligned} &\vec{p}_1 \perp \vec{p}_2 \\ &\vec{p}_{o\lambda} = \vec{p}_1 + \vec{p}_2 \end{aligned}\right\}$$

Αρχή διατήρησης της ορμής: $(m_1 + m_2)^2 V^2 = m_1{}^2 \upsilon_1^2 + m_2{}^2 \upsilon_2^2$

$$V^2 = \frac{m_1^2 \upsilon_1^2 + m_2^2 + \upsilon_2^2}{(m_1 + m_2)^2}$$

$$K = \frac{1}{2}(m_1 + m_2) V^2 = \frac{1}{2} \cdot \frac{m_1^2 \upsilon_1^2 + m_2^2 \upsilon_2^2}{m_1 + m_2} = \frac{64 + 36}{2 \cdot 5} = 10J$$

ΘΕΜΑ Γ

Γ1. $C = \dfrac{Q}{E} \Rightarrow Q = C \cdot E = 40 \cdot 10^{-6} C = 4 \cdot 10^{-5} C$

Γ2. $T = 2\pi\sqrt{LC} = 2\pi\sqrt{16 \cdot 10^{-8}} = 2\pi \cdot 4 \cdot 10^{-4} = 8\pi \cdot 10^{-4} s$

Γ3. $i = -I \cdot \eta\mu\omega t$

$$\omega = \frac{2\pi}{T} = \frac{2\cancel{\pi}}{8\cancel{\pi} \cdot 10^{-4}} = \frac{10^4}{4} = 2500 rad/s$$

$$I = \cdot Q = 2{,}5 \cdot 10^3 \cdot 4 \cdot 10^{-5} = 10 \cdot 10^{-2} = 0{,}1A$$

$$i = -0{,}1 \cdot \eta\mu 2500t \quad (SI)$$

Γ4. $\left.\begin{matrix} U_B = 3U_E \\ U_B + U_E = E \end{matrix}\right\} \Leftrightarrow 4U_E = E \Leftrightarrow 4 \cdot \dfrac{1}{\cancel{2}} \cdot \dfrac{q^2}{\cancel{C}} = \dfrac{1}{\cancel{2}} \cdot \dfrac{Q_2}{\cancel{C}} \Leftrightarrow \boxed{q = \pm\dfrac{Q}{2} = \pm 2 \cdot 10^{-5} C}$

ΘΕΜΑ Δ

Δ1. a_{cm}=σταθερό

$$x_{cm} = \frac{1}{2} a_{cm} \cdot t^2 \Rightarrow a_{cm} = \frac{2x_{cm}}{t^2} = \frac{4}{1} = 4 m/s^2$$

$$\Sigma F_x = m \cdot a_{cm} \Rightarrow w_x - T_s = m \cdot a_{cm} \Rightarrow$$

$$\Rightarrow T_s = m \cdot g \cdot \eta\mu\phi - m \cdot a_{cn} = 2 \cdot 10 \cdot \frac{1}{2} - 2 \cdot 4 = 2N$$

$$\left.\begin{matrix} \Sigma\tau = I \cdot a_{\gamma\omega\nu} \\ a_{\gamma\omega\nu} = \dfrac{a_{cm}}{r} = \dfrac{4}{1} = 4 rad/s^2 \end{matrix}\right\} I = \frac{\Sigma\tau}{a_{\gamma\omega\nu}} = \frac{T_s \cdot r}{a_{\gamma\omega\nu}} = \frac{2 \cdot 1}{4} \Rightarrow \boxed{I = 0{,}5 kg \cdot m^2}$$

Δ2. $\left.\begin{matrix} \Sigma F_x = M \cdot a_{cm} \Rightarrow M \cdot g \cdot \eta\mu\phi - T_s = M \cdot a_{cm} \\ \Sigma\tau = I \cdot a_{\gamma\omega\nu} \Rightarrow T_s \cdot \cancel{R} = \lambda \cdot M \cdot R^{\cancel{2}} \cdot a_{\gamma\omega\nu} \end{matrix}\right\} \Rightarrow$

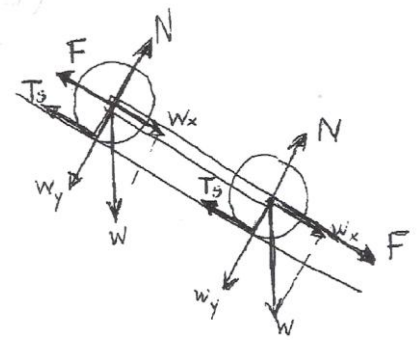
$$\Rightarrow M \cdot g \cdot \eta\mu\phi = (\lambda + 1) \cdot M \cdot a_{cm} \Rightarrow a_{cm} = \frac{g\eta\mu\phi}{\lambda + 1}$$

$$\left.\begin{matrix} \lambda_1 = \dfrac{1}{2} \\ \lambda_2 = 1 \end{matrix}\right\} \quad \left.\begin{matrix} a_{cm(1)} = \dfrac{2g \cdot \eta\mu\phi}{3} \\ a_{cm(2)} = \dfrac{g \cdot \eta\mu\phi}{2} \end{matrix}\right\} \Rightarrow a_{cm(1)} > a_{cm(2)}$$

Δ3.

$$\left.\begin{aligned} K_1 &= \frac{1}{2}M\upsilon^2 + \frac{1}{2}\cdot\frac{1}{2}MR^2\omega^2 = \frac{3}{4}M\upsilon^2 \\ K_2 &= \frac{1}{2}M\upsilon^2 + \frac{1}{2}MR^2\omega^2 = 1\cdot M\upsilon^2 \end{aligned}\right\} \Rightarrow \frac{K_1}{K_2} = \frac{3}{4}$$

Δ4.



Δίσκος

$$F + w_x - T_s = M\cdot a_{cm}$$

$$T_s\cdot \cancel{R} = \frac{1}{2}MR^{\cancel{2}}\cdot a_{\gamma\omega\nu}$$

$$\oplus$$

$$F + w_x = \frac{3}{2}M\cdot a_{cm} \Rightarrow \boxed{\frac{2}{3}(F + w_x) = M\cdot a_{cm}} \quad (1)$$

Δακτύλιος

$$w_x - F - T_s = M\cdot a_{cm}$$

$$T_s\cdot \cancel{R} = \frac{1}{2}MR^{\cancel{2}}\cdot a_{\gamma\omega\nu}$$

$$\oplus$$

$$\boxed{w_x - F = 2\cdot M\cdot a_{cm}} \quad (2)$$

Από (1) και (2) προκύπτει: $\frac{2}{3}(F + w_x) = \frac{1}{2}(w_x - F)$

$$\frac{2}{3}F + \frac{1}{2}F = \frac{1}{2}w_x - \frac{2}{3}w_x \Leftrightarrow \frac{7}{\cancel{6}}F = \frac{-1}{\cancel{6}}w_x$$

$$F = \frac{-w_x}{7} = \frac{-M\cdot g\cdot \eta\mu\phi}{7} = -1N$$

Η φορά των δυνάμεων $\vec{F}$ είναι αντίθετη από αυτή που φαίνεται στο σχήμα