Γ΄ ΛΥΚΕΙΟΥ

ΦΥΣΙΚΗ ΚΑΤΕΥΘΥΝΣΗΣ

ΑΠΑΝΤΗΣΕΙΣ

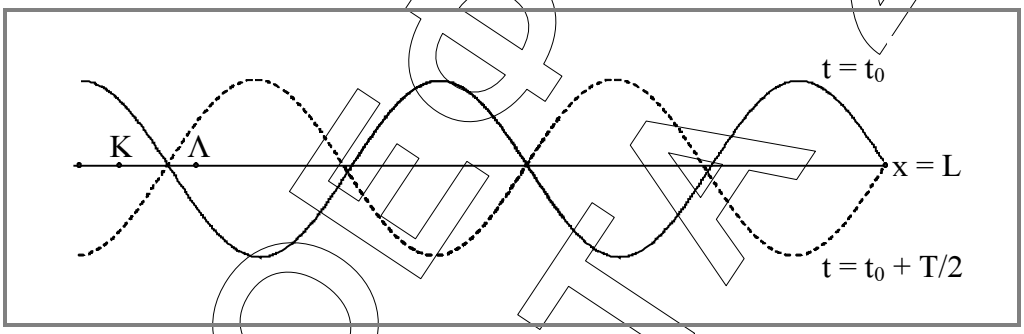
επαναληπτικά θέματα 2006

ΘΕΜΑ 1ο

1. γ
2. γ
3. γ
4. β
5. α. Λ β. Σ γ. Σ δ. Λ ε. Σ

ΘΕΜΑ 2ο

Α. α.



β. $x_K = \frac{\lambda}{4} - \frac{\lambda}{8} = \frac{\lambda}{8}$

$x_\Lambda = \frac{\lambda}{4} + \frac{\lambda}{12} = \frac{\lambda}{3}$

$A_K = 2A\left|\text{συν}\frac{2\pi x_K}{\lambda}\right| = 2A\left|\text{συν}\frac{\pi}{4}\right| = A\sqrt{2}$, $\alpha_{K,max} = \omega^2 A_K$

$A_\Lambda = 2A\left|\text{συν}\frac{2\pi x_\Lambda}{\lambda}\right| = 2A\left|\text{συν}\frac{2\pi}{3}\right| = A$, $\alpha_{\Lambda,max} = \omega^2 A_\Lambda$

$\frac{\alpha_{K,max}}{\alpha_{\Lambda,max}} = \frac{A_K}{A_\Lambda} = \frac{A\sqrt{2}}{A} = \sqrt{2}$

Σωστή απάντηση η Α

Β. $E=U_E + U_B= 2\ U_B+ U_B=3\ U_B$ ή

$$\frac{1}{2} L\ I^2 = 3\frac{1}{2} L\ i^2$$

$$I^2 = 3i^2$$

$$i^2 = \frac{I^2}{3}$$

$$i = \pm \frac{I}{\sqrt{3}}$$

$$I = \pm \frac{I\sqrt{3}}{3}$$

Σωστή απάντηση η γ.

Γ. α. $\frac{A_0}{4} = A_0 \cdot e^{-\Lambda \cdot 10T}$ ή $e^{-\Lambda \cdot 10T} = \frac{1}{4}$ ή

$$-10\Lambda T = \ln \frac{1}{4}$$

$$10\Lambda T = \ln 4$$

$$10\Lambda T = 2 \ln 2 \quad \text{ή} \quad \Lambda T = \frac{\ln 2}{5} \quad (1)$$

$$A = A_0 .e^{-\Lambda 20T} \overset{(1)}{=} A_0 .e^{-20\frac{\ln 2}{5}} = A_0 .e^{-4\ln 2} = A_0 (e^{-\ln 2})^4 = A_0 (\frac{1}{2})^4 = \frac{A_0}{16}$$

Σωστή απάντηση η 2.

β. $E_0 = \frac{1}{2}\ DA_0{}^2$

$$E = \frac{1}{2}\ DA^2 = \frac{1}{2}\ D\ (\frac{A_0}{4})^2 = \frac{1}{16} \cdot \frac{1}{2}\ DA_0{}^2 = \frac{E_0}{16}$$

$$\Delta E = E - E_0 = \frac{E_0}{16} - E_0 = -\frac{15}{16}\ E_0$$

Επομένως $W_F = -\frac{15}{16}\ E_0$

Σωστή απάντηση η 3.

ΘΕΜΑ 3ο

Α. $\upsilon_1' = \dfrac{m-M}{m+M}\,\upsilon = \dfrac{1-3}{1+3}\,2\sqrt{3} = \dfrac{-2}{4}\,2\sqrt{3} = -\sqrt{3}$ m/s

$\upsilon_2' = \dfrac{2mu}{m+M} = \dfrac{2\cdot 1\cdot 2\sqrt{3}}{4} = \sqrt{3}$ m/s (με φορά προς τα αριστερά)

Β. $\omega = 2\pi f = 2\pi\dfrac{5}{\pi} = 10\,r/s$ (1)

$\dfrac{1}{2}M\omega^2A_1^2 + \dfrac{1}{2}Mu_2'^2 = \dfrac{1}{2}M\omega^2A_2^2$

$\omega^2A_1^2 + u_2'^2 = \omega^2A_2^2$

$100\cdot 0{,}1^2 + (\sqrt{3})^2 = 100A_2^2$

$1+3 = 100A_2^2$

$A_2^2 = \dfrac{4}{100}$

$A_2 = 0{,}2$ m (2)

$x = A_2\eta\mu(\omega t + \varphi_0)$ Για $t_0=0$, $x=A_1$. Άρα:

$0{,}1 = 0{,}2\eta\mu\phi_0$ ή $\eta\mu\phi_0 = \dfrac{1}{2}$

άρα $\phi_0 = \dfrac{\pi}{6}$ ή $\phi_0 = \dfrac{5\pi}{6}$

Για t=0 η u_2' έχει φορά προς τα αριστερά, δηλαδή $u_2'<0$. Άρα $\phi_0 = \dfrac{5\pi}{6}$

$x = 0{,}2\eta\mu(10t + \dfrac{5\pi}{6})$

Γ. Θεωρούμε ότι ο δέκτης βρίσκεται πολύ κοντά στο σώμα Σ.

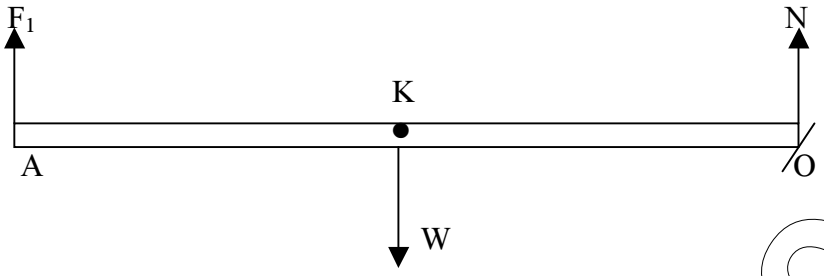
$u_{max} = \omega A_2 = 10\cdot 0{,}2 = 2m/s$

α. $f_{Amax} = \dfrac{u_{\eta\chi}}{u_{\eta\chi} - u_{max}} f_s = \dfrac{340}{340-2}676 = \dfrac{340}{338}676 = 680Hz$

β. $\Sigma F = DA_2 = M\omega^2A_2 = 3\cdot 100\cdot 0{,}2 = 60N$

ΘΕΜΑ 4ο

A.



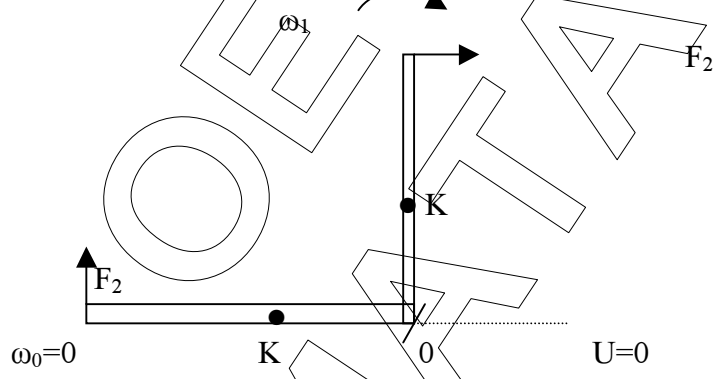
$\Sigma T_{(A)} = 0$ ή $T_{F_1(A)} + T_{W(A)} + T_{N(A)} = 0$

$$0 - mg\frac{\ell}{2} + N \cdot \ell = 0$$

$$N = \frac{mg}{2} = 15N$$

$\Sigma F = 0$ ή $F_1 = W \quad N = mg \quad N = 30 \quad 15 = 15N$

B.



ΘΜΚΕ: $\frac{1}{2} I_0 \omega_1^2 - 0 = W_{F_2} + W_W$ (1)

$$I_0 = I_K + m(\frac{\ell}{2})^2 = \frac{1}{12} m\ell^2 + \frac{m\ell^2}{4} = \frac{1}{3} m\ell^2 \quad (2)$$

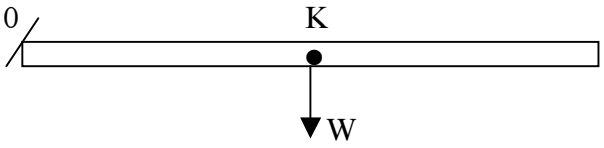
Από (1) και (2): $\frac{1}{2} \cdot \frac{1}{3} m\ell^2 \omega_1^2 = F_2 \cdot \ell \cdot \frac{\pi}{2} - mg\frac{\ell}{2}$ ή

$$\frac{1}{6} \cdot m\ell^2 \omega_1^2 + mg\frac{\ell}{2} = F_2 \ell \frac{\pi}{2} \quad \text{ή}$$

$$\frac{1}{6} \cdot 3 \cdot 1^2 \cdot 30 + 3 \cdot 10\frac{1}{2} = F_2 \cdot \frac{\pi}{2} \quad \text{ή}$$

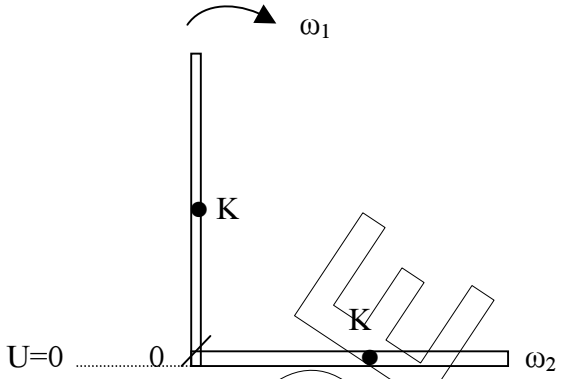
$$F_2 = \frac{60}{\pi} N$$

Γ. (i)



$$\left(\frac{dL}{dt}\right)_0 = \Sigma T_{(0)} = T_{W(0)} = mg\frac{\ell}{2} = 15 \text{ Nm}$$

(ii)



$$K_{αρ} + U_{αρ} = K_{τελ} + U_{τελ} \text{ ή}$$

$$\frac{1}{2}I_0\omega_1^2 + mg\frac{\ell}{2} = \frac{1}{2}I_o\omega_2^2 \text{ ή}$$

$$\frac{1}{2}\cdot\frac{1}{3}m\ell^2\omega_1^2 + mg\frac{\ell}{2} = \frac{1}{2}\cdot\frac{1}{3}m\ell^2\omega_2^2$$

$$\frac{1}{3}m\ell^2\omega_1^2 + mg\ell = \frac{1}{3}\cdot m\ell^2\cdot\omega_2^2$$

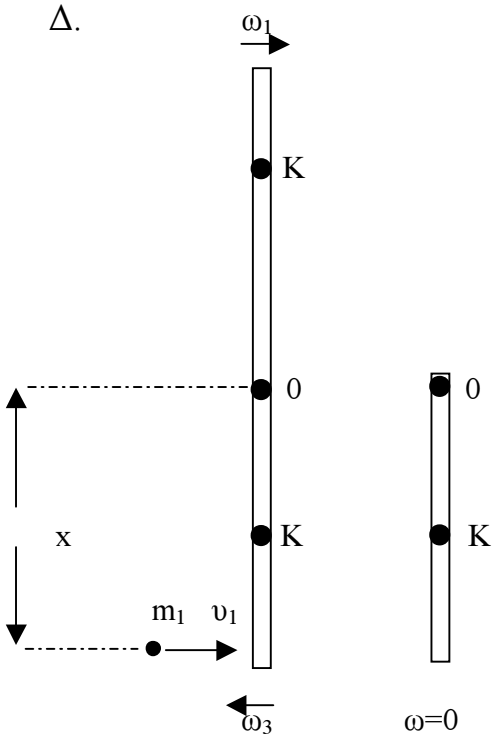
$$\omega_2 = \sqrt{\omega_1^2 + \frac{3g}{l}}$$

ή $\omega_2 = \sqrt{60}$ rad/s

$$\frac{dK}{dt} = \Sigma T_{(0)} \quad \omega_2 = T_{W(0)} \quad \omega_2 = W \quad \frac{\ell}{2}\omega_2 =$$

$$mg\frac{\ell}{2}\omega_2 = 3 \quad 10 \quad \frac{1}{2} \quad \sqrt{60} = 15\sqrt{60} \text{ J/s}$$

Δ.



ΑΔΜΕ $mg\frac{\ell}{2}+\frac{1}{2}I_o\omega_1^2=-mg\frac{\ell}{2}+\frac{1}{2}I_o\omega_3^2$

$$mg\ell+\frac{1}{2}\cdot\frac{1}{3}m\ell^2\omega_1^2=\frac{1}{2}\cdot\frac{1}{3}m\ell^2\omega_3^2$$

$$mg\ell+\frac{1}{6}m\ell^2\omega_1^2=\frac{1}{6}m\ell^2\omega_3^2$$

$$6g+\ell\cdot\omega_1^2=\ell\cdot\omega_3^2$$

$$6\cdot10+30=\omega_3^2 \quad \text{ή} \quad \omega_3=\sqrt{90}\ \text{rad/s}$$

$$m_1\cdot\upsilon_1 x-I_o\omega_3=0 \quad \text{ή} \quad x=\frac{I_o\omega_3}{m_1\upsilon_1}$$

$$x=\frac{m\ell^2\omega_3}{3m_1\upsilon_1}=\frac{3\cdot1\cdot\sqrt{90}}{3\cdot0,1\cdot100}=\frac{\sqrt{90}}{10}m$$