



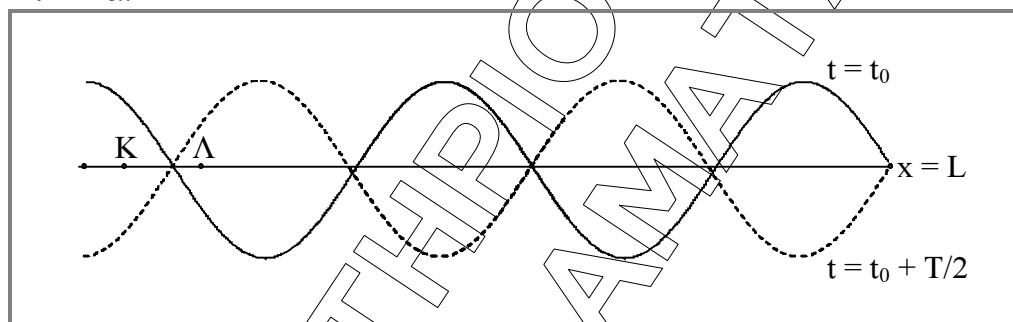
Γ' ΛΥΚΕΙΟΥ
ΦΥΣΙΚΗ
ΚΑΤΕΥΘΥΝΣΗΣ
ΑΠΑΝΤΗΣΕΙΣ

ΘΕΜΑ 1°

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

ΘΕΜΑ 2°

A. α.



$$\beta. x_K = \frac{\lambda}{4} = \frac{\lambda}{8} = \frac{\lambda}{8}$$

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

$$A_K = 2A \left| \sin \frac{2\pi x_K}{\lambda} \right| = 2A \left| \sin \frac{\pi}{4} \right| = A\sqrt{2}, \quad a_{K,\max} = \omega^2 A_K$$

$$A_\Lambda = 2A \left| \sin \frac{2\pi x_\Lambda}{\lambda} \right| = 2A \left| \sin \frac{2\pi}{3} \right| = A, \quad a_{\Lambda,\max} = \omega^2 A_\Lambda$$

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

Σωστή απάντηση η A

B. $E = U_E + U_B = 2 U_B + U_B = 3 U_B$ 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

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

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

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

$$A = A_0 \cdot e^{-\Lambda \cdot 20T} \stackrel{(1)}{=} A_0 \cdot e^{-20 \cdot \frac{\ln 2}{5}} = A_0 \cdot e^{-4 \ln 2} = A_0 (e^{-\ln 2})^4 = A_0 \left(\frac{1}{2}\right)^4 = \frac{A_0}{16}$$

Σωστή απάντηση η 2.

β. $E_0 = \frac{1}{2} D A_0^2$

$$E = \frac{1}{2} D A^2 = \frac{1}{2} D \left(\frac{A_0}{4}\right)^2 = \frac{1}{16} \cdot \frac{1}{2} D A_0^2 = \frac{E_0}{16}$$

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

Επομένως $W_F = -\frac{15}{16} E_0$

Σωστή απάντηση η 3.

ΘΕΜΑ 3^ο

A. $v_1' = \frac{m-M}{m+M} v = \frac{1-3}{1+3} 2\sqrt{3} = \frac{-2}{4} 2\sqrt{3} = -\sqrt{3} \text{ m/s}$

$$v_2' = \frac{2mu}{m+M} = \frac{2 \cdot 1 \cdot 2\sqrt{3}}{4} = \sqrt{3} \text{ m/s (με φορά προς τα αριστερά)}$$

B. $\omega = 2\pi f = 2\pi \frac{5}{\pi} = 10 \text{ rad/s (1)}$

$$\frac{1}{2} M \omega^2 A_1^2 + \frac{1}{2} M u_2'^2 = \frac{1}{2} M \omega^2 A_2^2$$

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

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

$$1 + 3 = 100 A_2^2$$

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

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

$x = A_2 \eta \mu(\omega t + \phi_0)$. Για $t_0=0$, $x=A_1$. Άρα:

$$0,1 = 0,2 \eta \mu \phi_0 \quad \text{ή} \quad \eta \mu \phi_0 = \frac{1}{2}$$

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

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

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

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

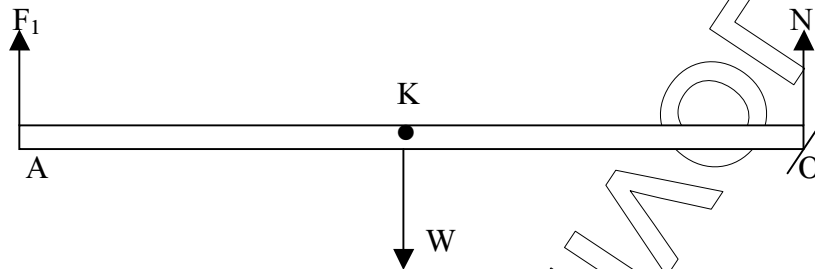
$$u_{\max} = \omega A_2 = 10 \cdot 0,2 = 2 \text{ m/s}$$

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

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

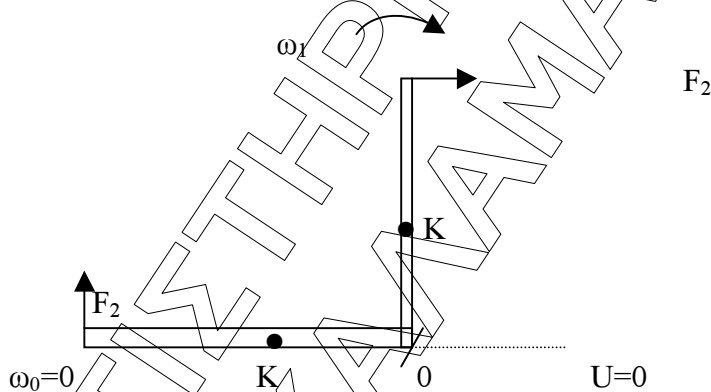
ΘΕΜΑ 4°

A.



$$\begin{aligned} \Sigma T_{(A)} = 0 \quad \text{ή} \quad T_{F_1(A)} + T_{W(A)} + T_{N(A)} &= 0 \\ 0 - mg \frac{\ell}{2} + N \ell &= 0 \\ N = \frac{mg}{2} = 15\text{N} \\ \Sigma F = 0 \quad \text{ή} \quad F_1 = W \quad N = mg \quad N = 30 \quad 15 = 15\text{N} \end{aligned}$$

B.



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

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

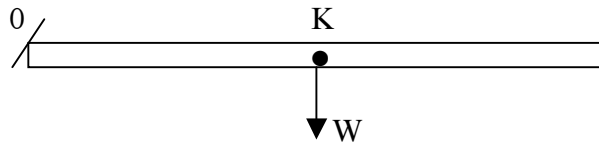
$$\text{Από (1) και (2): } \frac{1}{2} \cdot \frac{1}{3} m\ell^2 \omega_1^2 = F_2 \cdot \ell \cdot \frac{\pi}{2} - mg \frac{\ell}{2} \quad \text{ή}$$

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

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

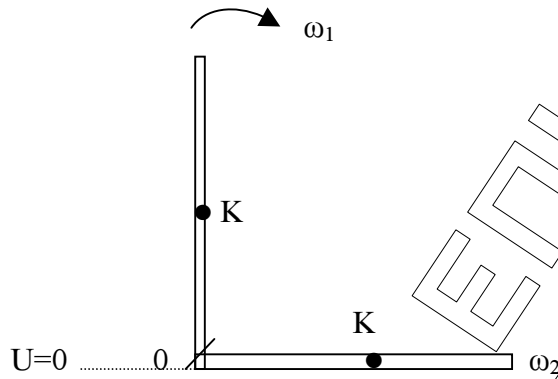
$$F_2 = \frac{60}{\pi} \text{N}$$

Γ. (i)



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

(ii)



$$K_{ap} + U_{ap} = K_{\tau\epsilon\lambda} + U_{\tau\epsilon\lambda} \quad \eta$$

$$\frac{1}{2} I_0 \omega_1^2 + mg \frac{\ell}{2} = \frac{1}{2} I_0 \omega_2^2 \quad \eta$$

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

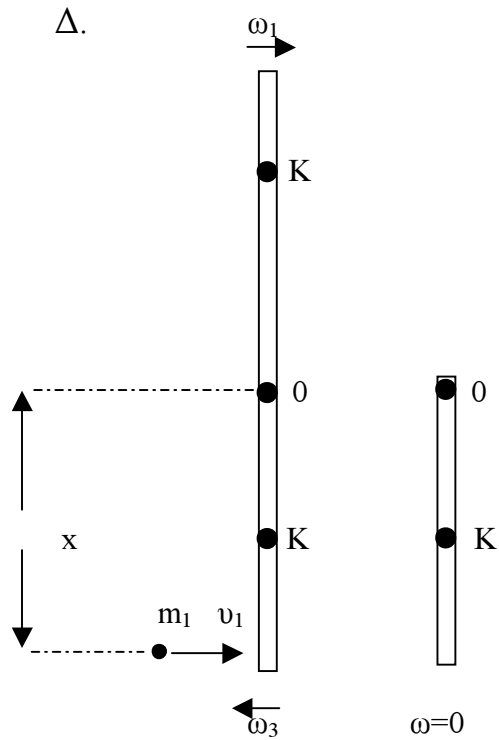
$$\frac{1}{3} m \ell^2 \omega_1^2 + mg \ell = \frac{1}{3} m \ell^2 \omega_2^2$$

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

$$\eta \quad \omega_2 = \sqrt{60} \text{ rad/s}$$

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

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



ΑΔΜΕ

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

$$mgl + \frac{1}{2} \cdot \frac{1}{3} ml^2 \omega_1^2 = \frac{1}{2} \cdot \frac{1}{3} ml^2 \omega_3^2$$

$$mgl + \frac{1}{6} ml^2 \omega_1^2 = \frac{1}{6} ml^2 \omega_3^2$$

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

$$6 \cdot 10 + 30 = \omega_3^2 \quad \eta \quad \omega_3 = \sqrt{90} \text{ rad/s}$$

$$m_1 \cdot v_1 x - I_o \omega_3 = 0 \quad \eta \quad x = \frac{I_o \omega_3}{m_1 v_1}$$

$$x = \frac{ml^2 \omega_3}{3m_1 v_1} = \frac{3 \cdot 1 \cdot \sqrt{90}}{3 \cdot 0,1 \cdot 100} = \frac{\sqrt{90}}{10} \text{ m}$$