



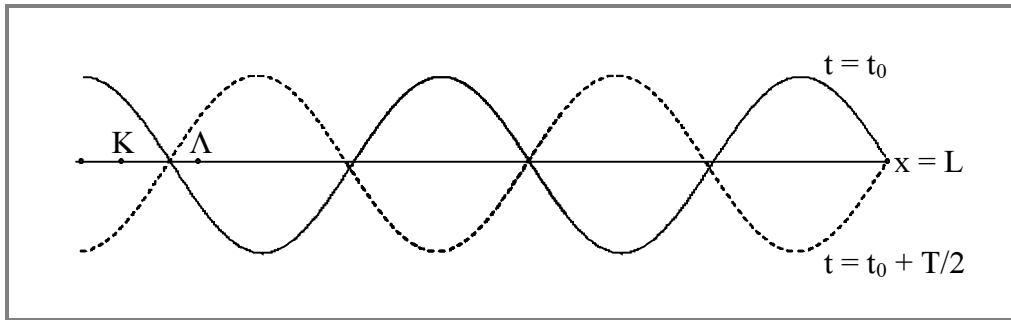
Γ' ΛΥΚΕΙΟΥ  
ΦΥΣΙΚΗ  
ΚΑΤΕΥΘΥΝΣΗΣ  
ΑΠΑΝΤΗΣΕΙΣ

**ΘΕΜΑ 1°**

1.  $\gamma$
2.  $\gamma$
3.  $\gamma$
4.  $\beta$
5. α.  $\Lambda$    β.  $\Sigma$    γ.  $\Sigma$    δ.  $\Lambda$    ε.  $\Sigma$

**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

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

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

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

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

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<sup>ο</sup>**

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

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

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

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

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

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

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

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

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

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

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

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

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.

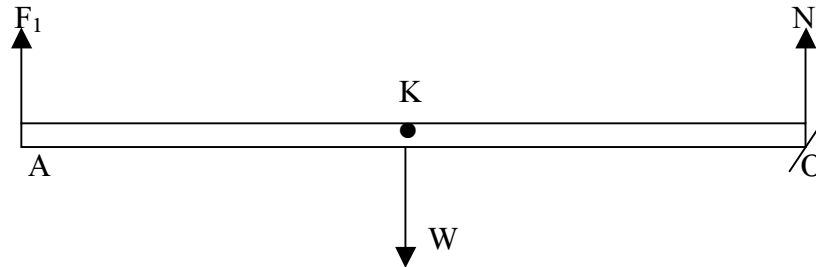
$$u_{\max} = \omega A_2 = 10 \cdot 0,2 = 2 \text{ m/s}$$

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

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

**ΘΕΜΑ 4°**

Α.



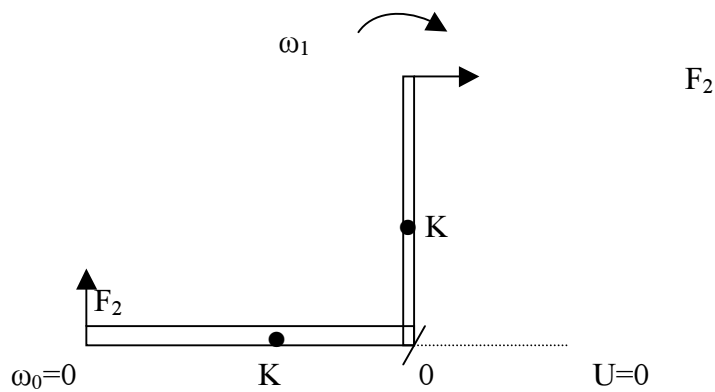
$$\Sigma T_{(A)} = 0 \quad \text{ή} \quad T_{F_1(A)} + T_{W(A)} + T_{N(A)} = 0$$

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

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

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

Β.



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

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

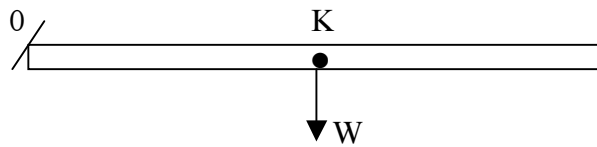
$$\text{Από (1) και (2): } \frac{1}{2} \cdot \frac{1}{3} m\ell^2 \omega_1^2 = F_2 \cdot \ell \cdot \frac{\pi}{2} - mg \frac{\ell}{2} \quad \text{ή}$$

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

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

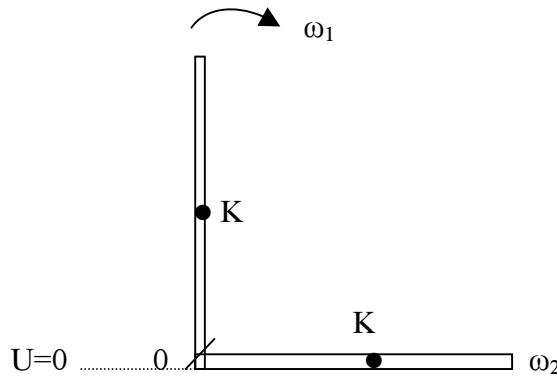
$$F_2 = \frac{60}{\pi} \text{N}$$

Γ. (i)



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

(ii)



$$K_{\text{αρ}} + U_{\text{αρ}} = K_{\text{τελ}} + U_{\text{τελ}} \quad \dot{\eta}$$

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

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

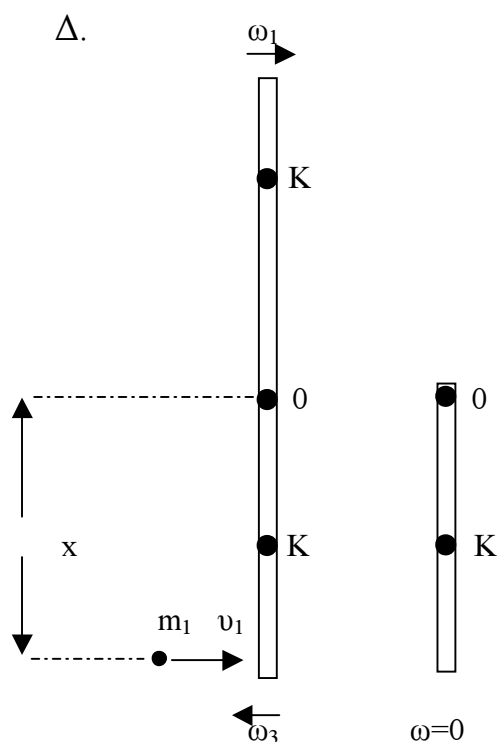
$$\frac{1}{3} m \ell^2 \omega_1^2 + mg \ell = \frac{1}{3} \cdot m \ell^2 \cdot \omega_2^2$$

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

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

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

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



ΑΔΜΕ

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

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

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

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

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

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

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