Λύσεις κριτηρίου 11

ΘΕΜΑ Α

Α1. (β) **Α2**. (δ) **Α3**. (β) **Α4**. (γ) **Α5**. α. Λ β. Σ γ. Σ δ. Λ ε. Λ

ΘΕΜΑ Β

Β1. (i)

$$\text{ΑΔΕΤ}: \ E = K + U \Rightarrow \frac{1}{2}m\upsilon^2 = \frac{1}{2}DA^2 - \frac{1}{2}Dx^2 \Rightarrow$$

$$\frac{1}{2}m\upsilon^2 = \frac{1}{2}m\omega^2A^2 - \frac{1}{2}m\omega^2x^2 \Rightarrow |\upsilon| = \omega A\frac{\sqrt{2}}{2}$$

$$\left|\frac{dK}{dt}\right| = \left|\frac{W_{F_{\epsilon\pi}}}{\Delta t}\right| = |F_{\epsilon\pi}\upsilon| = kx|\upsilon| \Rightarrow \left|\frac{dK}{dt}\right| = kA\frac{\sqrt{2}}{2}\omega A\frac{\sqrt{2}}{2} = \frac{1}{2}kA^2\frac{2\pi}{T} \Rightarrow \left|\frac{dK}{dt}\right| = \frac{2\pi E}{T}$$

Β2. (ii)

$$t_1 = t_2 \Rightarrow \frac{T_1}{4} = \frac{T_2}{4} \Rightarrow 2\pi\sqrt{\frac{m_1}{k_1}} = 2\pi\sqrt{\frac{m_2}{k_2}} \Rightarrow m_1 = 3m_2$$

(1)

$$\upsilon_{2,max} = \omega_2A_2 = \omega_1 3A_1 = 3\upsilon_{1,max} \Rightarrow \upsilon_2 = -3\upsilon_1$$

$$\upsilon_2' = \frac{2m_1}{m_1+m_2}\upsilon_1 + \frac{m_2-m_1}{m_1+m_2}\upsilon_2 = 3\upsilon_1$$

,

$$\upsilon_1' = \frac{m_1-m_2}{m_1+m_2}\upsilon_1 + \frac{2m_2}{m_1+m_2}\upsilon_2 = -\upsilon_1$$

Παίρνοντας υπόψη την (1) προκύπτει $\upsilon_2' = -\upsilon_2$

Άρα, μετά από κάθε κρούση τα σώματα επιστέφουν με αντίθετες ταχύτητες. Το χρονικό διάστημα μεταξύ δύο διαδοχικών κρούσεων αντιστοιχεί σε μισή περίοδο.

$$S_{ολ} = S_1 + S_2 = 5A_1 + 5A_2 = 20A_1$$

Β3. (iii)

$$Q_1 = E_0 - E_1 \Rightarrow \frac{8E_0}{9} = E_0 - E_1 \Rightarrow E_1 = \frac{E_0}{9} \Rightarrow \frac{1}{2}DA_1^2 = \frac{1}{9}\frac{1}{2}DA_0^2 \Rightarrow A_1 = \frac{1}{3}A_0$$

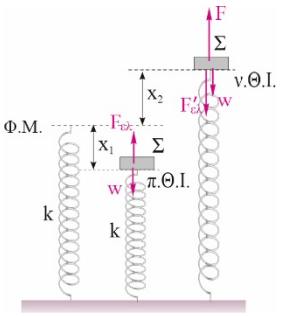
$$A_1 = A_0 e^{-\Lambda t_1} \Rightarrow e^{-\Lambda t_1} = \frac{1}{3}$$

$$A_2 = A_0 e^{-\Lambda t_2} = A_0 e^{-\Lambda 2t_1} = A_0\left(e^{-\Lambda t_1}\right)^2 = A_0\left(\frac{1}{3}\right)^2 \Rightarrow A_2 = \frac{A_0}{9}$$

ΘΕΜΑ Γ

Γ1.

$$\Pi.\Theta.\text{Ι.}\ \Sigma F = 0 \Rightarrow F_{\varepsilon\lambda} = w \Rightarrow x_1 = \frac{mg}{k} = 0,2\text{m}$$



$$\text{Ν.Θ.Ι.}\ \Sigma F = 0 \Rightarrow F = F_{\varepsilon\lambda} + \quad \Rightarrow \quad _2 = \frac{F - mg}{k} =$$

$$\Theta\text{ΜΚΕ}: K_{\tau\varepsilon\lambda} - K_{\alpha\rho\chi} = W_F + W_w + W_{F_{\varepsilon\lambda}} \Rightarrow$$
$$\frac{1}{2}m\upsilon_{1,\max}^2 = F\left(x_1 + x_2\right) - mg\left(x_1 + x_2\right) + \frac{1}{2}kx_1^2 - \frac{1}{2}kx_2^2$$
$$\Rightarrow \upsilon_{1,\max} = \sqrt{8}\text{m/s}$$

Γ2.

$$W_F = E \Rightarrow F\left(x_1 + x_2\right) = \frac{1}{2}kA^2 \Rightarrow A = 0,4\sqrt{2}\text{m}$$

Γ3.

$$\upsilon_{2,\max} = \omega A = \sqrt{\frac{k}{m}}A \Rightarrow \upsilon_{2,\max} = 4\text{m/s} \quad , \quad \frac{\upsilon_{1,\max}}{\upsilon_{2,\max}} = \frac{\sqrt{8}}{4} = \frac{\sqrt{2}}{2}$$

Γ4.

$$K = 3U \Rightarrow E - U = 3U \Rightarrow 4\frac{1}{2}Dx^2 = \frac{1}{2}DA^2 \Rightarrow x = \pm\frac{A}{2}$$

Γ5.

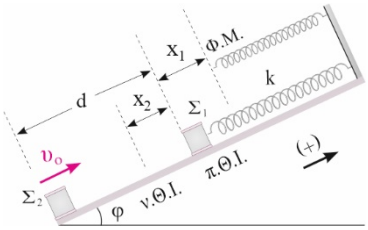
$$\left|\frac{dP}{dt}\right| = \left|F_{\varepsilon\pi}\right| = k\left|x\right| = k\frac{A}{2} \Rightarrow \left|\frac{dP}{dt}\right| = 20\sqrt{2}\text{N}$$

$$\alpha_{1,\max} = \frac{F + F_{\varepsilon\lambda} - w}{m} = \frac{F + kx_1 - mg}{m} = 20\text{m/s}^2$$

$$\alpha_{2,\max} = \omega^2 A = \frac{k}{m}A \Rightarrow \alpha_{2,\max} = 20\sqrt{2}\text{m/s}^2) \alpha_{1,\max}$$

ΘΕΜΑ Δ

Δ1. $\upsilon_{1,max} = \omega_1 A = \sqrt{\frac{k}{m_1}} A \Rightarrow \upsilon_{1,max} = 3m/s$



Α.Δ.Ο. $P_{αρχ}=P_{τελ}=0$ ή

$m_1\upsilon_{1,max} - m_2\upsilon_2 = 0 \Rightarrow \upsilon_2 = 1m/s$

$\Sigma F_x = m\alpha \Rightarrow -mg\eta\mu\varphi = m\alpha \Rightarrow \alpha = -5m/s^2$

$\upsilon_2 = \upsilon_0 + \alpha t \Rightarrow t = 0,2s$

Δ2. Παλιά θέση ισορροπίας: $\Sigma F_x = 0 \Rightarrow F_{ελ} = w_x = m_1 g\eta\mu\varphi \Rightarrow x_1 = \frac{m_1 g\eta\mu\varphi}{k} = 0,05m$

Νέα Θ. Ι.: $\Sigma F_x = 0 \Rightarrow F_{ελ} = \left(\quad_1 + \quad_2 \right) = \quad_{ολ,x} = \left(\quad_1 + \quad_2 \right) \eta\mu\varphi \Rightarrow \quad_2 = \frac{m_2 g\eta\mu\varphi}{k} =$

$\omega' = \sqrt{\frac{k}{m_1 + m_2}} = 5rad/s$

$A'=x_2=0,15m$,

$x = A\,\eta\mu(\omega \quad + \varphi_0) = A \Rightarrow \eta\mu\varphi_0 = \quad \Rightarrow \varphi_0 = \frac{\pi}{2}$

Για t=0 είναι x=A',

$x = A\,\eta\mu(\omega \quad + \varphi_0) = \quad \eta\mu\left(\quad + \frac{\pi}{2} \right)$

Δ3. $x = 0,15\eta\mu\left(5\frac{\pi}{3} + \frac{\pi}{2}\right) = 0,075m$, $\alpha = -\omega'^2 x = -1,875m/s^2$

Δ4. $d = \upsilon_0 t + \frac{1}{2}\alpha t^2 \Rightarrow d = 0,3m$

$U_{max} = (m_1 + m_2) g d\eta\mu\varphi \Rightarrow U_{max} = 6J$