Λύσεις κριτηρίου 12

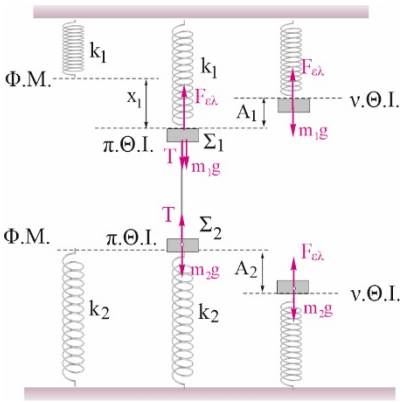
ΘΕΜΑ Α

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

ΘΕΜΑ Β

Β1. (i)

$$T_1 = T_2 \Rightarrow 2\pi\sqrt{\frac{m_1}{k_1}} = 2\pi\sqrt{\frac{m_2}{k_2}} \Rightarrow \frac{m_1}{k_1} = \frac{m_2}{k_2} \quad (1)$$



$$\Pi.\theta.\iota.: \Sigma F_2 = 0 \Rightarrow T = m_2 g \quad (2)$$

$$\Pi.\theta.\iota.: \Sigma F_1 = 0 \Rightarrow T + m_1 g = F_{\varepsilon\lambda} = k_1 x_1 \quad (3)$$

Από (2) και (3)

$$(m_1 + m_2)g = k_1 x_1 \quad (4)$$

$$N.\theta.\iota.: \Sigma F_2 = 0 \Rightarrow m_2 g = F_{\varepsilon\lambda} = k_2 x_2$$

$$\Rightarrow x_2 = A_2 = \frac{m_2 g}{k_2}$$

$$N.\theta.\iota.: \Sigma F_1 = 0 \Rightarrow$$

$$m_1 g = F_{\varepsilon\lambda} = k_1 (x_1 - A_1) = k_1 x_1 - k_1 A_1 \Rightarrow$$

$$m_1 g = (m_1 + m_2)g - k_1 A_1 \Rightarrow A_1 = \frac{m_2 g}{k_1}$$

$$A_1 = A_2 \Rightarrow \frac{m_2 g}{k_1} = \frac{m_2 g}{k_2} \Rightarrow k_1 = k_2 \xrightarrow{(1)} m_1 = m_2$$

Β2. (i)

$$W_{F_{\varepsilon\sigma}} = -\Delta U = U_B - U_\Gamma = \frac{1}{2}Dx_B^2 - \frac{1}{2}Dx_\Gamma^2 \quad (1)$$

$$\text{ΑΔΕΤ}: E = K_B + U_B \Rightarrow \frac{1}{2}DA^2 = K_B + \frac{1}{2}Dx_B^2 \Rightarrow K_B = \frac{1}{2}D(A^2 - x_B^2)$$

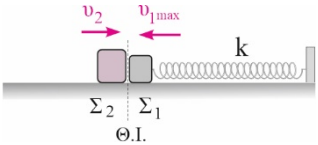
Ομοίως $K_\Gamma = \frac{1}{2}D(A^2 - x_\Gamma^2)$

$$\frac{K_B}{K_\Gamma}=\frac{\frac{1}{2}D\left(A^2-x_B{}^2\right)}{\frac{1}{2}D\left(A^2-x_\Gamma{}^2\right)}\Rightarrow\frac{A^2-3x_\Gamma{}^2}{A^2-x_\Gamma{}^2}=\frac{1}{3}\Rightarrow x_\Gamma=\pm\frac{A}{2}\quad\text{και}\quad x_B=\pm\frac{A\sqrt{3}}{2}$$

$$W_{F_{\epsilon\pi}}=\frac{1}{2}D\frac{3A^2}{4}-\frac{1}{2}D\frac{A^2}{4}\Rightarrow W_{F_{\epsilon\pi}}=\frac{E}{2}$$

Από (1)

Β3. (iii)



$$\alpha_{1,max}=\alpha_{2,max}\Rightarrow\omega_1{}^2A_1=\omega_2{}^2A_2\Rightarrow$$
$$\frac{k}{m_1}A_1=\frac{k}{m_1+m_2}A_2\Rightarrow A_2=4A_1$$

$$\text{ΑΔΟ}:P_{\alpha\rho\chi}=P_{\tau\epsilon\lambda}\Rightarrow m_2\upsilon_2-m_1\upsilon_{1,max}=\left(m_1+m_2\right)V_{max}\Rightarrow$$
$$3m\upsilon_2-m\omega_1A_1=4m\omega_2A_2\Rightarrow 3m\upsilon_2-m\sqrt{\frac{k}{m_1}}A_1=4m\sqrt{\frac{k}{m_1+m_2}}A_2\Rightarrow\upsilon_2=3A_1\sqrt{\frac{k}{m_1}}$$

ΘΕΜΑ Γ

Γ1.

$$\text{ΑΔΕΤ}:E=K+U\Rightarrow K=E-\frac{1}{2}Dx^2=1-25x^2\Rightarrow D=50N/m\ \text{και}\ E=1J$$

$$T=2\pi\sqrt{\frac{m}{D}}\Rightarrow T=\frac{\pi}{5}s$$

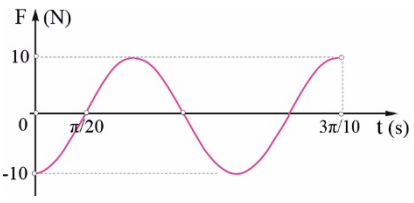
Γ2.

$$\omega=\frac{2\pi}{T}=10rad/s\ ,$$

$$E=\frac{1}{2}DA^2\Rightarrow A=0,2m$$

Για t=0 είναι χ=Α,

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



$$F = -Dx = -DA\eta\mu\left(\omega t + \frac{\pi}{2}\right) = -10\eta\mu\left(10t + \frac{\pi}{2}\right) \quad (S.I.)$$

,

$$\Delta t = \frac{3\pi}{10}s = 1,5T$$

Γ3.

$$\upsilon_1 = \omega A\sigma\upsilon\nu\left(\omega t_1 + \frac{\pi}{2}\right) = 2\sigma\upsilon\nu\left(10t_1 + \frac{\pi}{2}\right) = -1m/s$$

$$\upsilon_2 = \omega A\sigma\upsilon\nu\left(\omega t_2 + \frac{\pi}{2}\right) = 2\sigma\upsilon\nu\sigma\upsilon\nu\left(10t_2 + \frac{\pi}{2}\right) = 2m/s$$

$$\Delta p = p_2 - p_1 = m\upsilon_2 - m\upsilon_1 \Rightarrow \Delta p = 1,5kgm/s$$

Γ4. $x_1 = A = 0,2m$, $x_2 = A\eta\mu\left(\omega t_2 + \frac{\pi}{2}\right) = 0,2\eta\mu\left(10t_1 + \frac{\pi}{2}\right) = 0$

$$t_2 = \frac{7\pi}{20}s = \frac{7}{4}T \quad , \quad d = 7A = 1,4m$$

Γ5.

$$x_1 = A\eta\mu\left(\omega t_1 + \frac{\pi}{2}\right) = 0,2\eta\mu\left(10t_1 + \frac{\pi}{2}\right) = -0,1\sqrt{3}m$$

$$\frac{dK}{dt} = \frac{W_{F_{\varepsilon\pi}}}{\Delta t} = F_{\varepsilon\pi}\upsilon_1 = -Dx_1\upsilon_1 \Rightarrow \frac{dK}{dt} = -5\sqrt{3}J/s$$

ΘΕΜΑ Δ

Δ1.

$$\Pi.\theta.\iota.: \Sigma F = 0 \Rightarrow N + mg = F_{\varepsilon\lambda} = 10N$$

,

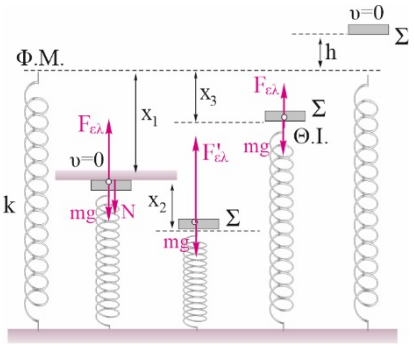
$$F_{\varepsilon\lambda} = kx_1 \Rightarrow x_1 = 0,1m$$

$F_{\varepsilon\lambda} = \quad_{\varepsilon\lambda} = \quad = (\quad_1 + \quad_2) \Rightarrow \quad_2 =$

$$N.\theta.\iota.: \Sigma F = 0 \Rightarrow mg = F_{\varepsilon\lambda} = kx_3 \Rightarrow$$

$$x_3 = \frac{mg}{k} = 0,05m$$

$$A = x_1 + x_2 - x_3 \Rightarrow A = 0,1m$$



$$\omega = \sqrt{\frac{k}{m}} \Rightarrow \omega = 10\sqrt{2}\,rad/s$$

Δ2.

Για t=0 είναι x=A, άρα

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

$$x = A\eta\mu\left(\omega t + \frac{\pi}{2}\right) = 0,1\eta\mu\left(10\sqrt{2}t + \frac{\pi}{2}\right) \Rightarrow x_1 - x_3 = 0,05 = 0,1\eta\mu\left(10\sqrt{2}t + \frac{\pi}{2}\right) \Rightarrow$$

$$\eta\mu\left(10\sqrt{2}t + \frac{\pi}{2}\right) = 0,5 = \eta\mu\frac{\pi}{6} \xrightarrow{\upsilon<0} 10\sqrt{2}t + \frac{\pi}{2} = \frac{5\pi}{6} \Rightarrow t = \frac{\pi\sqrt{2}}{60}s$$

Δ3.

$$A\Delta E\Gamma: \frac{1}{2}kA^2 = \frac{1}{2}m\upsilon^2 + \frac{1}{2}k\left(x_1 - x_3\right)^2 \Rightarrow \upsilon = \pm\sqrt{\frac{3}{2}}m/s \Rightarrow \upsilon = -\sqrt{\frac{3}{2}}m/s$$

$$\frac{dU_{\varepsilon\lambda}}{dt} = -\frac{W_{F_{\varepsilon\lambda}}}{\Delta t} = -F_{\varepsilon\lambda}\upsilon = -\left(-kx_1\right)\upsilon \Rightarrow \frac{dU_{\varepsilon\lambda}}{dt} = -10\sqrt{\frac{3}{2}}J/s$$

Δ4. Η επαφή του σώματος από το ελατήριο θα χαθεί όταν αυτό φτάσει στο φυσικό μήκος του.

$$A\Delta E\Gamma: \frac{1}{2}kA^2 = \frac{1}{2}m\upsilon_2{}^2 + \frac{1}{2}kx_3{}^2 \Rightarrow \upsilon_2 = \pm\sqrt{\frac{3}{2}}m/s$$

$$A\Delta M\Epsilon: K_{\alpha\rho\chi} = U_{\tau\varepsilon\lambda} \Rightarrow \frac{1}{2}m\upsilon_2{}^2 = mgh \Rightarrow h = 0,075m$$

$$H = x_1 + h = 0,175m$$