Λύσεις κριτηρίου 10

ΘΕΜΑ Α

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

ΘΕΜΑ Β

Β1. (ii)

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

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

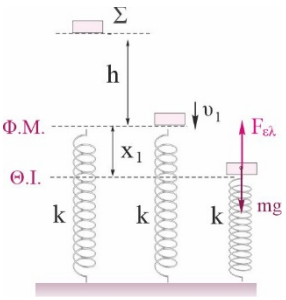
$$x_1 = A\eta\mu(\omega t_1 + \frac{\pi}{2}) = \frac{A}{2} \xrightarrow{\upsilon<0,\ \sigma\upsilon\nu\varphi<0} \frac{2\pi}{T}t_1 \quad \frac{\pi}{2} = \frac{5\pi}{6} \Rightarrow \quad _1 = t\frac{T}{6}$$

$$x_2 = A\eta\mu(\omega t_2 + \frac{\pi}{2}) = -\frac{A}{2} \xrightarrow{\upsilon<0,\ \sigma\upsilon\nu\varphi<0} \frac{2\pi}{T}t_2 \quad \frac{\pi}{2} = \frac{7\pi}{6} \Rightarrow \quad _2 = t\frac{T}{3}$$

$$\Delta t \quad = t_2 - t_1 = t\frac{T}{6}$$

Β2. (ii)

$$\theta.I.: \Sigma F = 0 \Rightarrow F_{\varepsilon\lambda} = mg \Rightarrow x_1 = \frac{mg}{k}$$



$$A\Delta ME: mgh = \frac{1}{2}m\upsilon_1^2 \Rightarrow \upsilon_1 = \sqrt{2gh}$$

$$A\Delta ET: \frac{1}{2}kA^2 = \frac{1}{2}m\upsilon_1^2 + \frac{1}{2}kx_1^2 \Rightarrow$$

$$kh^2 - 2mgh - \frac{m^2g^2}{k} = 0 \Rightarrow h = \frac{mg}{k}\left(1 + \sqrt{2}\right)$$

Β3. (i)

$$\upsilon = \upsilon_{max}\sigma\upsilon\nu\omega_0 t = \omega_0 A\sigma\upsilon\nu\frac{2\pi}{T}\frac{5T}{3} \Rightarrow \upsilon = -\frac{\omega_0 A}{2}$$

$$F_{\varepsilon\xi} = -F = \upsilon = -\frac{\omega_0 A}{2} \quad , \quad f_\Delta = f_0 = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

$$P_{F_{\varepsilon\xi}} = F_{\varepsilon\xi}\upsilon = b\upsilon^2 = b\left(-\frac{\omega_0 A}{2}\right)^2 = b\left(-\frac{2\pi f_0 A}{2}\right)^2 = \frac{bA^2}{4}\left(\sqrt{\frac{k}{m}}\right)^2 \Rightarrow P_{F_{\varepsilon\xi}} = \frac{bkA^2}{4m}$$

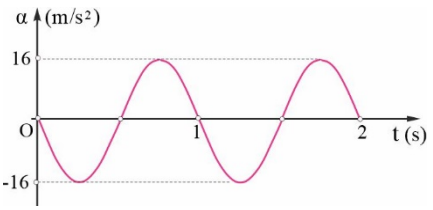
ΘΕΜΑ Γ

Γ1. $$E = \frac{1}{2}DA^2 \Rightarrow E = 6,4J \quad ,$$

$$D = m\omega^2 \Rightarrow D = k = 80N/m$$

Γ2. $$T = \frac{2\pi}{\omega} = 1s$$

$$\alpha = -\alpha_{max}\eta\mu\omega t = -\omega^2 A\eta\mu 2\pi t \Rightarrow \alpha = -16\eta\mu 2\pi t \quad \text{(S.I.)}$$



Γ3.

$$A\Delta ME:\ m_2 gh = \frac{1}{2}m_2\upsilon_2{}^2 \Rightarrow \upsilon_2 = \sqrt{2gh} = 4m/s$$

$$\upsilon_1 = \upsilon_{1,max}\sigma\upsilon\nu\omega t = 0,8\pi\sigma\upsilon\nu 2\pi\frac{8}{3} \Rightarrow \upsilon_1 = -0,4\pi m/s$$

$$A\Delta O(x):\ P_{\alpha\rho\chi,x} = P_{\tau\varepsilon\lambda,x} \Rightarrow m_1\upsilon_1 = (m_1 + m_2)V \Rightarrow V = -0,2\pi m/s$$

$$Q = \frac{1}{2}m_1\upsilon_1{}^2 + \frac{1}{2}m_2\upsilon_2{}^2 - \frac{1}{2}(m_1 + m_2)V^2 \Rightarrow Q = 16,8J$$

Γ4.

$$x_1 = A\eta\mu\omega t = 0,4\eta\mu\frac{16\pi}{3} \Rightarrow x_1 = -0,2\sqrt{3}m$$

$$\frac{dU}{dt} = -\frac{W_{F_{\varepsilon\pi}}}{\Delta t} = -F_{\varepsilon\pi}V = kx_1 V \Rightarrow \frac{dU}{dt} = 3,2\pi\sqrt{3}J/s$$

ΘΕΜΑ Δ

Δ1.

$$D_2 = m_2\omega^2 = m_2\frac{k}{m_1+m_2} \Rightarrow D_2 = 20N/m$$,

$$T_{\sigma,max} = \mu_\sigma N = \mu_\sigma m_2 g = 20N$$, $$F_{2,max} = D_2 A = 20N = T_{\sigma,max}$$

$F_2 \le T_{\sigma,max}$: το σώμα Σ_2 δε θα χάσει την επαφή του με το σώμα Σ_1.

$$\omega = \sqrt{\frac{k}{m_1+m_2}} \Rightarrow \omega = \sqrt{10}rad/s = \pi rad/s$$

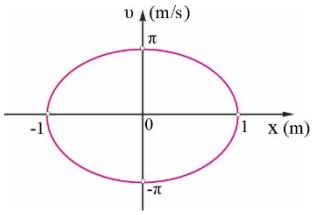
Δ2.

,

$$x_1 = A\eta\mu\omega t = 1\eta\mu\sqrt{10}\cdot 0,5 = \eta\mu\frac{\pi}{2} \Rightarrow x_1 = 1m$$

$$x_2 = A\eta\mu\omega t_2 = 1\eta\mu\sqrt{10}\cdot\frac{2}{3} = \eta\mu\frac{2\pi}{3} \Rightarrow x_2 = \frac{\sqrt{3}}{2}m$$

$$W_{F_{\epsilon\lambda}} = -\Delta U_{\epsilon\lambda} = \frac{1}{2}kx_1^2 - \frac{1}{2}kx_2^2 \Rightarrow W_{F_{\epsilon\lambda}} = 7,5J$$



Δ3.

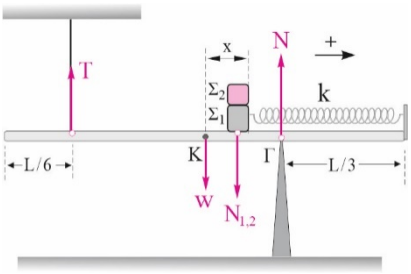
$$A\Delta E\Gamma: \frac{1}{2}kA^2 = \frac{1}{2}m\upsilon^2 + \frac{1}{2}kx^2 \Rightarrow \upsilon = \pm\omega\sqrt{A^2-x^2} = \pm\pi\sqrt{1-x^2}$$

Δ4.

$$\upsilon_2 = A\omega\sigma\upsilon\nu\omega t_2 = \pi\sigma\upsilon\nu\frac{2\pi}{3} \Rightarrow \upsilon_2 = -\frac{\pi}{2}m/s$$

$$\frac{dE}{dt} = \frac{dW_{F_{\epsilon\pi}}}{dt} = F_{\epsilon\pi}\upsilon_2 = -D_2x_2\upsilon_2 \Rightarrow \frac{dE}{dt} = 5\sqrt{30}J/s$$

Δ5. Η απόσταση ΚΓ είναι $(K\Gamma) = \frac{L}{2} - \frac{L}{3} = \frac{L}{6}$



Τα δύο σώματα ασκούν στη ράβδο κατακόρυφη

δύναμη $N_{1,2}$ που έχει μέτρο ίσο με το ολικό βάρος τους $(m_1+m_2)g$.

$$\Sigma\tau_{(r)} = 0 \Rightarrow T\left(L - \frac{L}{6} - \frac{L}{3}\right) =$$

$$Mg\frac{L}{6} + (m_1 + m_2)g\left(\frac{L}{6} - x\right) \Rightarrow$$

$$T = \frac{100}{3} - \frac{100}{3}x \quad (S.I.), \; -1m \le x \le 1m$$

Η ράβδος δεν ανατρέπεται γιατί το νήμα δε λυγίζει καθώς για την τάση του ισχύει διαρκώς $T \geq 0$.
Το διάγραμμα της τάσης του νήματος σε συνάρτηση με την απομάκρυνση δίνεται στο διπλανό σχήμα.