Λύσεις διαγωνίσματος 24/10/2020

ΘΕΜΑ Α A_1-β A_2-α A_3-β A_4-γ A_5 Σ Λ Σ Λ Σ

ΘΕΜΑ Β

B_1 – γ $mv = 2mv_k \Rightarrow v_k = \frac{v}{2}$

ΑΔΕΤ $A^2 = \frac{2m}{k} v_k^2 + y^2 \Rightarrow A^2 = \frac{2m}{k}\frac{v^2}{4} + \Delta\ell^2 = \frac{2m}{k}\frac{4g\Delta\ell}{4} + \Delta\ell^2$

$\Rightarrow A^2 = \frac{2mg}{k}\Delta\ell + \Delta\ell^2 = 2\cdot\Delta\ell\cdot\Delta\ell + \Delta\ell^2 = 3\Delta\ell^2 \Rightarrow \underline{A = \sqrt{3}\Delta\ell}$

B_2 – α $p_{\delta\iota\alpha x} + \rho_1 g h_1 = p_{\alpha\tau\mu} + \frac{1}{2}\rho_1 v^2 + \rho_1 g d$

$\Rightarrow p_{\alpha\tau\mu} + \rho_2 g h_2 + \rho_1 g h_1 = p_{\alpha\tau\mu} + \frac{1}{2}\rho_1 v^2 + \rho_1 g d$

$\Rightarrow \rho_2 g h_2 + \rho_1 g h_1 = \frac{1}{2}\rho_1 v^2 + \rho_1 g d$

$\Rightarrow \rho_2 g h_2 + \rho_1 g h_1 = \rho_1 g h_{max} \Rightarrow h_{max} = \frac{\rho_2}{\rho_1} h_2 + h_1 = 0{,}8 h_2 + 1{,}2 h_2$

$\Rightarrow \underline{h_{max} = 2h}$

B_3 **I-α II-β**

I) $\frac{T_2}{2} = 4\frac{T_1}{4} \Rightarrow T_2 = 2T_1 \Rightarrow 2\pi\sqrt{\frac{m_1+m_2}{k_1+k_2}} = 2\cdot 2\pi\sqrt{\frac{m_1}{k_1}} \Rightarrow \frac{m_1+m_2}{1{,}5k_1} = 4\frac{m_1}{k_1}$

$\Rightarrow m_1 + m_2 = 6m_1 \Rightarrow m_2 = 5m_1 \Rightarrow \underline{\frac{m_1}{m_2} = \frac{1}{5}}$

II) ΑΔΟ $w_1 v_{1max} = w_{0\lambda} v_{k_{max}} \Rightarrow w_1 w_1 A_1 = (m_1+m_2) w_2 A_2$

$\Rightarrow m_1\sqrt{\frac{k_1}{m_1}} A_1 = 6m_1\sqrt{\frac{k_1+k_2}{m_1+m_2}} A_2 \Rightarrow \sqrt{\frac{k_1}{m_1}} A_1 = 6\sqrt{\frac{1{,}5k_1}{6}} A_2 \Rightarrow \sqrt{\frac{k_1}{m_1}} A_1 = 6\sqrt{\frac{k_1}{4m_1}} A_2$

$\Rightarrow \underline{A_1 = 3A_2}$

ΘΕΜΑ Γ

Γ1 α) $\Sigma F = 0 \Rightarrow F + F_{\alpha\tau\mu} = F_{\upsilon\gamma\rho} \Rightarrow F + p_{\alpha\tau\mu} A_2 = [p_{\alpha\tau\mu} + \rho g H] A_2$

$\Rightarrow F = \rho g H A_2 \Rightarrow F = 10^3 \cdot 10 \cdot 3{,}2\cdot 10^{-3} \Rightarrow \boxed{F = 32N}$

β) $h_2 = H = 3{,}2\,m$ ονομαστική δοκός

Γ2 $v_2 = \sqrt{2gH} = \sqrt{64} = 8\,m/s \rightarrow x_{max} = v_2 t$, $t = \sqrt{\frac{2h}{g}} = 0{,}5s \rightarrow \boxed{x_{max} = 4m}$

Γ3 $p + \frac{1}{2}\rho v_1^2 = p_{\alpha\tau\mu} + \frac{1}{2}\rho v_2^2$ $A_1 v_1 = A_2 v_2 \Rightarrow v_2 = 2v_1 \rightarrow v_1 = v_2/2 = 4\,m/s$

$p_{\alpha\tau\mu} + \rho g h_2 + \frac{1}{2}\rho v_1^2 = p_{\alpha\tau\mu} + \frac{1}{2}\rho v_2^2 \Rightarrow h_2 = \frac{v_2^2 - v_1^2}{2g} \Rightarrow h_2 = \frac{64-16}{2\cdot 10} \Rightarrow \boxed{h_2 = 2{,}4m}$

Γ4 $x'_{max} = 5m \rightarrow v'_2 = \frac{x'_{max}}{t} = 10\,m/s \rightarrow v'_1 = 5\,m/s$

Bernulli $p_1 - p_2 = \frac{1}{2}\rho v_2'^2 - \frac{1}{2}\rho v_1'^2 = \frac{1}{2}\rho(v_2'^2 - v_1'^2) = \frac{1}{2}10^3(100-25) \Rightarrow p_1 - p_2 = \frac{75}{2}10^3\,N/m^2$

$\Delta V = \Pi' \Delta t = A_2 v'_2 \Delta t = 10^{-3}\cdot 10\cdot 120 = 1{,}2\,m^3 \rightarrow W = (p_1 - p_2)\Delta V = \frac{75}{2}10^3 \cdot 1{,}2 \Rightarrow \boxed{W = 4{,}5\cdot 10^3\,J}$

ΘΕΜΑ Δ

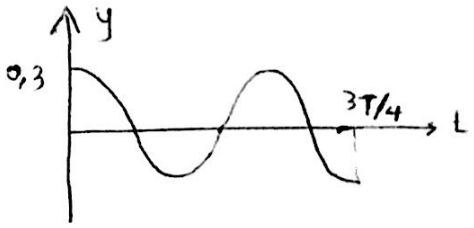
Δ1 $k\Delta\ell_1 = m_1 g \Rightarrow \Delta\ell_1 = \frac{m_1 g}{k} = 0{,}1\,m \qquad D = k$

Δ2 $A_1 = 0{,}3\,m \quad \omega_1 = \sqrt{\frac{k}{m_1}} = 10\,rad/s \quad \varphi_0 = \pi/2$

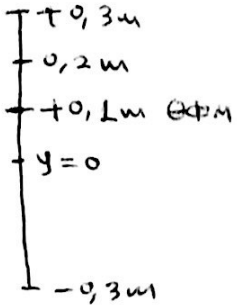
$$\boxed{y = 0{,}3\eta\mu(10t + \pi/2)\ SI}$$

Δ3 2η φορα $\quad t = \frac{3T}{4} = \frac{3}{4}2\pi\sqrt{\frac{m_1}{k}}$

$t = \frac{3}{4}2\pi\frac{1}{10} \Rightarrow \boxed{t = \frac{3\pi}{20}\,sec}$



Δ4 $F_{ελ} = 10\,N \longrightarrow k\,y_{ΘΦΜ} = 10 \Rightarrow y_{ΘΦΜ} = 0{,}1\,m$



Πανω απο ΘΦΜ $\longrightarrow y = \Delta\ell + y_{ΘΦΜ} = 0{,}1 + 0{,}1 \Rightarrow y = 0{,}2\,m$

Κατω απο ΘΦΜ $\longrightarrow y = 0$

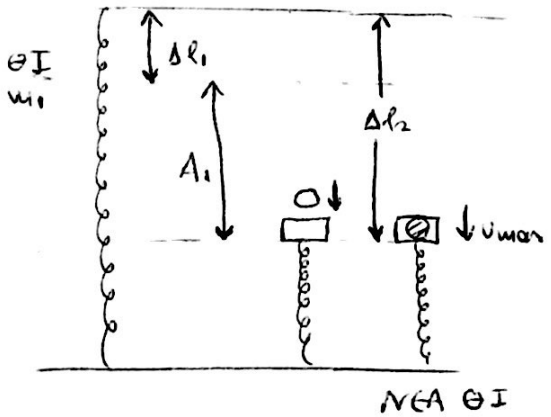
$y = 0{,}2\,m \longrightarrow |v| = \omega_1\sqrt{A_1^2 - y^2} = 10\sqrt{\frac{9}{100} - \frac{4}{100}} = \sqrt{5}\,m/s$

$y = 0 \longrightarrow v = v_{max} = \omega_1 A_1 = 3\,m/s$

$$\left|\frac{dK}{dt}\right| = |\Sigma F v| = k|y||v| = 100 \cdot 0{,}2 \cdot \sqrt{5} \Rightarrow \boxed{\left|\frac{dK}{dt}\right| = 20\sqrt{5}\ J/s}$$

$$\boxed{\frac{dK}{dt} = 0 \quad ΘΙ}$$

Δ5 ΝΕΑ ΘΙ $\Delta\ell_2 = \frac{(m_1+m_2)g}{k} \Rightarrow \Delta\ell_2 = 0{,}4\,m.$



$v_K = v_{max} \qquad \frac{v_{max}}{v_{ελmin}} = 9 \Rightarrow \frac{A^2}{(\Delta\ell_2 - A)} = 9$

$\frac{A}{\Delta\ell_2 - A} = \pm 3$ <

$A = 3\Delta\ell_2 - 3A \Rightarrow \boxed{A = \frac{3}{4}\Delta\ell_2}$

$A = -3\Delta\ell_2 + 3A \Rightarrow A = \frac{3}{2}\Delta\ell_2$ απο δε δεύτερη στη ΘΦΜ αφού $v_{ελmin} \neq$

$A = \frac{3}{4}\Delta\ell_2 = \frac{3}{4}0{,}4 \Rightarrow \underline{\underline{A = 0{,}3\,m}}$

$v_{max} = \omega A = \sqrt{\frac{k}{m_1+m_2}}A \Rightarrow v_{max} = \sqrt{\frac{100}{4}}\,0{,}3 \Rightarrow v_{max} = 1{,}5\,m/s = v_K$

$m_2 v_2 = (m_1+m_2)v_K \Rightarrow 3v_2 = 4 \cdot 1{,}5 \Rightarrow \boxed{v_2 = 2\,m/s}$