



ΕΚΠΑΙΔΕΥΣΗ
ΒΕΡΓΙΟΠΟΥΛΟΣ

ΘΕΜΑΤΑ ΠΑΝΕΛΛΑΔΙΚΩΝ ΕΞΕΤΑΣΕΩΝ

ΦΥΣΙΚΗ

12/6/2023

ΘΕΜΑ Α

A1. β A2. δ A3. β A4. α
A5. α, λ β. ε δ. ε ε. λ

ΘΕΜΑ Β

β1) $\phi(x, t) = \frac{2\pi}{T}t - \frac{2\pi}{\lambda}x = -\frac{2\pi}{\lambda}x + \frac{2\pi}{T}t$ $t_1 = 2s$

$\Rightarrow \phi(x, t) = -\frac{2\pi}{\lambda}x + \frac{4\pi}{T}$

$x = 0 \rightarrow \phi = 4\pi$ αρα $4\pi = \frac{4\pi}{T} \Rightarrow T = 1s$

$x = 4 \rightarrow \phi = 0$ αρα $0 = -\frac{2\pi}{\lambda} \cdot 4 + 4\pi \Rightarrow$

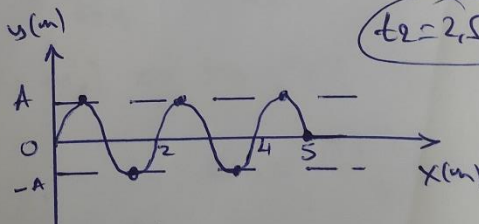
$\frac{8\pi}{\lambda} = 4\pi \Rightarrow \lambda = 2m$

$v = \lambda \cdot f = 2m$

με $y(x, t) = A \sin\left(\frac{2\pi}{T}t - \frac{2\pi}{\lambda}x\right) = A \sin(2\pi t - \pi x)$ (1)

για $t_2 = 2.5s$ $\rightarrow y(x, t_2) = A \sin(5\pi - \pi x)$
 $\phi = 5\pi \rightarrow x = 5m = 2.5\lambda$

στη χρονική στιγμή



5 φορές σε απόσταση 5m

(1)



εκπαίδευση
ΒΕΡΓΙΟΠΟΥΛΟΣ

B2. a) (ii)
 $\Delta \phi = \phi_H$ $h \cdot f_1 = \phi$
 $\Delta \phi = \phi_H$ $h \cdot f_2 = \phi + \phi \Rightarrow h \cdot 3f_1 = \phi + h \cdot f_1 \Rightarrow \boxed{k = 2h \cdot f_1}$
 Διότι $\omega_{\text{αποφ}} \rightarrow \omega_{\text{αποφ}}$
 $\Delta k = \Sigma W_F \Rightarrow 0 - k = W_{F_H}(\omega_2 - \omega_1) \Rightarrow$
 $\Rightarrow -k = q \cdot (V_{ka2} - V_{ka1}) \Rightarrow -k = -eV_0 \Rightarrow k = eV_0$
 $\Rightarrow V_0 = \frac{k}{e} = \frac{2h \cdot f_1}{e}$

B3. a) (ii)
 $q > 0$
 $\vec{F}_{H1} = q \cdot \vec{E}$
 $q > 0$
 $\vec{F}_{H1} \uparrow \vec{E}$
 $\Sigma \vec{F} = 0$ για όλα τα άνωμαλάκια
 όπου $\vec{F}_{H1} + \vec{F}_{H2} = 0 \Rightarrow |\vec{F}_{H1}| = |\vec{F}_{H2}|$
 $\Rightarrow B_1 \cdot v \cdot \frac{q}{2} = q \cdot E \Rightarrow v = \frac{E}{B_1}$

B. (i) $d = 2r_2 - 2r_1 = 2 \frac{m_2 v}{B_2 q} - 2 \frac{m_1 v}{B_2 q} \Rightarrow$
 $\Rightarrow d = \frac{2v}{B_2 q} (m_2 - m_1) \Rightarrow m_2 - m_1 = \frac{dB_2 q}{2v} \Rightarrow$
 $\Rightarrow \Delta m = \frac{dB_2 q}{2 \frac{E}{B_1}} \Rightarrow \Delta m = \frac{dB_1 B_2 q}{2E}$

(2)



εκπαίδευση
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ΘΕΜΑ Γ

$i = 2t$
 $\downarrow \downarrow \downarrow$
 $y = x$

$\frac{di}{dt} = \omega \cdot \frac{1}{\omega} = \frac{1}{\omega} = 2 \frac{A}{s} > 0$

$\lambda = 2 \frac{A}{s} > 0$

$\frac{di}{dt} = \omega \cdot \frac{1}{\omega} = \frac{1}{\omega} = 2 \frac{A}{s} > 0$

$E_{\text{area}} = \Delta q_{0 \rightarrow 2s} = \frac{1}{2} \cdot 2 \cdot 4 = 4C$

$(\Gamma_2) |E_{\text{ind}}| = \left| -L \frac{di}{dt} \right| = 0,5 \cdot 2V = 1V$

$(\Gamma_3) 2 \frac{A}{s}$ Ν. Κέρχων στο βρόχο ΖΗΓΑ2

$E_{\text{em}} = i \cdot R - |E_{\text{ind}}| = 0$ $\Rightarrow i \cdot R = |E_{\text{ind}}|$ $\Rightarrow$
 $\Rightarrow i \cdot R = v(t) - |E_{\text{ind}}| \Rightarrow 2t \cdot 1 = 1 \cdot v(t) - 1$ $\Rightarrow$
 $\Rightarrow v = 2t + 1$, (SI)

$(\omega_0 = \frac{1}{L}, \alpha = \omega \cdot \frac{1}{\omega} = 2 \frac{A}{s} \in \mathbb{R})$

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εκπαίδευση
ΒΕΡΓΙΟΠΟΥΛΟΣ

(F4) $t_1 = 2s$
 α) $\sum \vec{F} = m \cdot \vec{a}$ $\vec{F} + \vec{F}_L + \vec{W} = m \cdot \vec{a}$ $F - B \cdot i \cdot L - m \cdot g = m \cdot a$
 $\Rightarrow F = B \cdot i \cdot L + m \cdot g + m \cdot a$ $\xrightarrow[t_1 = 2s]{i = 9A}$ $F = (1 \cdot 4 \cdot 1 + 5 + 1) N \Rightarrow$
 $\Rightarrow \boxed{F = 10 N}$

β) $P_F = \frac{dw_F}{dt} = F \cdot \frac{dy}{dt} = Fv$ $t_1 = 2s \Rightarrow v_1 = 5 \frac{m}{s}$
 $\Rightarrow P_F = F_1 \cdot v_1 = 10 \cdot 5 \frac{J}{s} = 50 W$

γ) $\frac{dW_B}{dt} = v_B \cdot \frac{dW_B}{dv_B} = \frac{1}{2} L i^2 \cdot \frac{di}{dt} = L \cdot i \cdot \frac{di}{dt}$
 $\Rightarrow \frac{dW_B}{dt} \Big|_{t=2s} = L \cdot i \cdot \frac{di}{dt} \Big|_{t=2s} = 0,5 \cdot 4 \cdot 2 \frac{J}{s} = 4 W > 0$ $(v_B \uparrow)$

ΘΕΜΑ Α
 $\alpha = 0,84$ $A = 20$ $E = 30V$ $\vec{B}$ $m_1 = 3kg$
 $(\lambda = 0)$ $\phi = 37^\circ$ $m_2 = 1kg$ $k = 100 \frac{N}{m}$



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ΒΕΡΓΙΟΠΟΥΛΟΣ

$\textcircled{\Delta 3}$ $\sum \vec{F}_x = m_1 \vec{a}_1 \Rightarrow m_1 g \sin \phi = m_1 a_1 \Rightarrow a_1 = g \sin \phi = 6 \frac{m}{s^2}$
 $s_1 = \frac{1}{2} a_1 t_1^2$
 $v_1 = a_1 t_1 \Rightarrow t_1 = \frac{v_1}{a_1}$

$\Rightarrow s_1 = \frac{1}{2} a_1 \left(\frac{v_1}{a_1} \right)^2 = \frac{1}{2} \frac{v_1^2}{a_1} \Rightarrow s_1 = \frac{v_1^2}{2 a_1} \Rightarrow$
 $v_1 = \sqrt{2 a_1 s_1}$
 $\text{for } s_1 = \frac{1}{2} a_1 \left(\frac{v_1}{a_1} \right)^2 = \frac{1}{2} \cdot 6 \cdot \frac{v_1^2}{400} \Rightarrow v_1 = \frac{30}{\sqrt{5}} \frac{m}{s}$
 $\text{then } |\vec{v}_1| = \sqrt{2 \cdot 6 \cdot \frac{30^2}{400}} = \frac{60}{\sqrt{5}} \frac{m}{s}$

ΔAD $\Delta t \rightarrow 0 \text{ s}$
 $\vec{p}_{\text{before}} = \vec{p}_{\text{after}} \Rightarrow \vec{p}_1 + \vec{p}_2 = \vec{p}_F \Rightarrow p_1 + p_2 = p_F \Rightarrow$
 $\Rightarrow m_1 v_1 + m_2 v_2 = (m_1 + m_2) v_F$
 $\Rightarrow 3 \cdot \left(-\frac{60}{20} \right) + 1 \cdot \frac{30}{10} = 4 v_F \Rightarrow$
 $\Rightarrow -\frac{30}{10} + \frac{30}{10} = 4 v_F \Rightarrow 4 v_F = 0 \frac{m}{s} \Rightarrow v_F = 0 \frac{m}{s}$
 both blocks remain stationary

$\textcircled{\Delta 4}$ $\Theta \text{I} \text{res} \Rightarrow \sum \vec{F} \cdot \vec{r} = 0 \Rightarrow |\vec{F}_1| = |\vec{w}_2 \sin \phi| \Rightarrow$
 $\Rightarrow k \Delta l = (m_1 + m_2) g \sin \phi \Rightarrow \Delta l = \frac{(m_1 + m_2) g \sin \phi}{k} = \frac{40 \cdot 0,6}{100} \text{ m}$
 $\Rightarrow \Delta l = 0,24 \text{ m}$
 $A = \Delta l - \Delta l_2 = 0,18 \text{ m}$
 $D = k \cdot (m_1 + m_2) \omega^2 \Rightarrow \omega = \sqrt{\frac{k}{m_1 + m_2}}$
 $\Rightarrow \omega = \sqrt{\frac{100}{4}} \frac{r}{s} = \frac{5}{s}$



εκπαιδευση
ΒΕΡΓΙΟΠΟΥΛΟΣ

$$x(0) = +A \Rightarrow A \cdot \omega \cdot \phi_0 = A \Rightarrow \omega \cdot \phi_0 = 1 \quad \phi_0 \in [0, 2\pi] \quad \phi_0 = \frac{\pi}{2}$$

$$\text{οπότε } x(t) = 0,18 \cdot \omega \cdot \left(t + \frac{\pi}{2}\right) = 0,18 \cdot \omega \cdot (t), (s)$$

$$\textcircled{\Delta 5} \quad \vec{S}_{\text{fext}} = \vec{f}_{\text{ελ}} + m \vec{a}_x \Rightarrow m \cdot D x = f_{\text{ελ}} - (m_1 + m_2)g + b \Rightarrow$$

$$\Rightarrow f_{\text{ελ}} = (m_1 + m_2)g + b - m \cdot D x$$

$$\Rightarrow f_{\text{ελ}} = 40 \cdot 0,6 - 100x \Rightarrow f_{\text{ελ}}(x) = -100x + 24, (N)$$

$$\mu \in [-0,18 \leq x \leq 0,18 \text{ m}]$$

$$6 \leq f_{\text{ελ}} \leq 42 \text{ N}$$

$$\text{και } f_{\text{ελ}}(x) = -100x + 24 \quad \left. \begin{array}{l} \downarrow \\ y = \lambda x + b \end{array} \right\} \Rightarrow \lambda = -100 \frac{\text{N}}{\text{m}} < 0$$

