

Απαντήσεις

ΘΕΜΑ Α

A1 α A2 β A3 δ A4 α
A5 α λ β δ γ δ δ λ ε λ

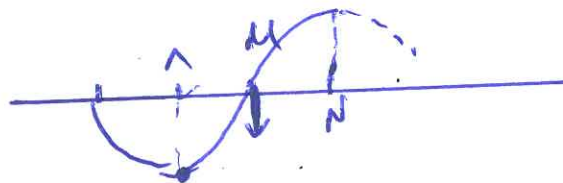
ΘΕΜΑ Β

(B1) AΔΟ $\vec{P}_{1x} = \vec{P}_{2x} \Rightarrow P_{1x} = P_{2x} \Rightarrow m v_0 = (m + 3m) v_K \Rightarrow$

$\Rightarrow \frac{1}{2} m v_0^2 = 4m v_K^2 \Rightarrow v_K = \frac{v_0}{4}$

αρχ $\frac{k_K}{k_1} = \frac{\frac{1}{2} 4m v_K^2}{\frac{1}{2} m v_0^2} = 4 \left(\frac{\frac{v_0}{4}}{v_0} \right)^2 = 4 \cdot \frac{1}{16} = \frac{1}{4}$ (iii)

(B2) $\phi_M < \phi_N$ (ti)



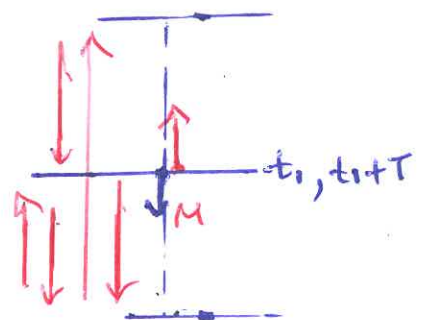
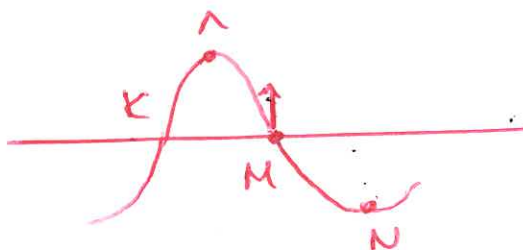
κύμα διαδίδεται

από το 1 $\rightarrow$ M

$\phi_M = \frac{2\pi}{T} t - \frac{2\pi}{\lambda} x_M$ } $\phi_N > \phi_M$ $x_N < x_M$

$\phi_N = \frac{2\pi}{T} t - \frac{2\pi}{\lambda} x_N$ }

για $t_1 + \frac{3T}{2} \approx M \approx$



(iii)

(i)

B3 $\phi = 60^\circ$ $E' = K_e$

ADP. $E = E' + K_e' \Rightarrow E = 2E' \Rightarrow \frac{hc}{\lambda} = 2 \frac{hc}{\lambda'} \Rightarrow \lambda' = 2\lambda$

or Compton $\lambda' - \lambda = \lambda_c (1 - \cos \phi) \Rightarrow 2\lambda - \lambda = \lambda_c (1 - \frac{1}{2})$

$\Rightarrow \lambda = \frac{\lambda_c}{2}$

Surveys $E_0 = \frac{hc}{\lambda} = \frac{hc}{\frac{1}{2} \lambda_c} = \frac{2hc}{\lambda_c} = 2m_e c^2$

(ii)

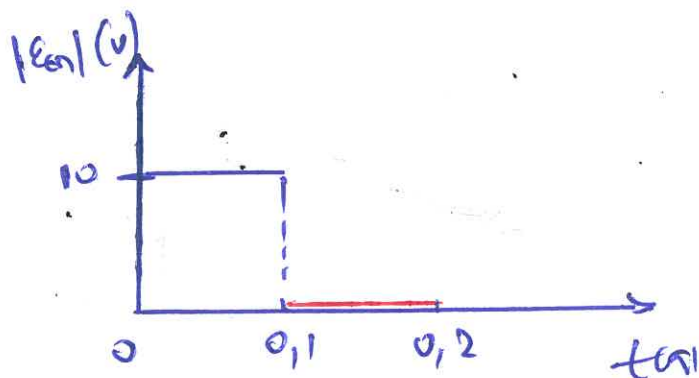
ΘΕΜΑ Γ
 $A = 2 \cdot 10^{-2} \text{ m}^2$ $N = 100$ $l = 1 \text{ m}$ $R = 10 \Omega$ $\mathcal{E} = 20 \text{ V}$

Γ1 $0 \rightarrow 0,1 \text{ sec}$ $\frac{dB}{dt} = \frac{0,5}{0,1} \frac{\text{T}}{\text{s}} = 5 \frac{\text{T}}{\text{s}}$

$\phi = BA \cos \theta' = BA \Rightarrow \frac{d\phi}{dt} = A \frac{dB}{dt} = 2 \cdot 10^{-2} \cdot 5 \frac{\text{Wb}}{\text{s}} = 0,1 \frac{\text{Wb}}{\text{s}}$

$\mathcal{E}_{\text{en}} = -N \frac{d\phi}{dt} \Rightarrow |\mathcal{E}_{\text{en}}| = 10^2 \cdot 0,1 \text{ V} = 10 \text{ V}$

$\text{για } 0,1 \text{ s} \rightarrow 0,2 \text{ s}$ $\phi = BA = \text{σταθ}$, $\frac{d\phi}{dt} = 0 \frac{\text{Wb}}{\text{s}}$, $\mathcal{E}_{\text{en}} = 0 \text{ V}$



$$B = 0,5 \text{ T} \quad \omega = 50\pi \frac{\text{r}}{\text{s}} \quad \text{Si υπεριεχόμενος} \quad \underline{\Gamma 2}$$

$$V = N\omega BA = \cancel{10^2} \cdot 5 \cdot 10\pi \cdot \frac{1}{2} \cdot \cancel{2} \cdot \cancel{10^{-2}} \quad V = 50\pi \text{ V}$$

$$\text{Σρα} \quad \mathcal{E}_{\text{em}} = 50\pi \omega \mu (50\pi r) \quad T = \frac{2\pi}{\omega} = 0,01 \text{ s}$$

$$I_{\text{em}} = \frac{\mathcal{E}_{\text{em}}}{R_{\text{em}}} = \frac{50\pi \omega \mu (50\pi r)}{10} = 5\pi \omega \mu (50\pi r), \quad (12)$$

$$\text{να} \quad Q_R = I^2 R T = \frac{I^2}{2} R \cdot T = \frac{25\pi^2}{2} \cdot \cancel{10} \cdot \cancel{10^{-2}} = 12,5 \text{ J}$$

$$\underline{\Gamma 3} \quad \omega \rightarrow \omega' = 2\omega$$

$$V = N\omega BA \rightarrow V' = 2N\omega BA$$

$$I = \frac{N\omega BA}{R} \rightarrow I' = \frac{2N\omega BA}{R} = 2I$$

$$\pi\% = \frac{Q' - Q}{Q} 100\% = \left(\frac{Q'}{Q} - 1 \right) 100\% = \left(\frac{I'^2 R T'}{I^2 R T} - 1 \right) 100\%$$

$$= \left[\left(\frac{\frac{I'}{\sqrt{2}}}{\frac{I}{\sqrt{2}}} \right)^2 \frac{\frac{2\pi}{2\omega}}{\frac{2\pi}{\omega}} - 1 \right] 100\% = \left[\left(\frac{2I}{I} \right)^2 \frac{1}{2} - 1 \right] 100\%$$

$$= \left(\frac{4}{2} - 1 \right) 100\% = 100\%$$

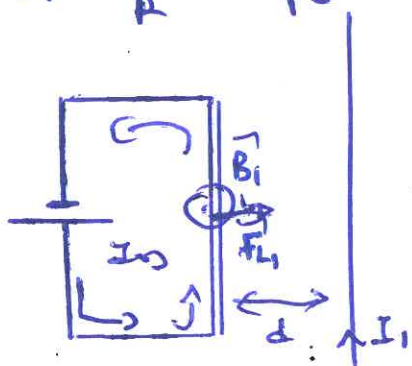
$$\underline{\Gamma 4} \quad d = 2 \cdot 10^{-2} \text{ m} \quad I_1 = 5 \text{ A}$$

Si ανοιχτός $\rightarrow$ ανασυνδέσει ηλαιοίον

Si υπεριεχόμενος $\rightarrow$ μηνί ε

$$I_{01} = \frac{\varepsilon}{R} = \frac{20}{10} \text{ A} = 2 \text{ A}$$

οπίσθεν ε ηλαιοίον



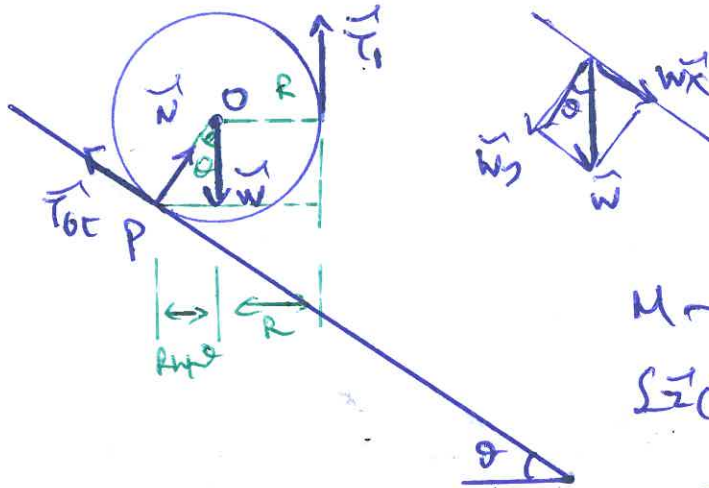
$$|F_{L1}| = B_1 \cdot I_{02} L \sin \frac{\pi}{2}$$

$$= \frac{\mu_0}{4\pi} \frac{2I_1}{d} \cdot I_{02} L =$$

$$= 10^{-7} \frac{2 \cdot 5}{2 \cdot 10^{-2}} \cdot 2 \cdot 1 \text{ N} = 10^{-4} \text{ N}$$

$\Theta \in M-A \quad \Delta$

(Δ1)



$\mu \rightarrow 160 \text{ g/cm}^3$

$$\sum \vec{\tau}(O) = \vec{0} \Rightarrow T_1 R - T_6 R = 0 \Rightarrow$$

$$\Rightarrow T_1 = T_6$$

$$\sum \vec{\tau}(P) = \vec{0} \Rightarrow T_1 (R + R \sin \theta) = \mu g R \sin \theta \Rightarrow T_1 R (1 + \sin \theta) = \mu g R \sin \theta$$

$$\Rightarrow T_1 \cdot 1,6 = 40 \cdot 0,6 \Rightarrow T_1 = \frac{24}{1,6} \text{ N} \Rightarrow T_1 = 15 \text{ N}$$



$$\sum \vec{F} = \vec{0} \Rightarrow \dots \Rightarrow k \Delta l = T_1 + m g$$

$$\Rightarrow 60 \Delta l = 30 \Rightarrow \Delta l = 0,5 \text{ m}$$

$$\Delta 2) \text{ a) } \vec{v}_2 = \vec{0} \Rightarrow v_{\text{net}} + v_{\text{ncp}} = \vec{0} \Rightarrow v_{\text{net}} = -v_{\text{ncp}} \Rightarrow$$

$$\Rightarrow |v_{\text{net}}| = |v_{\text{ncp}}| = v_{\text{cm}} \quad \text{στο σημείο επαφής με}$$

το δάπεδο

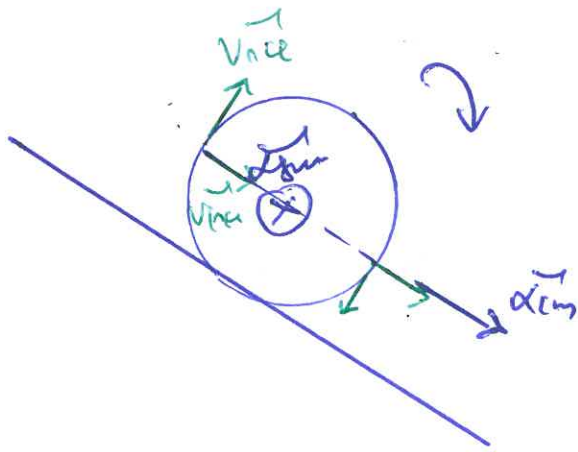
$$\text{για } \Delta 2 \text{ } \Delta \approx \text{φάση} \leadsto \text{εντάξει} \quad 1 \frac{1}{2} \text{ περίφ.} \leadsto \Delta \theta = 3\pi$$

$$s = \Delta \theta R = 3\pi \cdot \frac{9}{8} = \frac{27}{8} \text{ m} = 3,375 \text{ m}$$

$$\text{b) } t_1 = 1,5 \text{ s} \quad s = \frac{1}{2} \alpha_{\text{cm}} t_1^2 \Rightarrow \alpha_{\text{cm}} = \frac{2s}{t_1^2} = \frac{2 \cdot \frac{27}{8}}{\frac{9}{4}} = \frac{27}{3} = 9 \frac{\text{m}}{\text{s}^2}$$

$$\Rightarrow \alpha_{\text{cm}} = 4,5 \frac{\text{m}}{\text{s}^2}$$

$$v_{\text{cm}} = \alpha_{\text{cm}} t_1 = \frac{9}{2} \cdot \frac{3}{2} \frac{\text{m}}{\text{s}} = \frac{27}{4} \frac{\text{m}}{\text{s}}$$



$$\vec{v} = v_{cm} \vec{e}_{cm} + v_{kc} \vec{e}_{kc} \Rightarrow$$

$$\Rightarrow |\vec{v}| = \sqrt{v_{cm}^2 + v_{kc}^2} =$$

$$= \sqrt{2v_{cm}^2} = v_{cm} \sqrt{2} = \frac{27}{4} \sqrt{2} \frac{m}{s}$$

$$= 6,15 \sqrt{2} \frac{m}{s}$$

Δ3 m. tutejā dāz

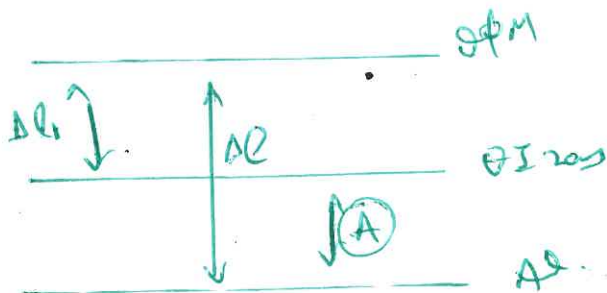
Θ I uz ~ $S \vec{F} = \vec{0} \Rightarrow k \Delta l_1 = m \cdot g \Rightarrow \Delta l_1 = \frac{m \cdot g}{k} = \frac{15}{60} m = 0,25 m$

$D = k = m \cdot \omega^2 \Rightarrow \omega = \sqrt{\frac{k}{m}} = \sqrt{\frac{60}{1,5}} = \sqrt{\frac{60 \cdot 10}{15}} = \sqrt{40} = 2\sqrt{10} \frac{r}{s}$

Ģenerāls un AQ

$A = \Delta l - \Delta l_1 = 0,25 m$

$T = \frac{2\pi}{\omega} = 1 s$



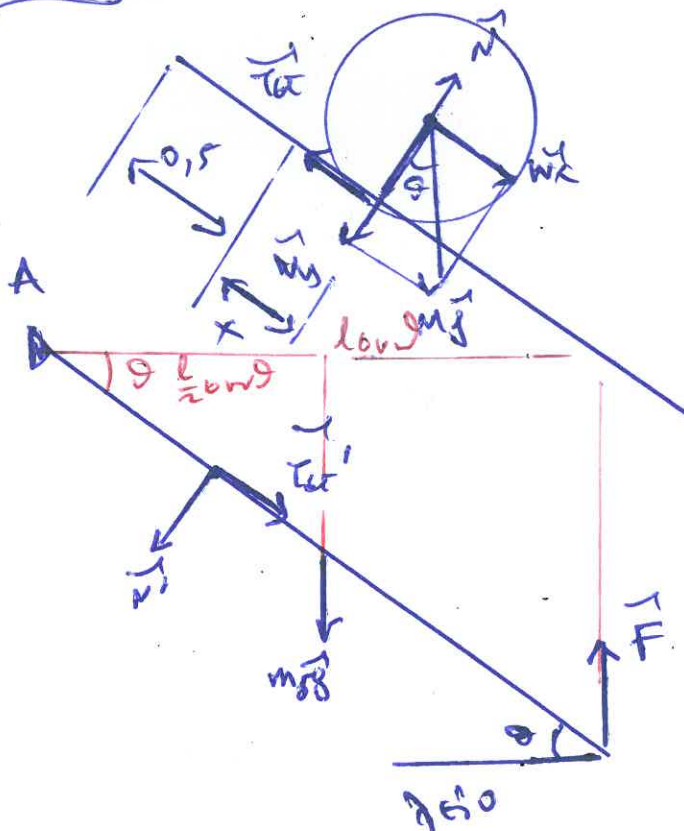
68 $t_1 = 1,5 sec = T + \frac{T}{2}$

↳ nārv AQ ≡ φM

Summa $W_{f_{kx}} = -\Delta V_{kx} = V_{kx_{\text{pēk}}} - V_{kx_{\text{pēk}}} = \frac{1}{2} k \Delta l^2 =$

$= \frac{1}{2} 60 \cdot \frac{1}{4} J = 7,5 J$

Δ4)



① $\sum \vec{F}_y = \vec{0} \Rightarrow N = m g \sin \theta = 32 \text{ N}$

$\sum \vec{L}(A) = \vec{0} \Rightarrow \sum L(A) = 0 \text{ Nm} \Rightarrow$

$\Rightarrow \cancel{L(W)(A)} + L(N')(A) + L(mg)(A) + L(F)(A) = 0$

$\Rightarrow N' \cdot (0,5 + x) + m g \frac{0,8}{2} \sin \theta = F \cdot 0,8 \sin \theta$

$\Rightarrow F \cdot 4 \cdot 0,8 = 32 (0,5 + x) + \cancel{10} \frac{4}{2} 0,8 \Rightarrow$

$\Rightarrow 3,2 F = 10 + 32 x + 16 \Rightarrow 3,2 F = 32 x + 32$

$\Rightarrow F = 10 x + 10$
 $\downarrow \downarrow \downarrow \downarrow$
 $y = \lambda x + b$ $\left\{ \begin{array}{l} \lambda = 10 \frac{\text{N}}{\text{m}} > 0 \\ b = 10 \end{array} \right.$

$x = 0 \text{ m} \rightarrow F = 10 \text{ N}$
 $x = 3 \text{ m} \rightarrow F = 40 \text{ N}$

