ΕΝΔΕΙΚΤΙΚΕΣ ΑΠΑΝΤΗΣΕΙΣ ΦΥΣΙΚΗΣ ΚΑΤΕΥΘΥΝΣΗΣ

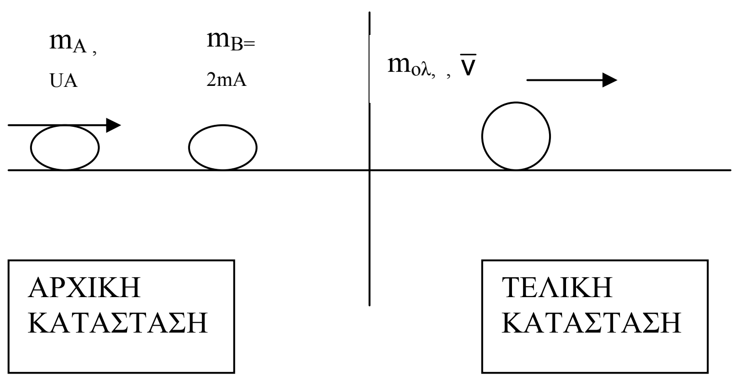
ΘΕΜΑ 1ο

1. γ
2. α
3. β
4. γ ($T' = 2\pi\sqrt{L4C} = 2 \cdot 2\pi\sqrt{LC} = 2T$
5. α)Λ
   β)Λ
   γ)Σ
   δ)Σ
   ε)Λ

ΘΕΜΑ 2ο

(1) $U_A = \sqrt{U_o^2 + U_o^2} = \sqrt{2U_o^2} = U_o\sqrt{2}$ σωστό το β

(2)



Θεωρούμε το σύστημα απομονωμένο οπότε $\sum \vec{F} = 0$ άρα ισχύει η ΑΔΟ:

$$\vec{P}_{\substack{ΟΛΙΚΗ \\ ΑΡΧΙΚΗ}} = \vec{P}_{\substack{ΟΛΙΚΗ \\ ΤΕΛΙΚΗ}} \Leftrightarrow$$

$$m_A \cdot u_A + m_B \cdot 0 = (m_A + m_B) \cdot \bar{V} \overset{m_B = 2m_A}{\Leftrightarrow}$$

$$m_A \cdot u_A = 3m_A \cdot \bar{V} \Leftrightarrow$$

$$\bar{V} = \frac{u_A}{3}$$

Άρα ΔΚ= Κτελ- Καρχ= $\frac{1}{2}(m_A + m_B) \cdot \bar{V}^2 - \frac{1}{2} m_A u_A^2 = \frac{1}{2} \cancel{3}m_A \frac{U_A^2}{\cancel{9}\,3} - \frac{m_A U_A^2}{2} \Leftrightarrow$

$$\Delta K=\frac{\overset{2}{m_A}u_A{}^2}{6}-\frac{\overset{3}{m_A}u_A{}^2}{2}\Leftrightarrow \boxed{\Delta K=\frac{-m_A u_A{}^2}{3}}$$ Άρα σωστό είναι το β

(3) Σωστό το γ

$$\left.\begin{array}{l} U=U_{max}\sigma\upsilon\nu(\omega t+\phi_o) \\ \alpha=-\alpha_{max}\eta\mu(\omega t+\phi_o) \end{array}\right. \Leftrightarrow \left.\begin{array}{l} \sigma\upsilon\nu(\omega t+\phi_o)=\dfrac{U}{U_{max}} \\ \eta\mu(\omega t+\phi_o)=-\dfrac{\alpha}{\alpha_{max}} \end{array}\right\} \Rightarrow$$

$$\left.\begin{array}{l} \sigma\upsilon\nu^2(\omega t+\phi_o)=\dfrac{U^2}{U_{max}{}^2} \\ \eta\mu^2(\omega t+\phi_o)=-\dfrac{\alpha^2}{\alpha_{max}{}^2} \end{array}\right\} \overset{+}{\Rightarrow} \underbrace{\sigma\upsilon\nu^2(\omega t+\phi_o)+\eta\mu^2(\omega t+\phi_o)}_{\downarrow=1}=\frac{U^2}{U_{max}{}^2}+\frac{\alpha^2}{\alpha_{max}{}^2}$$

$$1=\frac{U^2}{U_{max}{}^2}+\frac{\alpha^2}{\alpha_{max}{}^2} \overset{\alpha_{MAX}=\omega^2 A=\omega\omega A=\omega u_{MAX}}{\Leftrightarrow}$$

$$1=\frac{U^2}{U_{max}{}^2}+\frac{\alpha^2}{\omega^2 u_{MAX}{}^2} \overset{ΕΚΠ=\omega^2 u_{MAX}{}^2}{\Leftrightarrow}$$

$$\omega^2 u_{MAX}{}^2=\omega^2 \cancel{u_{MAX}{}^2}\frac{U^2}{\cancel{u_{MAX}{}^2}}+\omega^2\cancel{u_{MAX}{}^2}\frac{\alpha^2}{\omega^2\cancel{u_{MAX}{}^2}}\Leftrightarrow$$

$$\omega^2 u_{MAX}{}^2=\omega^2 U^2+\alpha^2 \Leftrightarrow$$

$$\alpha^2=\omega^2 u_{MAX}{}^2-\omega^2 U^2 \Leftrightarrow$$

$$\boxed{\alpha^2=\omega^2(u_{max}{}^2-U^2)}$$

<u>ΘΕΜΑ 3ο</u>

y= 0.4ημ2π(2t-0.5x) 1.
και
$y=A\eta\mu 2\pi(\frac{t}{T}-\frac{x}{\lambda})$ 2.

οπότε Α=0,4 m

$$2\cancel{t}=\frac{\cancel{t}}{T}\Leftrightarrow 2=\frac{1}{T}\Leftrightarrow T=\frac{1}{2}s$$

άρα $f=\frac{1}{T}\Leftrightarrow \boxed{f=2Hz}$

και $0.5\cancel{x}=\frac{\cancel{x}}{\lambda}\Leftrightarrow 0,5\lambda=1\Leftrightarrow \lambda=\frac{1}{0,5}m\Leftrightarrow \boxed{\lambda=2m}$

$$U = \lambda f \Leftrightarrow U = (2 \cdot 2)\frac{m}{s} \Leftrightarrow \boxed{U = 4\frac{m}{s}}$$

και $u_{max} = \omega A \overset{\omega=\frac{2\pi}{T}}{\Leftrightarrow} u_{max} = \frac{2\pi}{T} A \Leftrightarrow$

οπότε $u_{max} = (\frac{2\pi}{\frac{1}{2}} \cdot 0,4)\frac{m}{s} \Leftrightarrow$

$$u_{max} = (4\pi \cdot 0.4)\frac{m}{s} \Leftrightarrow$$

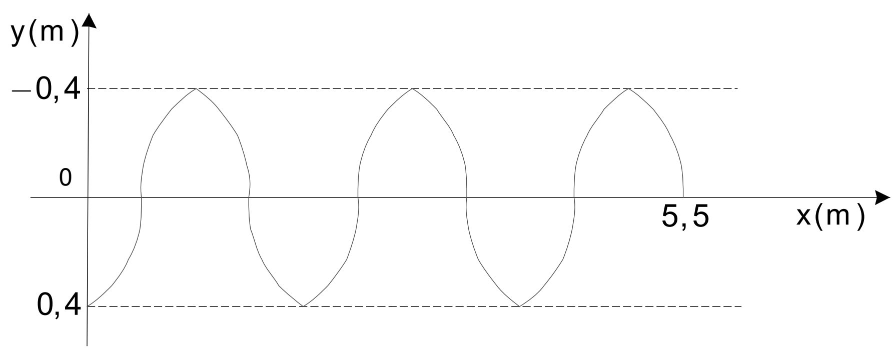
$$\boxed{u_{max} = 1.6\pi\frac{m}{s}}$$

γ) Δφ= $2\pi\frac{\Delta x}{\lambda} \Leftrightarrow \boxed{\Delta\phi = 1{,}5\pi \text{ rad}}$ προκειμένου να χρησιμοποιηθεί ο τύπος απαιτείται απόδειξη

δ) $u = \frac{x}{t} \Leftrightarrow x = u \cdot t \Leftrightarrow x = \cancel{4} \cdot \frac{1}{\cancel{8}2} \Leftrightarrow x = \frac{11}{2}m$

άρα $\frac{x}{\lambda} = \frac{\frac{11}{2}}{\frac{2}{1}} = \frac{11}{4} \Leftrightarrow \frac{x}{\lambda} = \frac{11}{4} \Leftrightarrow x = \frac{11}{4}\lambda = \frac{8\lambda}{4}\frac{3\lambda}{4} \Leftrightarrow$

$$x = 2\lambda + \frac{3}{4}\lambda$$



y=Αημ2π(2t-0.5x)$\Leftrightarrow$

$$y = 0.4\eta\mu 2\pi(\cancel{2}\frac{1}{\cancel{8}4} - 0,5x) \Leftrightarrow$$

$$y = 0.4\eta\mu(\frac{11}{2}\pi - x)$$

για χ=0 $y = 0.4ημ(\frac{11}{2}π - 0) = 0.4ημ(\frac{11}{2}π) = 0.4ημ\frac{3π}{2} = -0,4m$

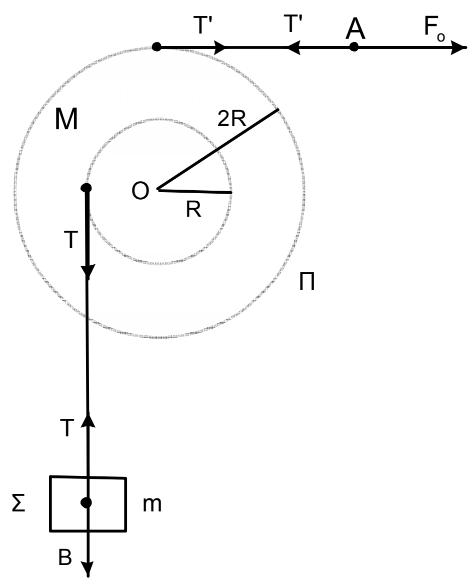
για χ=$\frac{λ}{4} \Leftrightarrow y = 0.4ημ(\frac{11}{2}π - \frac{2}{4}) = ... = 0$

για χ=$\frac{λ}{2}$ $y = 0.4$

για χ=$\frac{3λ}{4}$ $y = 0$

για x=λ y= - 0.4

<u>ΘΕΜΑ 4ο</u>



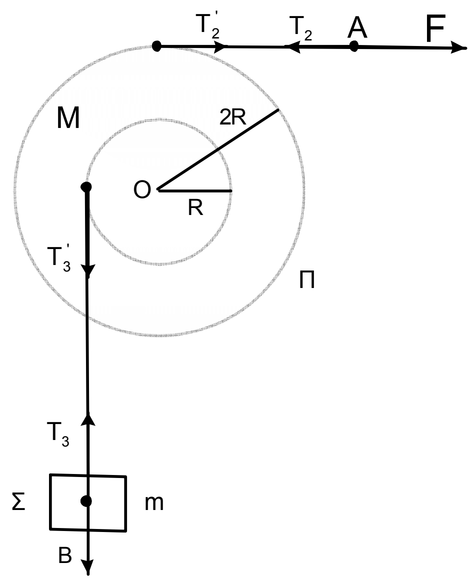
a) $\sum \vec{F} = 0 \Leftrightarrow T - B_m = 0 \Leftrightarrow T = mg \Leftrightarrow \boxed{T = 200N}$

και $\sum \vec{τ} = 0 \Leftrightarrow \overrightarrow{τ_{T'}} + \overrightarrow{τ_T} = 0$

$T'2R - TR = 0 \Leftrightarrow T'2R = TR \Leftrightarrow T' =$

$\frac{T}{2} \Leftrightarrow \boxed{T' = 100N}$ καιεπειδή έχουμε αβαρές νήμα $T' = F_o \Leftrightarrow \boxed{F_o = 100N}$

β)



$$\sum \vec{F}_y = m \cdot \vec{\alpha}_{cm}$$

$$\boxed{T_3 - mg = m\alpha_{cm}} \quad 1$$

και $\sum \vec{\tau} = I \cdot \vec{a}_\gamma \Leftrightarrow T_2 \cdot 2R - T_3 \cdot R = MR^2 \cdot a_\gamma$

$$\boxed{2T_2 - T_3 = M \cdot a_{cm}} \quad 2$$

Άρα από 1+2 έχουμε:

$$T_3 - mg + 2T_2 - T_3 = ma_{cm} + Ma_{cm} \Leftrightarrow$$

$$2T_2 - mg = (M+m)a_{cm} \Leftrightarrow a_{cm} = \frac{2T_2 - mg}{M+m} \Leftrightarrow \boxed{a_{cm} = 1 m/s^2}$$

και $h = \frac{1}{2}a_{cm}t^2 \Leftrightarrow t = \sqrt{\frac{2h}{a_{cm}}} \Leftrightarrow \boxed{t = 2s}$

γ) $L = I \cdot \omega = M \cdot R^2 \cdot a_d \cdot t \Leftrightarrow L = 4kg\frac{rad^2}{s^2}$

(όπου $a_{cm} = a_d t \Leftrightarrow a_d = \frac{a_{cm}}{t} = \frac{1}{0,2} = 5\frac{rad}{s}$ και $\omega = a_d t = 5 \cdot 2 = 10 rad$)

δ) Λόγω διπλάσιας ακτίνας x’ = 2h = 4m

ε) $\frac{\Delta K}{WF} = \frac{\frac{1}{2}I \cdot \omega^2}{F \cdot h} = \frac{\frac{1}{2} \cdot M \cdot R^2 \cdot \omega^2}{115 \cdot 4} = ... = \frac{1}{23} = 0,0434$ ή 4,34%