ΦΥΣΙΚΗ ΚΑΤΕΥΘΥΝΣΗΣ
ΠΑΝΕΛΛΗΝΙΕΣ 2011
ΕΝΔΕΙΚΤΙΚΕΣ ΑΠΑΝΤΗΣΕΙΣ

ΘΕΜΑ 1^{Ο}

1 – γ
2 – β
3 – γ
4 –γ
5 α- Σ
β - Λ
γ - Σ
δ - Λ
ε – Λ

ΘΕΜΑ 2^{Ο}

Β.1

Αρχική ισορροπία του συστήματος $Σ_1$+ $Σ_2$: ΣF=0 $\Rightarrow k\cdot \Delta l = (m_1 + m_2)g$ (1)

Μετά το κόψιμο του νήματος

Ισορροπία του $Σ_1$: $k\Delta l_1 = m_1 g$ (2)

Ισορροπία του $Σ_2$: $k\Delta l_2 = m_2 g$ (3)

Από (1) και (2) : $k(\Delta l - \Delta l_1) = m_2 g$

$$k\cdot A_1 = m_2 g$$

$$A_1 = \frac{m_2 g}{k}$$

Από (1) και (3): $k(\Delta l - \Delta l_2) = m_1 g$

$$k\cdot A_2 = m_1 g$$

$$A_2 = \frac{m_1 g}{k}$$

$$\frac{E_1}{E_2} = \frac{\frac{1}{2}kA_1^2}{\frac{1}{2}kA_2^2} = \left(\frac{A_1}{A_2}\right)^2 = \frac{m_2^2}{m_1^2}$$

Άρα σωστό το (β)

Β.2

$$f\delta_{(1)} = f\delta_{(2)} \Rightarrow |f - f_1| = |f - f_2| \Rightarrow f - f_1 = f_2 - f \Rightarrow f = \frac{f_1 + f_2}{2}$$

Άρα σωστό το α

Β.3.

Εφαρμόζουμε την ΑΔΟ για την κρούση των σωμάτων:

$$(m_1+m_2)\upsilon=(m_2+4m_1)\frac{\upsilon}{3}\Rightarrow 3m_1+3m_2=m_2+4m_1\Rightarrow 2m_2=m_1\Rightarrow\frac{m_1}{m_2}=2$$

Άρα σωστό το α

ΘΕΜΑ 3^{ο}

α) $\left.\begin{array}{l} y_M=0,2\eta\mu 2\pi(5t-10) \\ y_M=2A\eta\mu 2\pi\left(ft-\frac{r_1+r_2}{2\lambda}\right)\end{array}\right\}\Rightarrow$

$$\Rightarrow\begin{cases} A=0,1m \\ f=5Hz\rightarrow\lambda=\frac{\upsilon}{f}=0,4m \\ \frac{r_1}{\lambda}=10\Rightarrow r_1=10\lambda\Rightarrow r_1=10\frac{\upsilon}{f}\Rightarrow r_1=10\frac{2}{5}=4m\end{cases}$$

β) $\left.\begin{array}{l}\phi_0=2\pi\left(ft-\frac{d}{2\lambda}\right) \\ \phi_M=2\pi\left(ft-\frac{2r_1}{2\lambda}\right) \\ \Delta\Phi_{OM}=\phi_0-\phi_M\end{array}\right\}\Rightarrow\Delta\Phi_{OM}=2\pi\frac{2r_1-d}{2\lambda}=2\pi\frac{8-1}{2\cdot 0,4}=\frac{35\pi}{2}rad$

γ) $\left|r_1-r_2=N\cdot\lambda\Rightarrow r_1-r_2=N\cdot\lambda\right|$

$$r_1+r_2=d$$

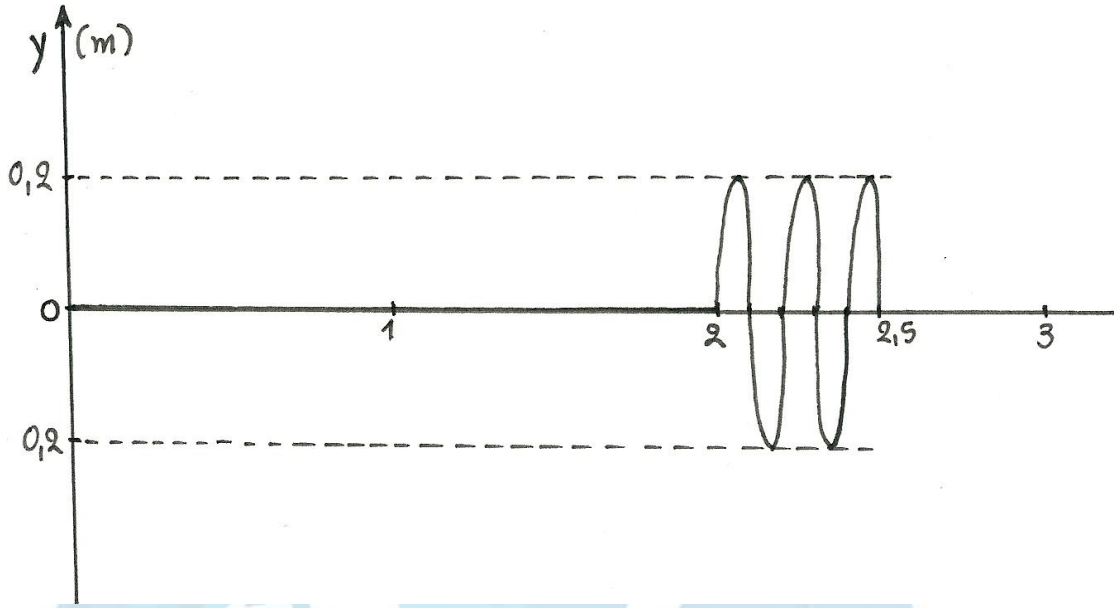
$$\overline{2r_1=N\cdot\lambda+d\Rightarrow r_1=0,2N+0,5}$$

$$0\le r_1\le 1\Rightarrow 0\le 0,2N+0,5\le 1\Rightarrow -0,5\le 0,2N\le 0,5\Rightarrow -2,5\le N\le 2,5$$

$\Rightarrow N=\{-2,-1,0,1,2\}$ Άρα, υπάρχουν 5 σημεία.

δ) $y_m=0$, για $0\le t<2s$

y_m=0,2ημ2π(5t-10), για $t \geq 2s$
Δt = 0,5s=5T

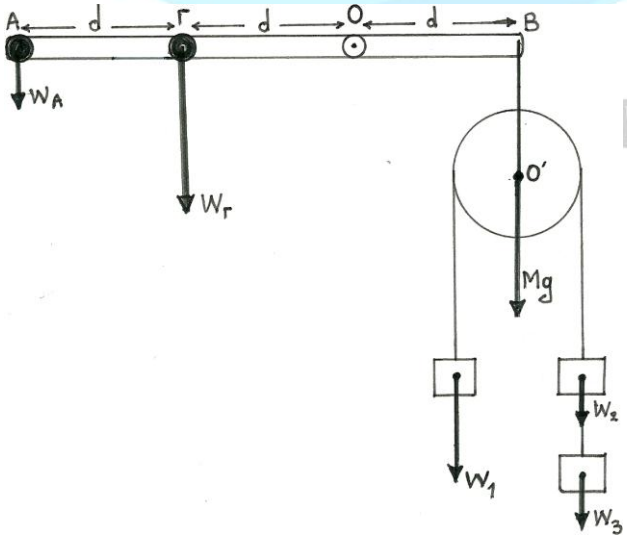


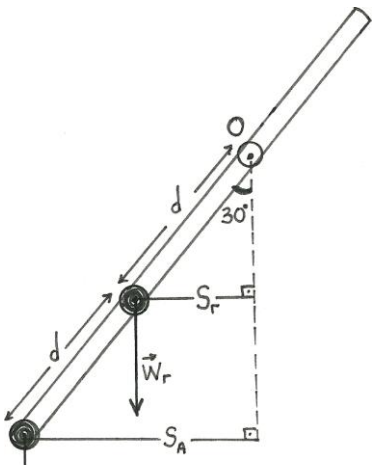
ΘΕΜΑ 4ο

α) Υπολογίζουμε τις ροπές των εξωτερικών δυνάμεων για όλο το σύστημα.

$$\Sigma\tau = \mathrm{m}_{\mathrm{A}} \cdot g \cdot 2d + m_{\Gamma} \cdot g \cdot d - mg(d-R) - (m_2+m_3)g(d+R) - Mgd$$

$$= 10 \cdot 2 + 60 \cdot 1 - 20 \cdot 1 + 20 \cdot R - 20 \cdot 1 - wR - 40 = 0$$



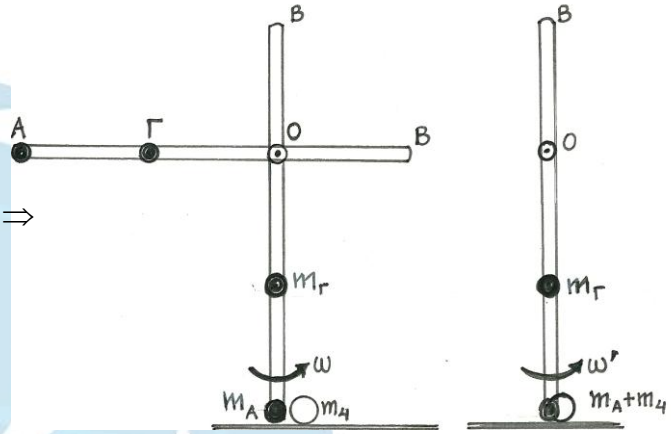


β) $I_{(0)} = m_A \cdot l_A^2 + m_\Gamma l_\Gamma^2 = 1 \cdot 4 + 6 \cdot 1 = 10\text{kg} \cdot \text{m}^2$

$I_{(0)} \cdot \alpha\gamma\omega\nu = w_A \cdot s_A + w_\Gamma \cdot s_\Gamma \Rightarrow 10 \cdot \alpha_{\gamma\omega\nu} = 10 \cdot 1 + 60 \cdot 0{,}5 \Rightarrow$

$\alpha_{\gamma\omega\nu} = 4\text{rad/s}^2$

γ) $\frac{1}{2} I_{(0)} \omega^2 + \text{m}_\Gamma g d = (m_A + m_\Gamma) g 2d \Rightarrow$



$\frac{1}{2} 10\omega^2 = 140 - 60 \Rightarrow 5\omega^2 = 80 \Rightarrow \omega^2 = 16 \Rightarrow$

$\omega = 4rad/s$

Α.Δ.Σ

$I'_{(0)} = I_{(0)} + m_4 \cdot (2d)^2 = 10 + 5 \cdot 4 = 30kg \cdot m^2$

$I'_{(0)} \cdot \omega' = I_{(0)} \cdot \omega \Rightarrow 30 \cdot \omega' = 10 \cdot 4 \Rightarrow \omega' = \frac{4}{3}\text{rad/s}$

$\upsilon'_\text{A} = \omega' \cdot 2\text{d} \Rightarrow \upsilon'_A = \frac{4}{3} \cdot 2 \Rightarrow \upsilon'_A = \frac{8}{3} m/s$

δ) $w_1 - T_1 = m_1 a \Rightarrow T_1 = m_1 g - m_1 a = T'_1$

$T_2 - w_2 = m_2 a \Rightarrow T_2 = m_2 g + m_2 a = T'_2$

$(T'_1 - T'_2) \cdot R = \frac{1}{2} MR^2 \cdot \alpha\gamma\omega\nu \Rightarrow$

$T'_1 - T'_2 = \frac{1}{2} Ma \Rightarrow m_1 g - m_1 a - m_2 g - m_2 a = \frac{1}{2} Ma \Rightarrow$

$a = \frac{m_1 - m_2}{m_1 + m_2 + \frac{M}{2}} g \Rightarrow a = \frac{2-1}{2+1+2} \cdot 10 \Rightarrow a = 2m/s^2$

Οπότε

$T'_1 = 16N$ $\qquad$ $T' = w + T'_1 + T'_2 \Rightarrow$

$T_2^{'} = 12N$ $\qquad$ $T^{'} = 40 + 16 + 12 \Rightarrow$

$T^{'} = 68N = T$

$\Sigma\tau_{(0)} = 0 \Rightarrow \text{mg}2d + m_{\Gamma} \cdot gd - Td = 0 \Rightarrow 2m = \dfrac{T}{g} - m_{\Gamma} \Rightarrow 2m = \dfrac{68}{10} - 6 \Rightarrow 2m = 0{,}8 \Rightarrow$

$2m = 0{,}8 \Rightarrow m = 0{,}4kg$