Θεμα. Α

Α1 γ.

Α2 δ

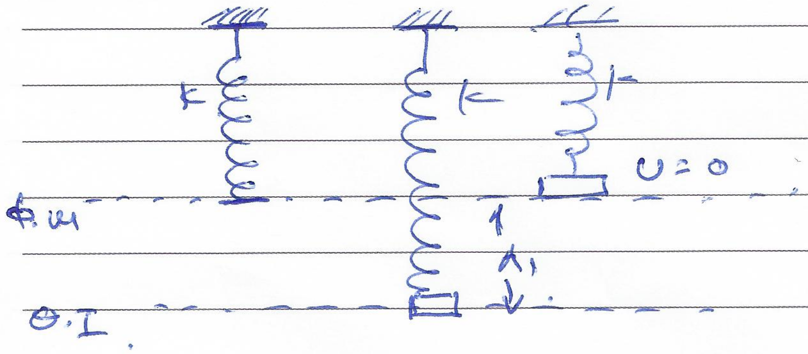
Α3. γ

Α4. Β

Α5. α Λαθος
β Σωστο
γ λαθος
δ Σωστο
ε. Σωστο

Θεμα Β

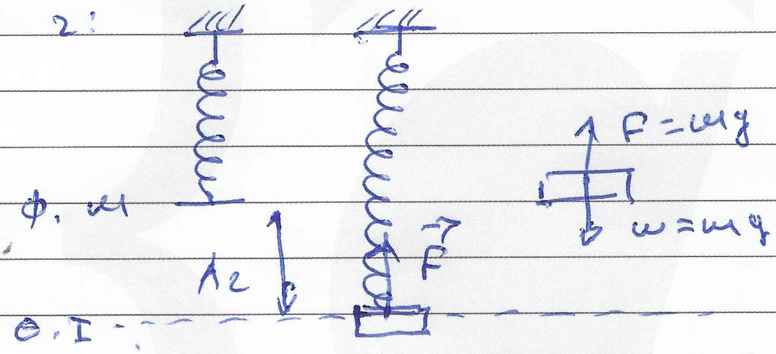
B1.



Πείραμα 1: Θ.Φ.Μ είναι ακραία θέση αφού $υ=0$.

Άρα $A_1 = \Delta\ell_1$.

Πείραμα 2:



Στην Θ.Ι ασκεί $F=mg$. Επειδή έχω $υ=0$ άρα είναι τώρα ακραία.

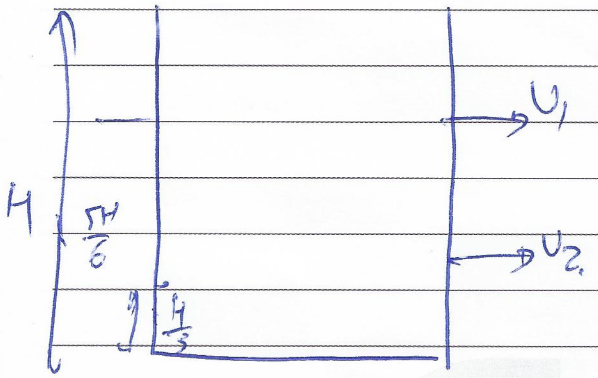
Στη Φ.Μ έχω $\Sigma F=0$ άρα Θ.Ι νέας ισορροπίας.

Άρα $A_2 = \Delta\ell_1$

και $\boxed{A_1 = A_2}$

Σωστή η (i)

B_2



$$v_1 = \sqrt{2g\left(H - \frac{5H}{6}\right)} = \sqrt{2g\frac{H}{6}}$$

$$\Pi_1 = A v_1 = A\sqrt{2g\frac{H}{6}}$$

$$\Pi_2 = A v_2 = A\sqrt{2g\left(H - \frac{H}{3}\right)}$$

$$= A\sqrt{\frac{4gH}{3}}$$

$$\frac{\Pi_1}{\Pi_2} = \frac{A}{A}\sqrt{\frac{2g\frac{H}{6}}{4g\frac{H}{3}}} = \frac{1}{2}$$

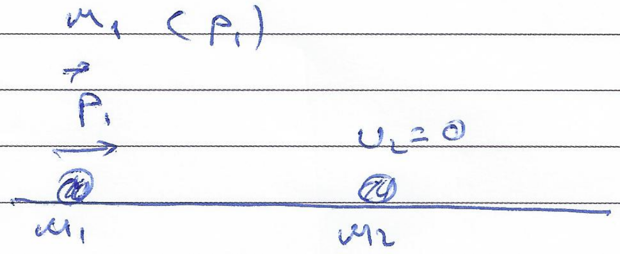
$$\Pi_2 = 2\Pi_1$$

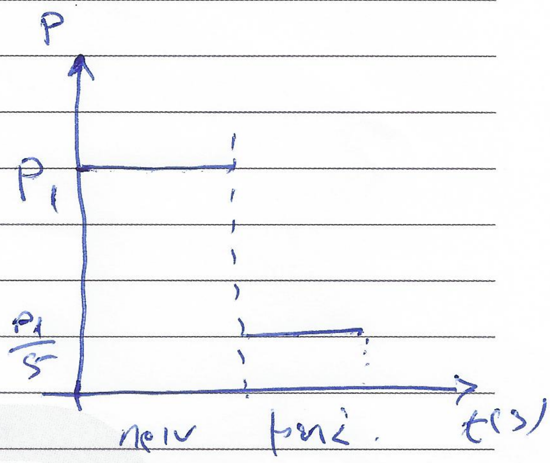
$$\Pi_{1,2} = \Pi_1 + \Pi_2 = 3\Pi_1$$

$$\Pi_1 = \frac{V}{\Delta t_1} \qquad \Pi_{1,2} = \frac{V}{\Delta t_2}$$

$$\frac{V}{\Delta t_2} = 3\frac{V}{\Delta t_1} \Rightarrow \frac{\Delta t_2}{\Delta t_1} = \frac{1}{3}$$

B3.





Ισχύει:

$$\Pi = \frac{K_2'}{K_1}\cdot 100\%$$

$$K_2' = \Delta K_1 = K_1 - K_1'$$

$\Rightarrow$

$$\Pi = \frac{K_1 - K_1'}{K_1}\cdot 100\% = \frac{\frac{p_1^2}{2\cancel{m_1}} - \frac{p_1'^2}{2\cancel{m_1}}}{\frac{p_1^2}{2\cancel{m_1}}}\cdot 100\% \Rightarrow$$

$$\Pi = \frac{p_1^2 - p_1'^2}{p_1^2}\cdot 100\% = 96\%$$ Σωστό η (iii).

Θέμα Γ

Γ1

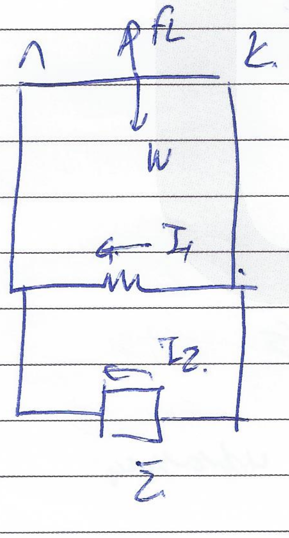
Διακόπτης $δ_1$ 0.

Το κύκλωμα Γ Λ Κ Α διαρρέεται από ρεύμα. $I=\frac{E}{R_{ολ}+r}=3A.$

Ο ΚΛ ισορροπεί $ΣF=0$
$F_L=mg$
$\boxed{B=1T}$

Έχει φορά προς τα μέσα.

Γ2. $P_Σ=\frac{V_Σ^2}{R_Σ} \rightarrow \boxed{R_Σ=6Ω}$



$R_{1,Σ}=\frac{R_1R_Σ}{R_1+R_Σ}=2Ω$

$R_{ολ}=R_{1,Σ}+R_{ΚΛ}=4Ω$

αλγόριθμος
ΦΡΟΝΤΙΣΤΗΡΙΟ ΜΕΣΗΣ ΕΚΠΑΙΔΕΥΣΗΣ

Για να αποκτήσει οριακή ταχύτητα

$$\Sigma F = 0$$

$$F_L = mg$$

$$BIl = mg$$

$$B \frac{B v_{op} l}{R_{ol}} = mg$$

$$v_{op} = 12 m/s$$

Γ3.
$$F_L' = BI'l$$

$$I' = \frac{B v l}{R_{ol}} = 1{,}5 A$$

$$\frac{\Delta p}{\Delta t} = \Sigma F = Mg - F_L = 3 - 1{,}5 = 1{,}5 \ kg \frac{m}{s^2}$$

Γ4
$$I_{εn} = \frac{B v_{op} l}{R_{ol}} = 3 A$$

$$V = I_{εn} R_{1,2} = 6 Volt = V_Σ$$

λειτουργεί κανονικά

ΘΕΜΑ Α.

Α.1

$m_\rho = 3\,kg$

$\ell = 2\,m$

$m = 1\,kg$

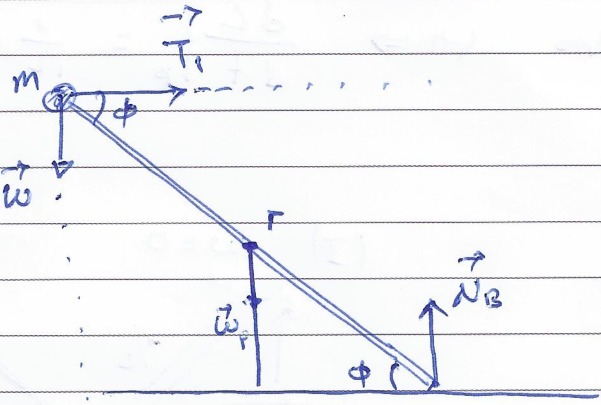
$\eta\mu\phi = 0{,}8$

$\sigma\upsilon\nu\phi = 0{,}6$.

$m_T = 7\,kg$.

$R = 0{,}4\,m$

$r = 0{,}3\,m$

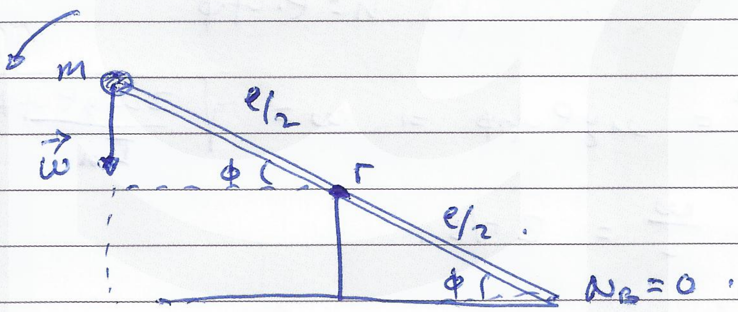


$T_1 = 10{,}5\,N$.

Ισορροπία ράβδου: $\Sigma\tau_{(\Gamma)} = 0 \Rightarrow \tau_{w}^{(\Gamma)} + \tau_{T_1}^{(\Gamma)} + \tau_{N_B}^{(\Gamma)} + \underbrace{\tau_{w_\rho}^{(\Gamma)}}_{=0} + \underbrace{\tau_{F_{\sigma\tau}}^{(\Gamma)}}_{=0} = 0 \Rightarrow mg\frac{\cancel{\ell}}{\cancel{2}}\cdot\sigma\upsilon\nu\phi + N_B\cdot\frac{\cancel{\ell}}{\cancel{2}}\cdot\sigma\upsilon\nu\phi = T_1\frac{\cancel{\ell}}{\cancel{2}}\eta\mu\phi$

$\Rightarrow N_B = \dfrac{T_1\,\eta\mu\phi - mg\,\sigma\upsilon\nu\phi}{\sigma\upsilon\nu\phi} = 4\,N$.

Α2.



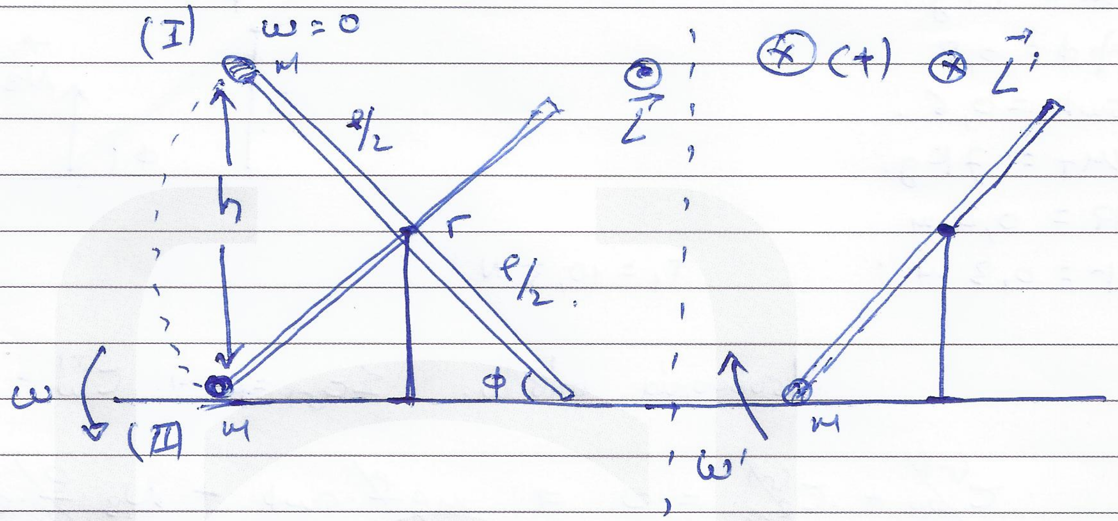
Για ράβδο: $\left.\dfrac{dL}{dt}\right|_\rho = I_{\rho(\Gamma)}\cdot a_\gamma$ (1).

Για το σύστημα: $\Sigma\tau_{(\Gamma)} = I_{o\lambda(\Gamma)}\,a_\gamma \Rightarrow mg\frac{\ell}{2}\cdot\sigma\upsilon\nu\phi = I_{o\lambda}\cdot a_\gamma$

$$\left.\begin{aligned} &\Rightarrow a_\gamma = \frac{mg\frac{\ell}{2}\sigma\upsilon\nu\phi}{I_{o\lambda}} \\ &I_{o\lambda} = \frac{m\ell^2}{4} + \frac{1}{12}m_\rho\ell^2 = 2\,kg\,m^2 \end{aligned}\right\} \Rightarrow a_\gamma = 3\,r/s^2.$$

Από (1) $\Rightarrow$ $\left.\frac{dL}{dt}\right|_p = \frac{1}{12} m_p \ell^2 \cdot a_\gamma \Rightarrow \left.\frac{dL}{dt}\right|_p = 3\ kg\, m^2/s^2$.

Δ3.



Θ.Μ.Κ.Ε για σύστημα ράβδος - μάζα m από (I) → (II):

$\Delta K = \Sigma W \Rightarrow \left.\begin{array}{l}\frac{1}{2} I_{ολ} \cdot \omega^2 - 0 = mgh \\ \text{με } h = \ell \cdot \eta\mu\phi\end{array}\right\} \Rightarrow$

$\frac{1}{2} I_{ολ} \cdot \omega^2 = mg\ell\eta\mu\phi \Rightarrow \omega = \sqrt{\frac{2mg\ell\eta\mu\phi}{I_{ολ}}} \Rightarrow \omega = 4\ r/s$.

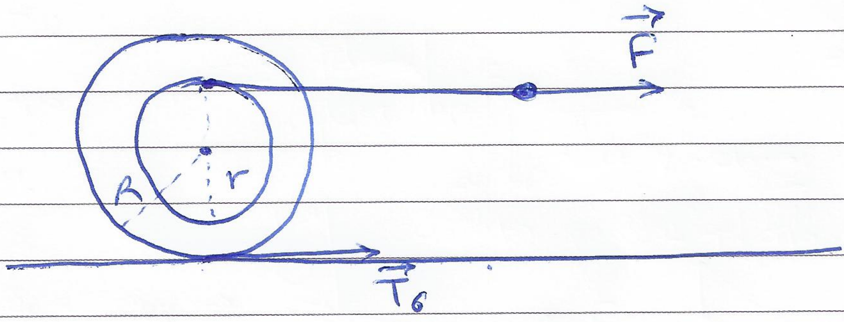
άρα $\omega' = \frac{\omega}{2} = 2\ r/s$.

$\Delta\vec{L} = \vec{L}' - \vec{L} \Rightarrow \Delta L = L' - (-L) \Rightarrow \Delta L = L' + L =$

$= I_{ολ}\omega' + I_{ολ}\omega = I_{ολ}(\omega' + \omega) \Rightarrow \Delta L = 12\ kg\, m^2/s^2$

με φορά ⊗ $\Delta\vec{L}$.

Δ4



Θ.Ν.Μ: $\Sigma F = m a_{cm} \Rightarrow F + T_\sigma = m a_{cm}$ (1)

Θ.Ν.Σ: $\Sigma \tau = I \cdot a_\gamma \Rightarrow F \cdot r - T_\sigma \cdot R = \frac{1}{2} m R^2 \cdot a_\gamma \Rightarrow$

$\xrightarrow[a_{cm} = R \cdot a_\gamma]{\text{κ.χ.ο}} F \cdot r - T_\sigma \cdot R = \frac{1}{2} m R a_{cm} \Rightarrow F \frac{r}{R} - T_\sigma = \frac{1}{2} m a_{cm}$ (2)

Από (1) + (2) $\Rightarrow F\left(1 + \frac{r}{R}\right) = \frac{3}{2} m a_{cm} \Rightarrow$

$a_{cm} = \frac{2F(1 + r/R)}{3m} \Rightarrow \boxed{a_{cm} = 2 \ m/s^2}$.

Δ5.

$W_F = W_F|_{στρ.} + W_F|_{μετ.} = F \cdot r \cdot \theta + F \cdot x_{cm}$ (1)

Για $t_1 = 2sec.$ $x_{cm} = \frac{1}{2} a_{cm} t_1^2 = 4m$ (2)

$\left.\begin{array}{l} \theta = \frac{1}{2} a_\gamma t_1^2 \\ a_\gamma = \frac{a_{cm}}{R} = 5 \ r/s^2 \end{array}\right\} \Rightarrow \theta = 10 rad$ (3).

Από (1) $\xrightarrow[(3)]{(2)}$ $W_F = 36J + 48J = 84J$.