ΘΕΜΑ Α.

Α1. γ

Α2. α

Α3 γ.

Α4. δ

Α5 α. Σ

β. Λ

γ. Σ

δ. Σ

ε. Λ

ΘΕΜΑ Β.

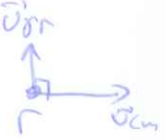
Β1. $\vec{v}_A = \vec{v}_{cm} + \vec{v}_{\gamma A}$

$v_A = v_{cm} + v_{cm}$

$v_A = 2v_{cm}$ (1)

$v_{\gamma\Gamma} = \omega \cdot \frac{R}{2} = \frac{v_{cm}}{2}$

$v_\Gamma = \sqrt{v_{cm}^2 + \left(\frac{v_{cm}}{2}\right)^2}$



$v_\Gamma = \frac{v_{cm}}{2} \cdot \sqrt{5}$ (2)

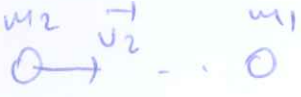
από (1) Λ (2) $\frac{v_\Gamma}{v_A} = \frac{\sqrt{5}}{4}$ άρα (iii)

Β2.

$v_2' = \frac{2m_1}{m_1+m_2} \cdot v_1$

$K_2' = \frac{1}{2} m_2 v_2'^2 = \frac{1}{2} m_2 \frac{4m_1^2}{(m_1+m_2)^2} \cdot v_1^2$

$\Pi_1 = \frac{K_2'}{K_1} = \frac{\frac{1}{2} \cdot \frac{4m_1^2 m_2}{(m_1+m_2)^2} \cdot v_1^2}{\frac{1}{2} m_1 v_1^2} = \frac{4m_1 m_2}{(m_1+m_2)^2}$



$v_1' = \frac{2m_2}{m_1+m_2} \cdot v_2$ $\quad K_1' = \frac{1}{2} m_1 \frac{4m_2^2}{(m_1+m_2)^2} \cdot v_2^2$

$\Pi_2 = \frac{K_1'}{K_2} = \frac{\frac{1}{2} \frac{4m_1 m_2^2}{(m_1+m_2)^2} \cdot v_2^2}{\frac{1}{2} m_2 v_2^2} = \frac{4m_1 m_2}{(m_1+m_2)^2}$

Άρα (ii) $\Pi_1 = \Pi_2$

B3. Αφού η σταθερή διαφορετική σε όλη Η

$$\Pi = A \cdot v$$

$$\Pi = A \cdot \sqrt{2g(H-h_1)} \quad (1)$$

$$s = v \cdot t$$

$$s = \sqrt{2g(H-h_1)} \cdot \sqrt{\frac{2h_1}{g}} \quad (2)$$

αλλά $\epsilon 2 = \frac{s}{2}$

$$\frac{s}{2} = v \cdot t' \rightarrow \frac{s}{2} = \sqrt{2g(H-h_1)} \cdot \sqrt{\frac{2(h_1-h_2)}{g}} \quad (3)$$

από (2) και (3) :

$$2\sqrt{\frac{2(h_1-h_2)}{g}} = \sqrt{\frac{2h_1}{g}}$$

$$4 \cdot \frac{2(h_1-h_2)}{g} = \frac{2h_1}{g}$$

$$4h_1 - 4h_2 = h_1$$

$$h_1 = \frac{4h_2}{3} = \frac{4}{3} \cdot \frac{21H}{32} = \frac{7}{8}H$$

και από την (1)

$$\Pi = A \cdot \sqrt{2g\left(H - \frac{7}{8}H\right)}$$

$$\Pi = \frac{A}{2}\sqrt{gH} \quad \text{το i)}$$

ΘΕΜΑ Γ

Γ1. επιταχυνόμενη, όχι ομαλά, με επιτάχυνση που ελαττώνεται.

$$\Sigma F = m \cdot a$$

$$F - F_L = m \cdot a \Rightarrow a = \frac{F - B_1 I_{\epsilon\pi} L}{m}$$

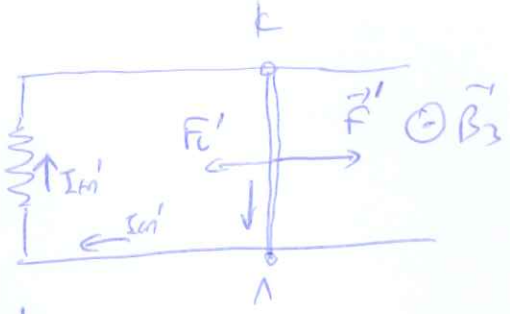
$$a = \frac{F}{m} - \frac{B_1^2 L^2 \cdot v}{m \cdot R_{o\lambda}}$$

για $a = 0 \quad v = v_{op} = 4\ m/s$

Γ2. Πρέπει $\Sigma F = 0$

$$F' = F_L$$

$$F' = B_3 I'_{\epsilon\pi} L$$



$$I'_{\epsilon\pi} = \frac{\mathcal{E}'_{\epsilon\pi}}{R_{o\lambda}} = \frac{B_3 \cdot v_{op} \cdot L}{R_{o\lambda}} = 0,8\ A \qquad \mathcal{E}_{\epsilon\pi\alpha} = \frac{B\Delta l}{\Delta t} = \dots = BvL$$

άρα $F' = 0,8\ N$.

Γ3.

$$I_{\epsilon\pi}' = \frac{\Delta q}{\Delta t} \Rightarrow \Delta t = \frac{Q_2}{q_B} = 0,25\ sec$$

$$Q = I_{\epsilon\pi}'^2 \cdot R_{o\lambda} \cdot \Delta t = 0,8^2 \cdot 5 \cdot \frac{1}{4} = 0,8\ Joule$$

Γ4. $R_{12} = 1\ \Omega \quad R'_{o\lambda} = R_{\epsilon\pi} + R_{12} = 4\ \Omega$.

$$\Sigma F = 0$$

$$F' = B_3 \cdot I \cdot L$$

$$F' = B_3 \cdot \frac{B_3 v'_{op} L}{R'_{o\lambda}} \cdot L$$

$$v'_{op} = \frac{F' \cdot R'_{o\lambda}}{B_3^2 \cdot L^2} = \frac{0,8 \cdot 4}{1} = 3,2\ m/s$$

Г4. при $v = v_0' = 3{,}2$ м/с

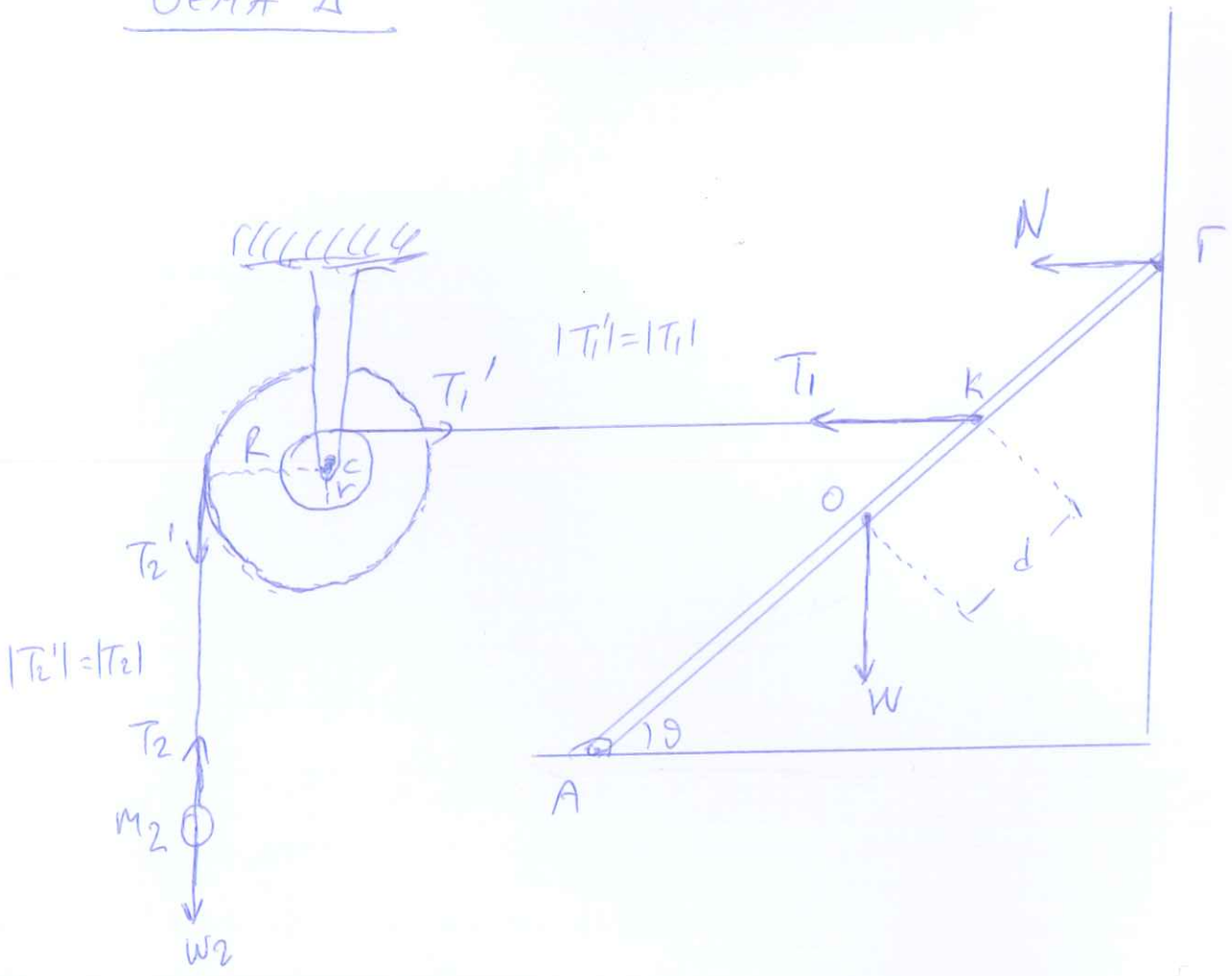
$$V_{1K} = E_{сум} - I \cdot R_{КЛ} = 0{,}8\ V$$

$$V_{КЛ} = -0{,}8\ V$$

тогда $V_{1K} = I_1 \cdot R_1 \Rightarrow I_1 = 0{,}4\ A$

$V_{1K} = I_2 \cdot R_2 \Rightarrow I_2 = 0{,}4\ A$

ΘΕΜΑ Δ



Δ1] για το m_2 $W_2 = T_2$ (1)

για το σχοινί $\Sigma\tau_{(C)} = 0 \Rightarrow T_2' \cdot R = T_1' \cdot r \Leftrightarrow 2T_2' = T_1'$ (2)

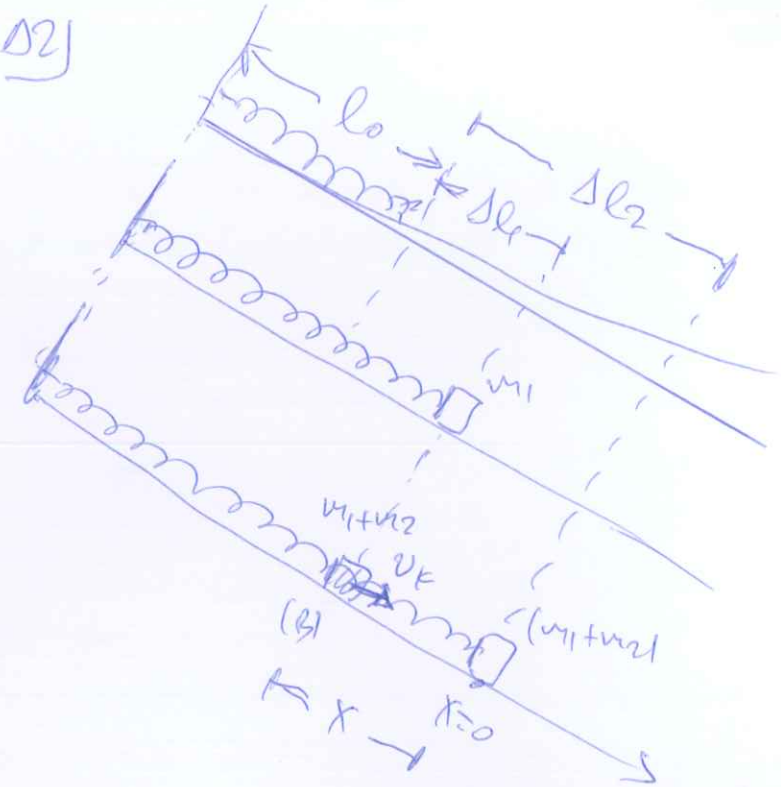
νόμος άβαρές και μη εκτατό από (1) & (2) $T_1 = 60\,N$

για τον ράβδο $\Sigma\tau_{(A)} = 0$

$$N \cdot l\eta\vartheta + T_1 \cdot \left(\frac{l}{2} + d\right)\eta\vartheta - W \cdot \frac{l}{2}\sigma\upsilon\vartheta = 0$$

$$N = 10\,N$$

Δ2)



$$\Delta l_1 = \frac{m_1 g \eta \mu}{k} = 0{,}05\,m$$

$$\Delta l_2 = \frac{(m_1+m_2) g \eta \mu}{k} = 0{,}2\,m$$

Από το θεώρημα διατήρησης της ενέργειας

$$E = K + U$$

$$\frac{1}{2} k A^2 = \frac{1}{2}(m_1+m_2) v_K^2 + \frac{1}{2} k (\Delta l_2 - \Delta l_1)^2$$

$$A = 0{,}3\,m.$$

03) $\text{na } t=0 \quad x=-0{,}15\,\text{m}.$

$$x = A\cos(\omega t+\varphi_0)$$

$$-0{,}15 = 0{,}3\cos\varphi_0$$

$$\cos\varphi_0 = -\frac{1}{2}$$

$$\cos\varphi_0 = \cos\frac{7\pi}{6}$$

$$\left.\begin{array}{l}\varphi_0 = 2k\pi+\frac{7\pi}{6}\\ \varphi_0 = 2k\pi+\pi-\frac{7\pi}{6}\end{array}\right\} \Longrightarrow \begin{array}{l}\varphi_0 = \frac{7\pi}{6}\ \text{rad}\\ \varphi_0 = \frac{11\pi}{6}\ \text{rad}\end{array}$$

$v>0$ depois $\cdots \varphi_0 = \frac{11\pi}{6}\ \text{rad}$

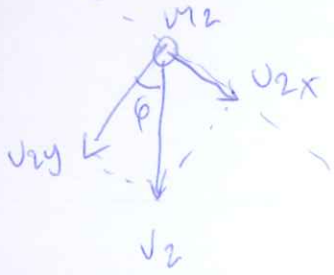
$$\omega = \sqrt{\frac{k}{m_1+m_2}} = 5\ \text{rad/s}$$

$$x = 0{,}3\cos\left(5t+\frac{11\pi}{6}\right)\ (SI)$$

4

Δ3) ΑΔΜΕ για m_2 : $K_{A\Pi\Lambda} + U_{A\Pi\Lambda} = K_{2\kappa\alpha} + U_{2\kappa\alpha}$

$m_2 g h = \frac{1}{2} m_2 v_2^2 \Rightarrow v_2 = \sqrt{2gh}$ (1)



ΑΔΟ x'x

$m_2 v_{2x} = (m_1+m_2) v_K$

$m_2 \cdot v_2 \sigma\upsilon\nu\varphi = (m_1+m_2) \cdot v_K$

$v_2 = 2\sqrt{3}\ m/s$

Και από (1) $h = 0{,}6$ m.

Δ5) για $x = +A$ $\quad \Delta l \to \Delta l_{max}$

$$\frac{(F_{\Sigma\lambda})}{(F_{\Sigma\pi\nu})} = \frac{k(\Delta l_2 + A)}{kA} = \frac{5}{3}$$