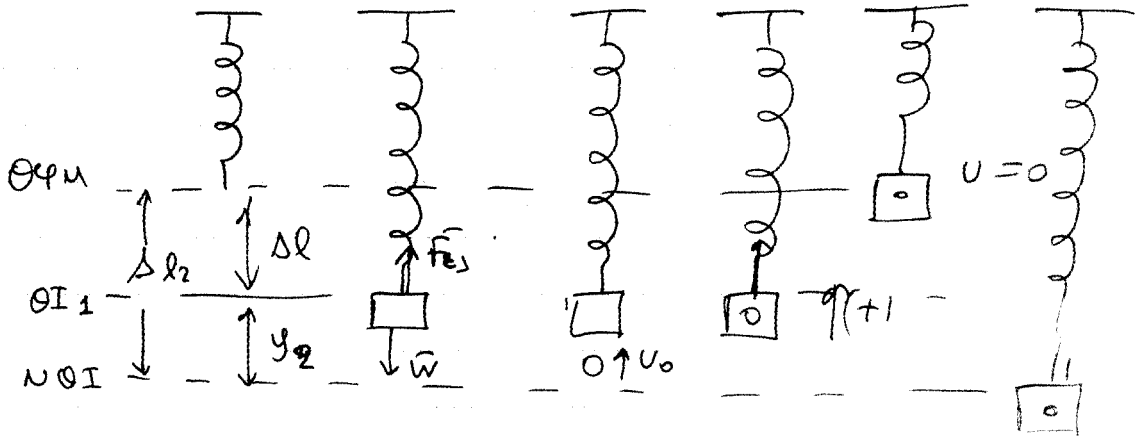
ΘΕΜΑ Γ

$m_1 = 1\ Kg$

$\Delta l = 0,05\ m$

$m_2 = 1\ Kg$



Γ1)

ΘΙ(1) $\Sigma F_y = 0 \Rightarrow w = F_{\varepsilon 1} \Rightarrow m_1 g = K \Delta l$

$$K = \frac{10}{0,05} \Rightarrow \boxed{K = 200\ N/m}\ \checkmark$$

(ΝΘΙ)

$\Sigma F_y = 0 \Rightarrow w_2 = F_{\varepsilon 1}' \Rightarrow (m_1 + m_2) g = K \Delta l_2$

$$20 = 200\ \Delta l_2 \Rightarrow \boxed{\Delta l_2 = 0,1\ m}\ \checkmark$$

ΑΔΕΤ στο σώμα εκτός το Φ.Μ

$E_1 = K + U_1$

$\frac{1}{2} D A^2 = 0 + \frac{1}{2} D \Delta l_2^2$

$A = \Delta l_2 = 0,1\ m$

[redacted]

Γ2) ΑΔΕΤ αμέσως μετά την κρούση

$E_T = K + U_T \Rightarrow$

$\frac{1}{2}DA^2 = \frac{1}{2}(m_1+m_2)υ_ε^2 + \frac{1}{2}D(Δl_2-Δl)^2$

$200 \cdot 0{,}01 = 2\cdot υ_ε^2 + 200\cdot\frac{1}{400}$

$2 = 2υ_ε^2 + \frac{1}{2} \Rightarrow \frac{3}{2} = 2υ_ε^2 \rightarrow υ_ε = \frac{\sqrt{3}}{2}\ \frac{m}{s}$

<u>ΑΔΟ</u>

$\vec{p}_{πριν} = \vec{p}_{μετά} \Rightarrow m_2υ_0 = (m_1+m_2)υ_ε$

$1\cdot υ_0 = 2\frac{\sqrt{3}}{2} \Rightarrow υ_0 = \sqrt{3}\ m/s$

$K_{2πριν} = \frac{1}{2}m_2υ_0^2 = \frac{3}{2}\ J$

Γ3) $|Δp_2| = |m_2υ_ε - m_2υ_0| = \left|\frac{\sqrt{3}}{2} - \sqrt{3}\right| \Rightarrow$

$|Δp_2| = \left|-\frac{\sqrt{3}}{2}\ kg\ m/s\right| = \frac{\sqrt{3}}{2}\ kg\frac{m}{s}$

με φορά αντίθετη της $\vec{υ}_0$

Γ4) $t=0$

$y = +(Δl_2 - Δl) = +y_2 \Rightarrow y = +0{,}05m$

$υ > 0$

$y = Aημ(ωt+φ_0) \xrightarrow[t=0]{y=+y_2}$

$y_2 = Aημφ_0 \Rightarrow 0{,}05 = 0{,}1\ ημφ_0$

$ημφ_0 = ημ\frac{π}{6} \Rightarrow φ_0 = \begin{cases} 2κπ + π/6 \\ 2κπ + \frac{5π}{6} \end{cases}$ $φ_0 \in [0, 2π)$

$φ_0 = \begin{cases} π/6\ rad \\ \frac{5π}{6}\ rad \end{cases}$ $υ>0 \Rightarrow συνφ_0 > 0 \Rightarrow φ_0 = \frac{π}{6}\ rad$

ΟΕΦΕ

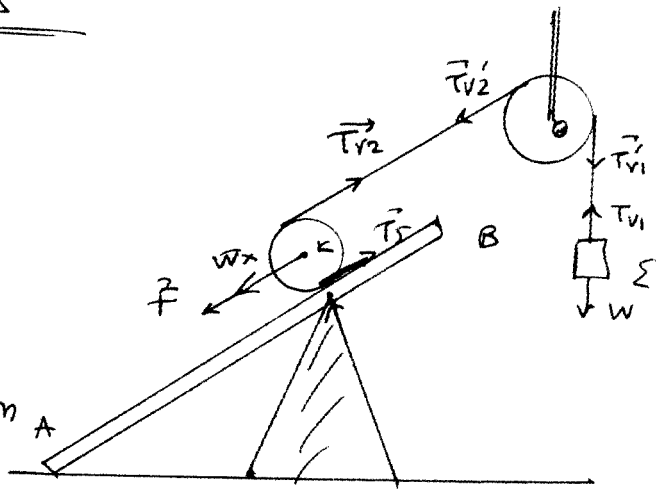
$D = K \Rightarrow (m_1 + m_2)\omega^2 = K$

$2\omega^2 = 200 \Rightarrow \omega = 10 \frac{rad}{s}$

$$y = 0{,}2\ \eta\mu\left(10t + \frac{\pi}{6}\right)(SI)$$

ΘΕΜΑ Δ

$M = 2\,kg$
$l = 4\,m$
$\varphi = 30^\circ$
$(B\Gamma) = 1,5\,m$
$M_K = 2\,kg$
$(\Gamma\Delta) = 0,2\,m$
$M_\Sigma = 2\,kg$
$M_T = 2\,kg$



κυλινδρος $\quad \Sigma F_x = 0 \Rightarrow T_{V2} + T_S = W_x + F \Rightarrow$

$T_{V2} + T_S = 2 \cdot 10 \cdot \frac{1}{2} + F \Rightarrow$

$T_{V2} + T_S = 10 + F \quad (1)$

$\Sigma \tau_K = 0 \Rightarrow -T_{V2} R + T_S R = 0$

$T_S = T_{V2} \quad (2)$

$(1) \overset{(2)}{\Rightarrow}$ $\boxed{2\,T_{V2} = 10 + F \quad (3)}$

τροχαλία

$\Sigma \tau_{(O)} = 0 \Rightarrow T_{V1}' R_T = T_{V2}' R_T \rightarrow \boxed{T_{V1} = T_{V2}} \quad (4)$

σώμα

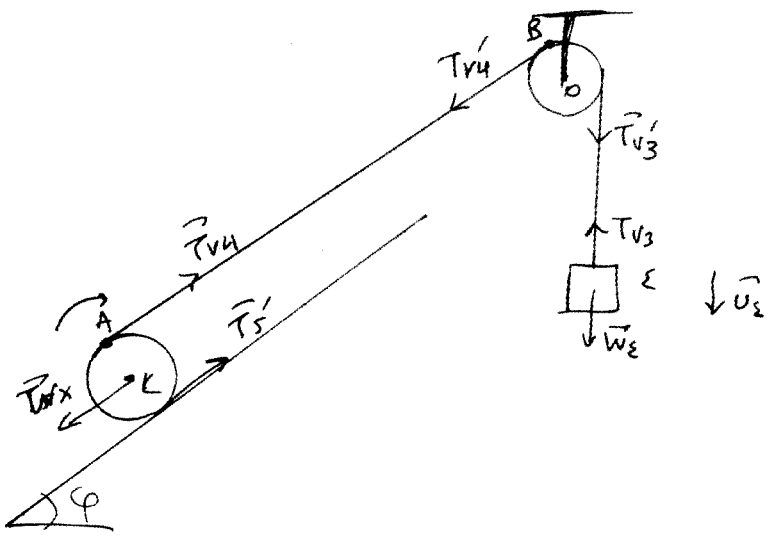
$\Sigma F_y = 0 \Rightarrow \boxed{T_{V1} = W = 20\,N}$

$(4) \Rightarrow \boxed{T_{V2} = 20\,N}$

$(3) \Rightarrow \boxed{F = 30\,N}$

ΟΕΦΕ

Δ2)



Επειδή το νήμα δε γλιστρά.

$$\upsilon_A = \upsilon_B = \upsilon_\Sigma \Rightarrow \boxed{2\upsilon_{cm} = \omega_T R_T = \upsilon_\Sigma} \Rightarrow$$

$$\boxed{2\,a_{cm} = R_T \cdot a_{\gamma T} = a_\Sigma} \quad (5)$$

Σώμα (Σ)

ΘΝΜΚ

$\Sigma F_y = M a_\Sigma \Rightarrow w_\Sigma - T_{\nu 3} = M a_\Sigma \Rightarrow$

$$T_{\nu 3} = 20 - 2a_\Sigma \quad (6)$$

Τροχαλία (ΘΝΣΚ)

$\Sigma \tau_{(O)} = I a_{\gamma T} \overset{(5)}{\Rightarrow} T'_{\nu 3} R_T - T'_{\nu 4} \cdot R_T = \frac{1}{2} M_T R_T^2 \frac{a_\Sigma}{R_T}$

(6)

$\Rightarrow \quad 20 - 2a_\Sigma - T_{\nu 4} = a_\Sigma \Rightarrow \boxed{T_{\nu 4} = 20 - 3a_\Sigma} \quad (7)$

Κεντρο

ΘΝΜΚ

$\Sigma F_x = M_K a_{cm} \overset{(5)}{\Rightarrow} T_{\nu 4} + T'_5 - w_x = M_K \frac{a_\Sigma}{2} \overset{(7)}{\Rightarrow}$

$20 - 3a + T'_5 - 10 = a \Rightarrow$

$$\boxed{T'_5 = 4a_\Sigma - 10} \quad (8)$$

ΘΝΣΚ

$\Sigma \tau = I_{cmK} a_{\gamma K} \Rightarrow T_{\nu 4} R_K - T'_5 R_K = \frac{1}{2} M_K R_K^2 \frac{a_{cm}}{R_K}$

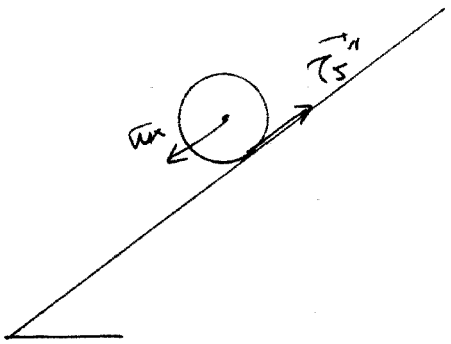
(7)

$\overset{(8)}{\Rightarrow} \quad 20 - 3a_\Sigma - 4a_\Sigma + 10 = \frac{a_\Sigma}{2} \Rightarrow$

$30 = 7{,}5\, a_\Sigma \Rightarrow \boxed{a_\Sigma = 4\ \frac{m}{s^2}}$ με $a_{cm} = 2\ \frac{m}{s^2}$

ΟΕΦΕ

Δ3)



$$a_{cm} = \frac{a}{2} = 2\ m/s$$

$$v_{cm} = a_{cm} t_1 = v_0 \Rightarrow \quad v_0 = 1\ m/s$$

ΘΝΜΚ

$$\Sigma F_x = M a_{cm} \Rightarrow T_s'' - w_x = M a_{cm} \Rightarrow$$

$$\boxed{T_s'' = 10 + 2 a_{cm}} \quad (9)$$

ΘΝΕΚ

$$\Sigma \tau = I_{cm} \alpha_\gamma \Rightarrow -T_s'' R_K = \frac{1}{2} M_K R_K^2 \frac{a_{cm}}{R_K} \quad (9) \Rightarrow$$

$$-10 - 2 a_{cm} = a_{cm} \Rightarrow$$

$$a_{cm} = -\frac{10}{3}\ \frac{m}{s^2}$$

ο κύλινδρος θα σταματήσει όταν $v_{cm} = 0$

$$v_{cm} = v_0 - |a_{cm}| \Delta t \Rightarrow$$

$$0 = 1 - \frac{10}{3} \Delta t \Rightarrow \Delta t = 0{,}3\ sec$$

$$t_2 = t_1 + \Delta t = 0{,}8\ sec$$

ΟΕΦΕ

Δ4) $S_{cm_1} = \frac{1}{2} a_{cm} t_1^2 = \frac{1}{4} m = 0,25\,m$

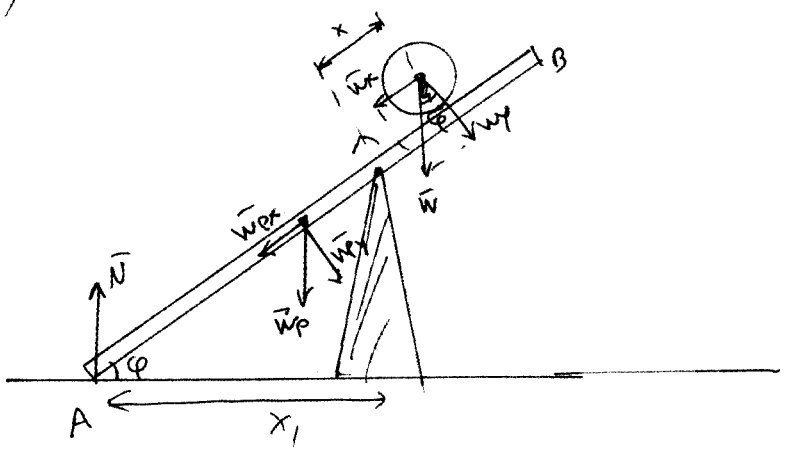
$S_{cm_2} = U_0 \Delta t - \frac{1}{2} |a_{cm}| \Delta t^2$

$S_{cm_2} = 0,3 - \frac{1}{2} \frac{10}{8} \cdot \frac{9}{100}$

$S_{cm_2} = 0,15\,m$

$S_{o\lambda} = S_{cm_1} + S_{cm_2} = 0,4\,m$

Δ5)



$\Sigma \tau_{(\Gamma)} = 0 \Rightarrow$

$- w_g \cdot x + w_{py} \cdot (\Gamma\Delta) - N \cdot x_1 = 0$

$N \cdot (A\Gamma) \eta\mu\varphi = \mu_p g \sigma\upsilon\nu\varphi \cdot (\Gamma\Delta) - \mu_K g \sigma\upsilon\nu\varphi \cdot x \Rightarrow$

$N \cdot \frac{5}{2} = 2 \cdot 10\ 0,2 - 2 \cdot 10\ x$

$N \cdot \frac{5}{2} = 4 - 20x \Rightarrow$

$5N = 8 - 40x \Rightarrow$ $\boxed{N = \frac{8 - 40x}{5}\ (S.I.)}$ (10)

ΟΕΦΕ

* ράβδος μπορεί να ανατραπεί όταν κύλινδρος περάσει το (Γ).

$S_{o\lambda} = 0,4\,m$

$x_{max} = S_{o\lambda} - \Gamma\Delta \Rightarrow x_{max} = 0,4 - 0,2 = 0,2\,m$

(20) $\Rightarrow N = \frac{8-8}{5} = 0$

Μολις που δεν ανατρέπεται