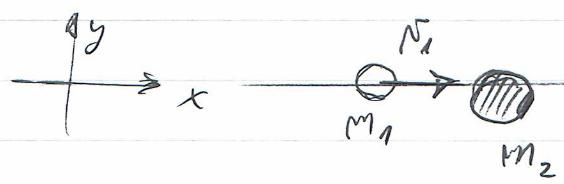
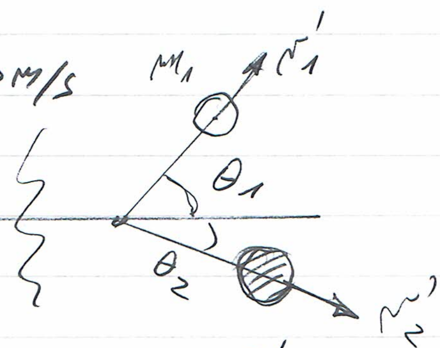
Física 1 - Tecnólogo - 2do parcial 28/11/2019

Ejercicio 1

$m_1 = 1\,kg$ $m_2 = 3\,kg$ $\theta_1 = 50°$ $v_1' = 2\,m/s$

$v_1 = 6\,m/s$





Conservación en P_x: $m_1 v_1 = m_1 v_1' \cos\theta_1 + m_2 v_{2x}'$

$\Rightarrow 6 = 1,29 + 3 v_{2x}' \Rightarrow v_{2x}' = 1,57\,\frac{m}{s}$

Conservación en P_y: $0 = m_1 v_1' \operatorname{sen}\theta_1 - m_2 v_{2y}' \Rightarrow$

$\Rightarrow 0 = 1.53 - 3 v_{2y}' \Rightarrow v_{2y}' = 0,51\,m/s$

a) $v_2' = \sqrt{v_{2x}'^2 + v_{2y}'^2} = 1,65\,m/s$ $\theta_2 = \operatorname{atan}\frac{v_{2y}'}{v_{2x}'} \approx 18°$

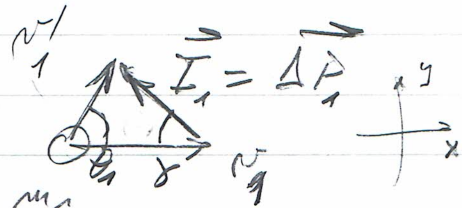
$K_{ini} = \frac{1}{2} m v_1^2 = 18\,J$ $K_{fin} = \frac{1}{2} m_1 v_1'^2 + \frac{1}{2} m_2 v_2'^2$

$K_{fin} = 2 + 4,08 = 6,08\,J \Rightarrow \Delta K = 6,08 - 18 = -11,92$

b) Se invirtieron 11,92 J en la deformación

$\vec{I}_1 = \Delta \vec{P}_1 \Rightarrow I_{1x} = \Delta P_{1x} = m_1 v_{1x}' - m_1 v_1$

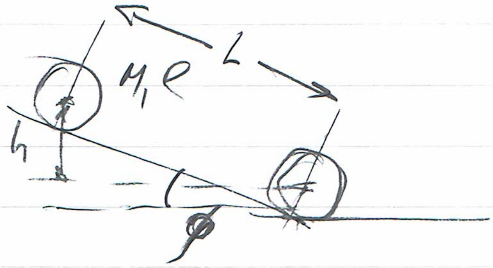
$I_{1x} = m_1 v_1' \cos\theta_1 - m_1 v_1 = -4,71\,kg\frac{m}{s}$



$I_{1y} = \Delta P_{1y} = m_1 v_{1y}' - 0 = m_1 v_1' \operatorname{sen}\theta_1 = 1,53\,kg\,m/s$

c) $I_1 = \sqrt{I_{1x}^2 + I_{1y}^2} = 4,95\,kg\,m/s$ $\gamma = \operatorname{atan}\left|\frac{I_{1y}}{I_{1x}}\right| \approx 18°$

Ejercicio 2



Conservación de la energía:

$$K_{final} = U_{inicial} \Rightarrow \frac{1}{2}Mv_{cm}^2 + \frac{1}{2}I\omega^2 = Mgh$$

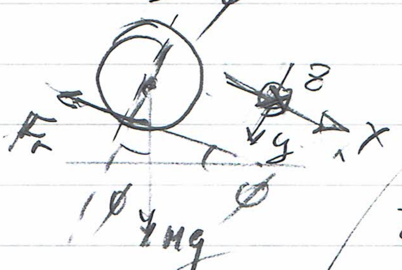
$$\omega = v_{cm}/R \Rightarrow \frac{1}{2}Mv_{cm}^2 + \frac{1}{2}\frac{I}{R^2}v_{cm}^2 = Mgh$$

$$\frac{1}{2}v_{cm}^2\left(M + \frac{I}{R^2}\right) = Mgh \Rightarrow v_{cm}^2 = \frac{2Mgh}{M + I/R^2}$$

$$v_{cm} = \sqrt{\frac{2gh}{1 + I/MR^2}} \Rightarrow \text{Cilindro } I = \frac{1}{2}MR^2 \Rightarrow$$

a) $\boxed{v_{cm}^{(cil)} = \sqrt{\frac{4gh}{3}}}$ anillo: $I = MR^2 \Rightarrow \boxed{v_{cm}^{(an)} = \sqrt{gh}}$

$$L = \frac{1}{2}a_{cm}t^2 = \frac{h}{\operatorname{sen}\phi} \Rightarrow t = \sqrt{\frac{2h}{a_{cm}\operatorname{sen}\phi}}$$



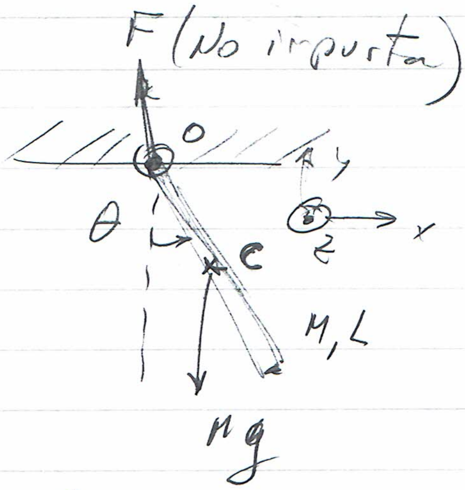
$$F_x = Mg\operatorname{sen}\theta - F_r = Ma_{cm}$$

$$\tau_z = F_r R = I\alpha = I\frac{a_{cm}}{R} \Rightarrow$$

$$\Rightarrow F_r = \frac{I a_{cm}}{R^2} \longrightarrow Mg\operatorname{sen}\theta - \frac{I}{R^2}a_{cm} = Ma_{cm}$$

$$g\operatorname{sen}\theta - \frac{I}{MR^2}a_{cm} = a_{cm} \Rightarrow a_{cm} = \frac{g\operatorname{sen}\theta}{1 + I/MR^2}$$

b) Cilindro $I = \frac{1}{2}MR^2 \Rightarrow a_{cm} = \frac{2g\operatorname{sen}\theta}{3} \Rightarrow \boxed{t = \frac{1}{\operatorname{sen}\theta}\sqrt{\frac{3h}{g}}}$



Ejercicio 3

$$\tau_0 = -Mg\frac{L}{2}\operatorname{sen}\theta = I_0\ddot{\theta}$$

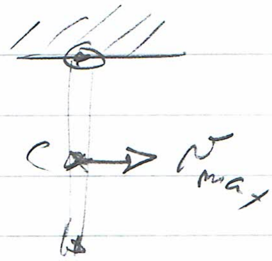
$$\ddot{\theta} + \frac{ML}{2I_0}\operatorname{sen}\theta = 0$$

pequeñas oscilaciones $\operatorname{sen}\theta \simeq \theta \Rightarrow$

$$\ddot{\theta} + \frac{MgL}{2I_0}\theta = 0 \qquad I_0 = I_c + M\left(\frac{L}{2}\right)^2 = \frac{1}{12}ML^2 + \frac{ML^2}{4}$$

$$I_0 = \frac{1}{3}ML^2 \Rightarrow \boxed{\ddot{\theta} + \frac{3g}{2L}\theta = 0} \quad a)$$

$$\omega = \sqrt{\frac{3g}{2L}} = \frac{2\pi}{T} \Rightarrow \boxed{T = 2\pi\sqrt{\frac{2L}{3g}}} \quad b)$$



$$\theta(t) = \theta_0 \cos\omega t \qquad \dot{\theta}(t) = -\omega\theta_0 \operatorname{sen}\omega t$$

$$\dot{\theta}_{máx} = \omega\theta_0 = v_{max}/(L/2)$$

$$\boxed{v_{max} \simeq \frac{L}{2}\omega\theta_0 \simeq \frac{\theta_0}{2}\sqrt{\frac{3gL}{2}}} \quad c)$$

$$\boxed{\text{ó} \quad v_{max} = \frac{1}{2}\sqrt{3gL(1-\cos\theta_0)}}$$

Conservación energía sin aproximación de pequeñas oscilaciones