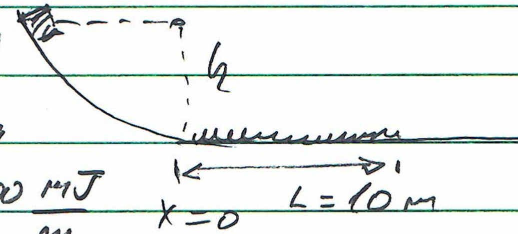
EXAMEN Física 1. Tecnólogo Mecánico - 17/02/2021

Ejercicio 1

$m = 200g$ $h = 1,5\ m$

$L = 10\ m$ perdida de energía en zona rugosa: $300\ \frac{mJ}{m}$



$E_i = mgh = 0,2 \times 9,8 \times 1,5 = 2.94\ J$

Energía perdida si atravesara toda la zona rugosa

$\Delta E = 300\ \frac{mJ}{m} \times L = 0,3\ \frac{J}{m} \times 10\ m = 3\ J \Rightarrow$

(a) No la alcanza. Se detiene antes de salir

Distancia recorrida: $2,94\ J = 0,3\ \frac{J}{m}\ x \Rightarrow x = 9,8\ m$

$- W_{roz} = 2.94\ J = F_r \cdot x \Rightarrow F_r = \frac{2,94}{9,8} = 0,3\ N$

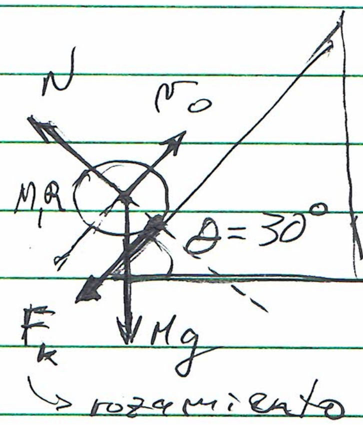
(b) $\mu_k = \frac{F_r}{N} = \frac{F_r}{mg} = \frac{0.3}{0.2 \times 9,8} = \boxed{0.15}$

Ejercicio 2

$N = Mg\cos\theta$

(i) $Mg\,\mathrm{sen}\,\theta + F_k = -Ma$

(ii) $F_k R = I_c \dfrac{d\omega}{dt}$



$F_k = \mu_k N = \mu_k Mg\cos\theta$

de (i) → $Mg\,\mathrm{sen}\,\theta + \mu_k Mg\cos\theta = -Ma$ →

(iii) $g\,\mathrm{sen}\,\theta + \mu_k g\cos\theta = -a$

de (ii) → $\mu_k Mg\cos\theta \cdot R = \dfrac{2}{5}MR^2\dfrac{d\omega}{dt} \Rightarrow \mu_k g\cos\theta = \dfrac{2}{5}R\dfrac{d\omega}{dt}$

$\dfrac{d\omega}{dt} = \dfrac{5\mu_k g\cos\theta}{R} \Rightarrow \omega(t) = \underset{0}{\omega_0} + \dfrac{5\mu_k g\cos\theta}{R}t$

(iv) $\omega(t) = \dfrac{5\mu_k g\cos\theta}{R}t$

de (iii) $\dfrac{dv}{dt} = -g\,\mathrm{sen}\,\theta - \mu_k g\cos\theta \Rightarrow v(t) = v_0 - g(\mathrm{sen}\,\theta + \mu_k\cos\theta)t$

v_f = velocidad final (empieza la rodadura)

$v_f = \omega_f R \Rightarrow v_0 - g(\mathrm{sen}\,\theta + \mu_k\cos\theta)t_f = \dfrac{5\mu_k g\cos\theta}{R}t_f R$

$\Rightarrow t_f = \dfrac{v_0/g}{\mathrm{sen}\,\theta + \frac{7}{2}\mu_k\cos\theta}$

$\mathrm{sen}\,30° = \dfrac{1}{2}$ $\quad\cos 30° = \sqrt{3}/2$ $\Rightarrow \boxed{t_f = \dfrac{4v_0}{9g}}$ (a)

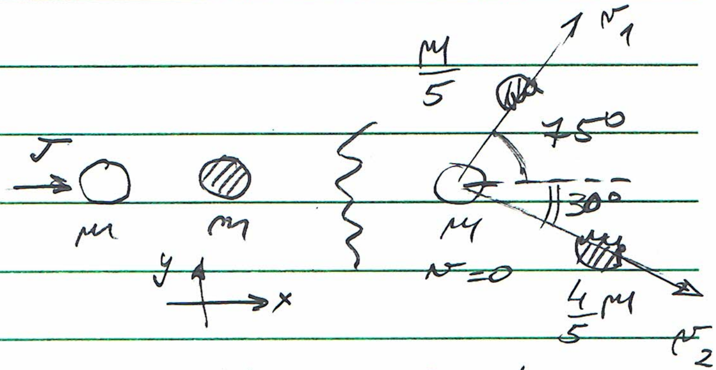
Ejercicio 2 (continuación)

$$x = v_0 t_f + \frac{1}{2} a t_f^2 \qquad a = -g \,\text{sen}\,\theta - g \mu_k \cos\theta$$

$$a = -g \frac{1}{2} - g \frac{1}{\sqrt{3}} \frac{\sqrt{3}}{2} = -g \qquad t_f = \frac{4 v_0}{9g} \text{ [parte (a)]}$$

$$\boxed{x = \frac{28}{81} \frac{v_0^2}{g}} \quad \text{(b)}$$

Ejercicio 3



$$J = m v_0 \Rightarrow v_0 = \frac{J}{m}$$

(a) $$v_0 = \frac{0{,}16}{0{,}20} = 0{,}8 \frac{m}{s}$$

Conservación de P_x: $$m v_0 = \frac{m}{5} v_1 \cos 75^\circ + \frac{4}{5} m v_2 \cos 30^\circ$$

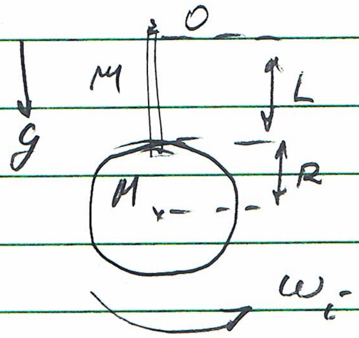
$$\Rightarrow 5 v_0 = v_1 \cos 75^\circ + 4 v_2 \cos 30^\circ \Rightarrow 4 = v_1 \times 0{,}26 + v_2 \times 3{,}46 \text{ (i)}$$

Conservación de P_y: $$\frac{m}{5} v_1 \,\text{sen}\, 75^\circ = \frac{4}{5} m v_2 \,\text{sen}\, 30^\circ$$

$$\Rightarrow v_2 = \frac{v_1}{4} \frac{\text{sen}\, 75^\circ}{\text{sen}\, 30^\circ} \Rightarrow v_2 = 0{,}48 v_1 \text{ (ii)} \Rightarrow \text{de (i) y (ii)}$$

(b) $$\boxed{v_1 = 2{,}08 \ m/s \qquad v_2 = 1{,}00 \ m/s}$$

EJERCICIO 4



$m = 0,20\ kg \quad L = R = 0,50\ m$

$M = 0,40\ kg$

$I_O = I_{vO} + I_{cO}$

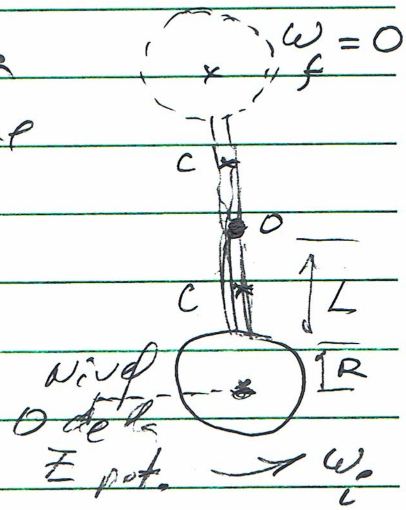
I_{vO} → varilla respecto a O; I_{cO} → cilindro respecto a O

$$I_{vO} = \frac{1}{12} mL^2 + m\left(\frac{L}{2}\right)^2 = \frac{mL^2}{3} = \frac{0,20 \times (0,50)^2}{3} = 0.02\ kgm^2$$

$$I_{cO} = \frac{1}{2} MR^2 + M(L+R)^2 = \frac{1}{2} 0,4 \times (0,5)^2 + 0,4(0,5+0.5)^2$$

$$I_{cO} = 0.45\ kgm^2 \Rightarrow I_O = 0,02 + 0.45 = \boxed{0.47\ kgm^2}$$

(a)



La mínima ω_i para que de una vuelta completa es la necesaria para que llegue arriba con $\omega_f = 0$

Conservación de la energía:

$E_i = I_O \omega_i^2 / 2 + mg(L/2 + R)$

$E_i = 0.24\ \omega_i^2 + 1.47$

$E_f = mg\left(R + L + \frac{L}{2}\right) + Mg\,2(L+R)$

$$E_f = 10.29\ J \Rightarrow E_i = E_f \Rightarrow \omega_i = \sqrt{\frac{10.29 - 1.47}{0,24}}$$

(b) $\boxed{\omega_i = 6,06\ rad/s}$