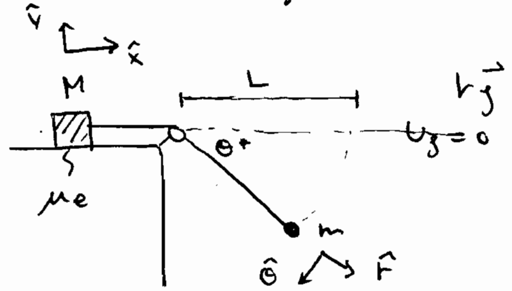
Aux 7: Trabajo y Energía II 4/4/05

P1]



Datos: M, m, L, μe

¿θ*?

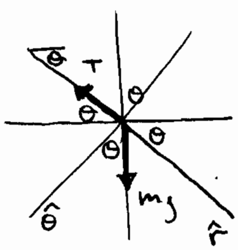
$$E_f = E_i + \underbrace{W(\vec{f}_{roce})}_{\vec{f}_{roce}\cdot\cancelto{0}{\Delta\vec{r}}}$$

$$E_i = 0$$

$$E_f = \frac{1}{2} m v^2 - m g L \sin\theta$$

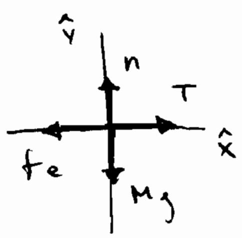
$$E_i = E_f \Rightarrow v^2 = 2 g L \sin\theta \quad (1)$$

DCL m



$$\hat{r})\ -T + m g \sin\theta = -m\frac{v^2}{L} \quad (2)$$

DCL M



$$\hat{y})\ n - Mg = 0$$

$$\hat{x})\ -\underbrace{f_e}_{\mu_e n} + T = 0$$

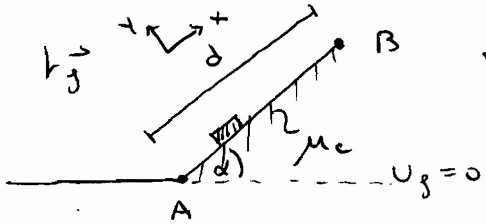
$$\Rightarrow T = \mu_e M g \quad (3)$$

(1) en (2) y (3) en (2) $\Rightarrow -\mu_e M \cancel{g} + m \cancel{g} \sin\theta^* = -\frac{m}{\cancel{L}}(2\cancel{g}\cancel{L}\sin\theta^*)$

$$\Rightarrow 3 m \sin\theta^* = \mu_e M$$

$$\Rightarrow \boxed{\sin\theta^* = \frac{\mu_e}{3}\cdot\frac{M}{m}}$$

P2]



Datos: v_0, λ, α

¿μ_c?

$$E_f = E_i + \underbrace{W(\vec{f}_{roce})}_{\vec{f}_{roce}\cdot\Delta\vec{r}} \qquad E = \frac{1}{2}mv^2 + mgh$$

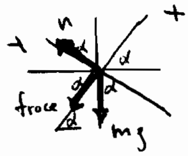
A → B:

$$E_B = E_A + \vec{f}_{roce}\cdot\Delta\vec{r}$$

$$E_B = 0 + mgd\sin\alpha$$

$$E_A = \frac{1}{2}mv_0^2 + 0$$

$$\vec{f}_{roce}\cdot\Delta\vec{r} = (-f_{roce}\,\hat{\imath})(d\,\hat{\imath}) = -\underbrace{f_{roce}}_{\mu_c\cdot n}\cdot d$$



$\hat{y})\ n - mg\cos\alpha = 0$

$\Rightarrow\ n = mg\cos\alpha$

$$\Rightarrow \cancel{m}gd\sin\alpha = \frac{1}{2}\cancel{m}v_0^2 - \mu_c\cancel{m}gd\cos\alpha$$

$$\Rightarrow \frac{1}{2}v_0^2 = gd(\sin\alpha + \mu_c\cos\alpha) \quad (1)$$

B → A:

$$E_A = E_B + \vec{f}_{roce}\cdot\Delta\vec{r}$$

$$E_A = \frac{1}{2}m(\lambda v_0)^2 + 0$$

$$E_B = 0 + mgd\sin\alpha$$

$$\vec{f}_{roce}\cdot\Delta\vec{r} = (f_{roce}\,\hat{\imath})\cdot(-d\,\hat{\imath}) = -\underbrace{f_{roce}}_{\mu_c\cdot n = \mu_c mg\cos\alpha}\cdot d$$

$$\Rightarrow \frac{1}{2}\cancel{m}\lambda^2 v_0^2 = \cancel{m}gd\sin\alpha - \mu_c\cancel{m}gd\cos\alpha$$

$$\Rightarrow \frac{1}{2}\lambda^2 v_0^2 = gd(\sin\alpha - \mu_c\cos\alpha) \quad (2)$$

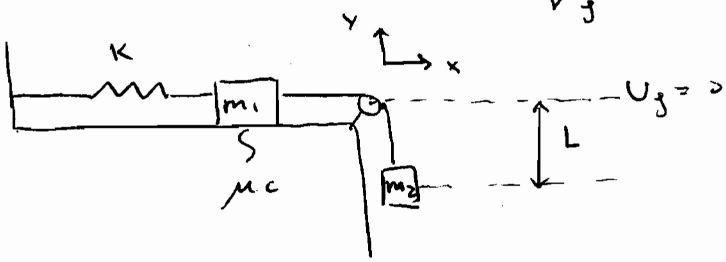
$$(2)/(1) \Rightarrow \lambda^2 = \frac{\sin\alpha - \mu_c\cos\alpha}{\sin\alpha + \mu_c\cos\alpha}$$

$$\Rightarrow \boxed{\mu_c = \frac{1-\lambda^2}{1+\lambda^2}\tan\alpha}$$

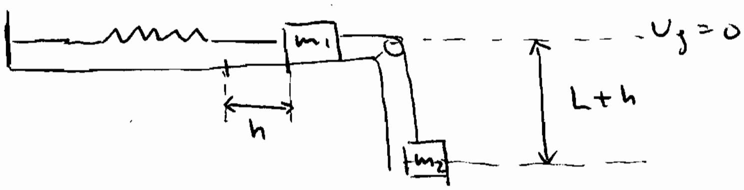
P3] Antes

Datos: m_1, m_2, K, h

¿μ_c?



Después



$$E = \underbrace{\frac{1}{2} m v^2}_{\text{e. cinética}} + \underbrace{m g h}_{\text{e. pot. gravitatoria}} + \underbrace{\frac{1}{2} K \Delta x^2}_{\text{e. pot. elástica}}$$

$$E_f = E_i + \vec{f}_{roce} \cdot \Delta \vec{r}$$

$$E_i = 0 - m_2 g L + 0$$

$$E_f = \quad - m_2 g (L+h) + \frac{1}{2} k h^2$$

$$\vec{f}_{roce} \cdot \Delta \vec{r} = (-f_{roce}\, \hat{\imath}) \cdot (h \hat{\imath}) = -\underbrace{f_{roce}}_{\mu_c m_1 g} \cdot h$$

$$\Rightarrow -m_2 g (L+h) + \frac{1}{2} K h^2 = -m_2 g L - \mu_c m_1 g h$$

$$\Rightarrow -\cancel{m_2 g L} - m_2 g h + \frac{1}{2} K h^2 = -\cancel{m_2 g L} - \mu_c m_1 g h$$

$$\Rightarrow \mu_c = \frac{m_2 g h - \frac{1}{2} K h^2}{m_1 g h}$$

$$\Rightarrow \boxed{\mu_c = \frac{m_2 g - \frac{1}{2} K h}{m_1 g}}$$