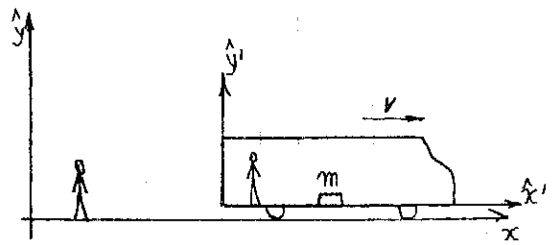
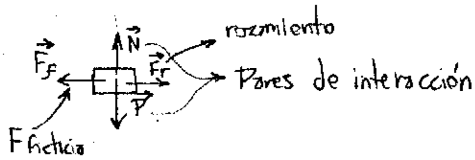
SISTEMAS NO INERCIALES

1.



① obs. no inercial (acelerado) [en el micro]

a)



$\hat{y})$ $N = m.g$

$\hat{x})$ $m.a' = \Sigma F - \underbrace{m.A}$

$0 = Fr - F_F$

$0 = Fr - m.a$

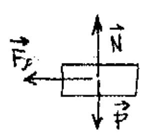
$Fr = m.a$

$m.a \leq \mu_e . m.g$

$a \leq g.\mu_e$

$\boxed{a_{max} = g.\mu_e}$

b)



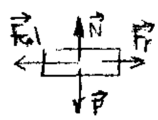
$m.a' = -F_F$

$\cancel{m}.a' = -\cancel{m}.A$

$a' = -A$

② obs. inercial [en la calle]

a)



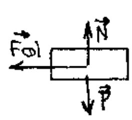
$\hat{x})$ $-F_{colectivo} + Fr = m.a$

$-m.A + Fr = m.a$

$\hat{y})$ $N - m.g = 0$

$N = m.g$

b)

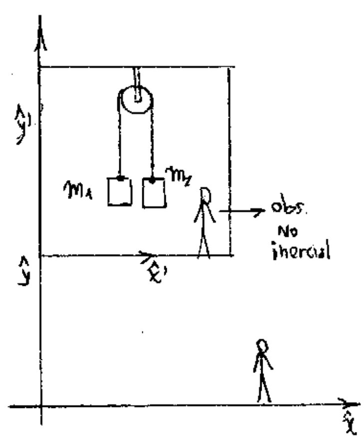


$\hat{x})$ $-F_{colec.} = m.a$

$-\cancel{m}.A = \cancel{m}.a$

$-A = a$

2.

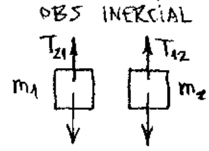


a) $V = k \Rightarrow A = 0$

OBS INERCIAL = OBS. NO INERCIAL

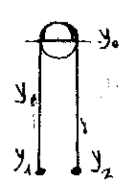
$T_{21} - T_{12} = \overbrace{m_h}^{0} . a_h$

$T_{21} = T_{12} = T$



m_1 $\hat{y})$ $-m_1.g + T = m_1.\overbrace{\ddot{y}_1}^{a'_1}$

m_2 $\hat{y})$ $-m_2.g + T = -m_2.\overbrace{\ddot{y}_1}^{a'_2}$



$L = y_0 - y_1 + y_0 - y_2 + \pi.r$

$0 = 0 - \ddot{y}_1 + 0 - \ddot{y}_2 + 0$

$\ddot{y}_1 = -\ddot{y}_2$

$-m_1.g + m_2 g = (m_1 + m_2)\ddot{y}_1$

$\boxed{\frac{(m_2 - m_1).g}{(m_1 + m_2)} = \ddot{y}_1}$

b) $A = a$ $\qquad$ $m.a' = \sum F - m.A$

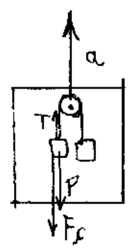
OBS. NO INERCIAL $\qquad$ OBS. INERCIAL

$m_1 \quad \hat{y})\ (T - m_1.g) - m_1.A = m_1\ddot{y}_1 \qquad m_1 \quad \hat{y})\ T - m_1.g - m_1.A = m_1.\ddot{y}_1$

$m_2 \quad \hat{y})\ T - m_2.g - m_2A = -m_2.\ddot{y}_1 \qquad m_2 \quad \hat{y})\ T - m_2.g - m_2.A = -m_2.\ddot{y}_1$

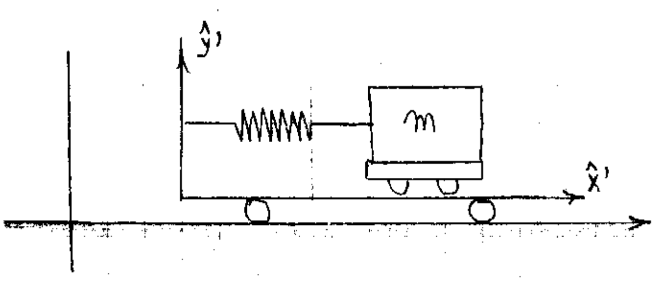
$$-m_1 g + m_2 g = (m_1 + m_2).\ddot{y}$$

$$\boxed{\frac{(m_2 - m_1)}{(m_1 + m_2)}(g + A) = \ddot{y}_1}$$

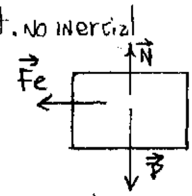


c)

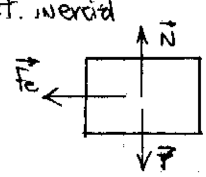
3.



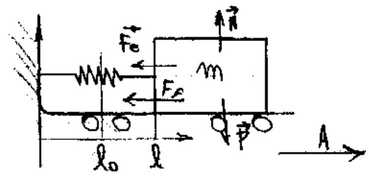
a) sist. no inercial



sist. inercial



b) es oscilatorio; armónico simple



$\hat{x})$ obs. no inercial

$$m.\ddot{x} = -k(l-l_0) - m.A$$

$$m(\ddot{x}+A) = -k.(x-l_0)$$
$$= -\frac{k}{m}.x + \frac{k}{m}l_0$$

$\hat{y})$ $N - m.g = 0$

$N = m.g$

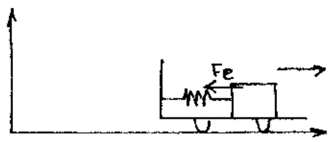
$a' = a - A$

$$\ddot{x} + \frac{k}{m}x = \frac{k}{m}.l_0 - \underbrace{A}_{\text{Aceleración entre los dos sistemas (es constante)}}$$

sistema no inercial $\rightarrow$ $x_{s'}(t) = B_0.\cos(\underbrace{\omega}_{\sqrt{\frac{k}{m}}} t + \varphi) + l_0 - A.\frac{m}{k}$

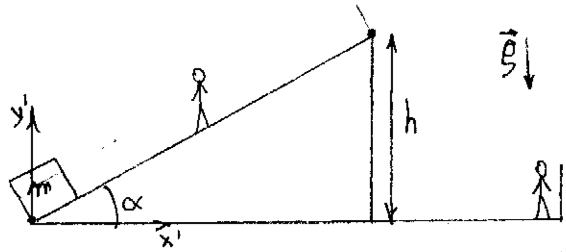
sistema inercial $\rightarrow$ $x_s(t) = \frac{1}{2}.A.t^2 + x_{s'}(t)$

c)

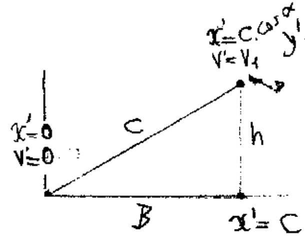


$\hat{x})$ $=$

4.



$\vec{g}\downarrow$



$x' = C.\cos\alpha$

$\text{sen}\ \alpha = \frac{h}{c}$

$\cos\alpha = \frac{B}{C}$

$C = \frac{h}{\text{sen}\ \alpha}$

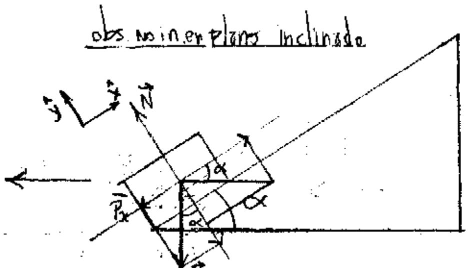
$$x(t) = \overset{0}{x_0} + \overset{0}{V_0}t + \frac{a}{2}t^2$$

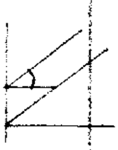
$D = \frac{a}{2}t^2$

$\cos\alpha = B$

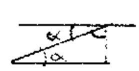
$\frac{a}{2}t^2 \cos\alpha = B$

obs. no iner. plano inclinado





$$m.\vec{a}' = \sum\vec{F} - m.\vec{A}$$



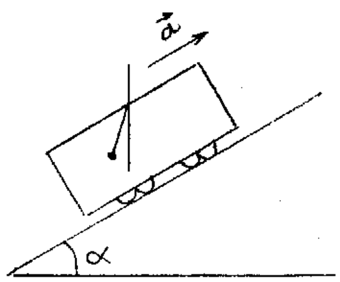
$\hat{x}')$ $\frac{m}{}$

$$m.a' = -m.g.\text{sen}\ \alpha - (-m.A.\cos\alpha)$$

$$a' = -g.\text{sen}\ \alpha + A.\cos\alpha$$
$$a' = -g.\frac{h}{c} + A.\frac{B}{c}$$
$$a' + g\frac{h}{c} = A.\frac{B}{c}$$
$$\frac{C}{B}.a' + g.\frac{h}{B} = A$$

$$\frac{a'}{\cos\alpha} + g.tg\ \alpha = A$$

5.



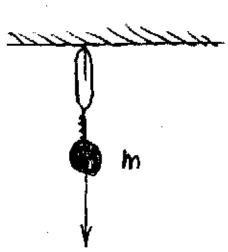
i) $\alpha = 0$ $\quad a \neq 0$

a)

la plomada se aparta de la vertical debido a la $\vec{a}$ (pero para los del interior del vagón por una F_f)

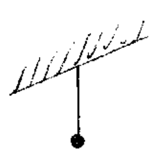
b)

c)



ii) $\alpha \neq 0$ $\quad a = 0$

a)

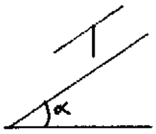


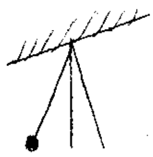
la plomada señala la vertical del lugar

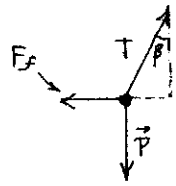
b)

iii) $\alpha \neq 0 \qquad a = -g \cdot \text{sen}\,\alpha$

a)







la plomada se aparta de la vertical

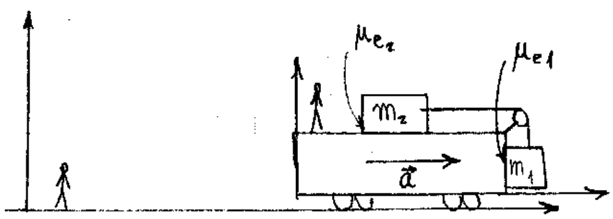
$$\left.\begin{array}{l}\hat{x})\\ \hat{y})\end{array}\right\} \begin{array}{l} 0 = T \cdot \text{sen}\,\beta - m \cdot A \\ 0 = T \cdot \cos\beta - m \cdot g \end{array}$$

$$\frac{\cancel{m}\, g}{\cancel{m}} \frac{\text{sen}\,\beta}{\cos\beta} = A$$

$$g\, tg\, \beta = A$$

b)

6.



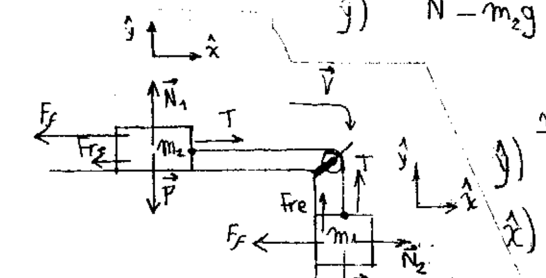
sistema no inercial (carro)

m_2

$\hat{x}) \quad (T - Fre_2) - m_2 A = m_2 \cdot \ddot{x}$

$\hat{y}) \quad N - m_2 g = 0$

$N = m_2 g$



m_1

$\hat{y}) \quad -m_1 g + T + Fre_1 = -m_1 \cdot \ddot{x}$

$\hat{x}) \quad N_2 - m_1 \cdot A = 0$

$N_2 = m_1 \cdot A$

$L = x_p - x_{m_2} + y_p - y_{m_1}$

$0 = -\ddot{x}_{m_2} - \ddot{y}_{m_1}$

$\ddot{x} = -\ddot{y}$

① si $\vec{v} \rightarrow$

$-Fre_2 - m_2 A + m_1 g - Fre_1 = (m_1 + m_2) \cdot \ddot{x}$

$Fre_2 + Fre_1 = -m_2 A + m_1 g$

$m_1 g - m_2 A = |Fre_2 + Fre_1|$

$m_1 g - m_2 A \leq \mu_{e2} \cdot m_2 \cdot g + \mu_{e1} \cdot m_1 \cdot A$

$(m_1 - \mu_e m_2)\, g \leq (\mu_{e1} m_1 + m_2)\, A$

$$\boxed{A \geq g \frac{(m_1 - \mu_e m_2)}{(\mu_e m_1 + m_2)}}$$

② si $\leftarrow \vec{V}$

$Fre_2 - m_2 A + m_1 g + Fre_1 = (m_1 + m_2) \cdot \ddot{x}$

$Fre_2 + Fre_1 = (m_2 A - m_1 g)$

$m_2 A - m_1 g \leq \mu_{e2} \cdot m_2 \cdot g + \mu_{e1} m_1 A$

$A\, (m_2 - \mu_{e1} m_1) \leq g\, (\mu_{e2} \cdot m_2 + m_1)$

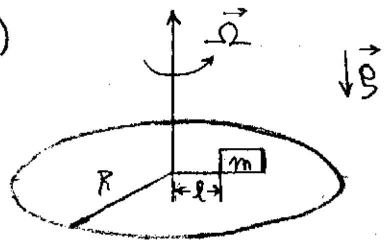
$$\boxed{A \leq g \frac{(\mu_e m_2 + m_1)}{(m_2 - \mu_{e1} m_1)}}$$

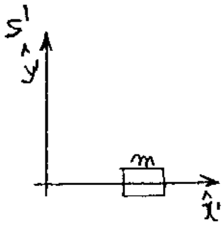
7. En la carpeta

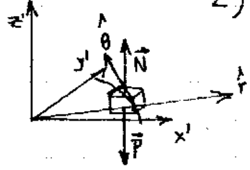
8.

$$\vec{\Omega} = k \quad \Rightarrow \quad \dot{\vec{\Omega}} = 0$$

a)







S' (No inercial)

$\hat{r}$) $0 = -Fre + m.\omega^2.l$

$\hat{\theta}$) $0 = 0$

$\hat{z}$) $0 = -m.g + N_z \Rightarrow N_z = m.g$

Coriolis

$$2\,\vec{\Omega} \times \vec{V} = 2\,\Omega\,\hat{z} \times 0 = 0$$

Centrífuga

$$\vec{\Omega} \times (\vec{\Omega} \times \vec{r}) = \vec{\Omega} \times \left(\omega\,\hat{z} \times l.\hat{r}\right)$$

$$\omega\hat{z} \times -\omega.l\,\hat{\theta}$$

$$-\omega^2.l.\hat{r}$$

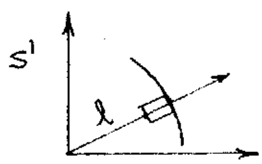
b)

$$Fre = m.\omega^2.l \leq \mu_e.m.g$$

$$\omega^2 \leq \frac{\mu_e.g}{l}$$

$$|\vec{\Omega}| = \omega \leq \sqrt{\frac{\mu_e.g}{l}} \qquad \boxed{\Omega_{max} = \sqrt{\frac{\mu_e.g}{l}}}$$

c)



$\hat{r}$) $\cancel{m}.a'_r = \cancel{m}.\omega^2.l - \ddot{l}\,m$

$\hat{\theta}$) $\cancel{m}.a'_\theta = -2\,\omega.\dot{l}.\cancel{m}$

Coriolis

$$2\,\vec{\Omega} \times \vec{V} = 2.\Omega\,\hat{z} \times \dot{l}.\hat{r} = 2\Omega.\dot{l}.\hat{\theta}$$

$$\vec{V}_{s'} = \dot{\vec{l}}$$

$$\vec{V} = \dot{\vec{l}} + \vec{\Omega} \times \vec{r}$$

$$\omega.\hat{z} \times l.\hat{r}$$

$$\vec{V} = \dot{\vec{l}} + \omega.l.\hat{\theta}$$

$$\dot{\vec{l}} = \vec{V} - \omega\,l.\hat{\theta}$$