⑦

$S = \{1,2\}$ $\quad \sum \bar{F}_{ext} = \bar{0} \rightarrow \bar{p}_S = cte$

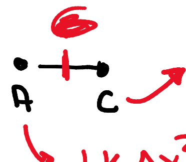
$$m_1 V_{01} + m_2 \underbrace{V_{02}}_{=0} = (m_1 + m_2) V_{12F}$$

$$V_{12F} = \frac{m_1}{m_1 + m_2} V_{01} = \frac{V_{01}}{2}$$

2-3

$$\begin{cases} \frac{1}{2} m_1 V_{120}^2 + \frac{1}{2} m_3 V_{30}^2 = \frac{1}{2} m_1 \underbrace{V_{12F}^2} + \frac{1}{2} m_3 \underbrace{V_{3F}^2} \\ m_{12} V_{120} + m_3 V_{30} = m_{12} \underbrace{V_{12F}} + m_3 \underbrace{V_{3F}} \end{cases}$$

⑥



mgh

$\frac{1}{2} K \Delta x^2$

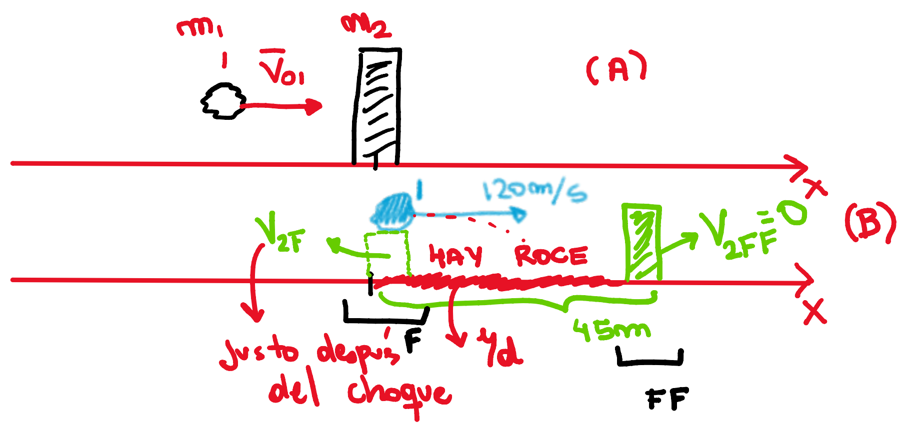
$\Delta E_p = mg(h_C - h_B)$

⑨ Una bala de 4g se mueve horizontalmente con velocidad de 400m/s y choca con un bloque de madera de 0.8kg que se encuentra en reposo sobre una superficie plana. La bala atraviesa el bloque y sale con su rapidez reducida a 120m/s. Luego de recibir el impacto, el bloque se desliza una distancia de 45m sobre la superficie con respecto a su posición inicial.

(a) ¿Qué coeficiente de rozamiento dinámico hay entre el bloque y la superficie?

(b) ¿En cuánto se reduce la energía cinética de la bala?

(c) ¿Qué energía cinética tiene el bloque en el instante en que la bala sale de él?



- $\Delta E_c \underset{m_2}{(\text{bloque})} = W_{F_T}$

- $\Delta E_M (\text{bloque}) = W_{FR} + \overbrace{W_N}^{0} = W_{FNC}$ $\quad \bar{N} \perp d\bar{r}$

• $\underbrace{\Delta E_M (\text{bloque})} = W_{FR} + W_N = W_{FNC}$

$$\frac{1}{2} m_2 V_{2FF}^2 + m_2 g\, h_{2FF} - \frac{1}{2} m_2 V_{2F}^2 - m_2 g\, h_{2F}$$

$$\frac{1}{2} m_2 (\underbrace{V_{2FF}^2}_{=0} - V_{2F}^2) = -\frac{1}{2} m_2 \underbrace{V_{2F}^2}_{\text{justo luego del choque}}$$

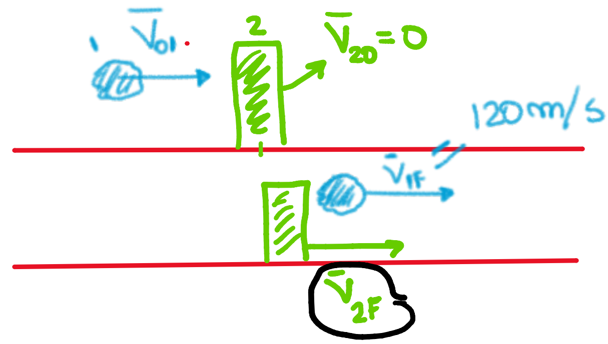
$m_2 g = N$

$\mu_d N = F_R = cte$

$$W_{FR} = |\bar{F}_R^{(d)}|\,|\Delta x|\,\overbrace{\cos(\gamma)}^{-1} = -\mu_d N \underbrace{|\Delta x|}_{L=45m} = -\mu_d m_2 g L$$

$\bar{F}_R$ $\bar{d}F$ $180 = \pi$

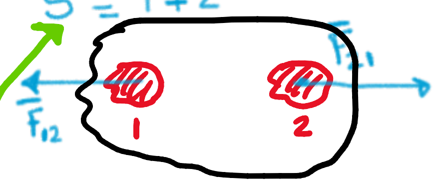
$$-\frac{1}{2} m_2 \underbrace{V_{2F}^2}_{?} = -\mu_d m_2 \underbrace{g}_{>0} L \to \boxed{\mu_d = \frac{V_{2F}^2}{2gL}} \to \text{justo luego del choque}$$



Choque

AFUERA

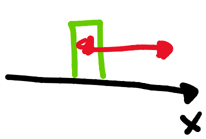
$S = 1+2$



$$\frac{d\bar{P}_S}{dt} = \frac{d(m_S \bar{V}_S)}{dt} = m_S \bar{A}_S = \bar{F}_{ext}$$

$$\bar{0} = \Sigma \bar{F}_{ext} = \frac{d\bar{P}_S}{dt} \to \bar{P}_S = \overline{cte}$$

$\bar{p}_1 + \bar{p}_2 + \bar{p}_3 = \overline{cte}$ Momento lineal se conserva siempre que $S = \{1, 2\}$



$$m_1 V_{10} + m_2 \underbrace{V_{20}}_{=0} = m_1 \underbrace{V_{1F}}_{120m/s} + m_2 V_{2F}$$

$$V_{2F} = \frac{m_1}{m_2}(V_{10} - V_{1F}) = 1{,}4\ m/s$$ = Velocidad del bloque justo después del choque

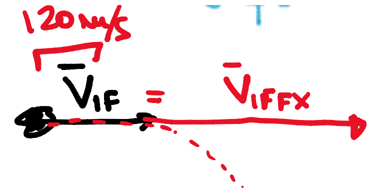
$$\boxed{\mu_d = \frac{V_{2F}^2}{2gL} = 0{,}0022}$$

120 m/s

$\bar{V}_{1F} = \bar{V}_{1FFV}$

$$\boxed{\mu_d = \frac{\quad}{2gL} = 0{,}0022}$$

b) $\Delta E_c(m_1) = \frac{1}{2} m_1 \underbrace{V_{1F}^2}_{120\,m/s} - \frac{1}{2} m_1 \underbrace{V_{10}^2}_{400\,m/s}$



c) $E_c(m_2)_F = \frac{1}{2} m_2 \underbrace{V_{2F}^2}$

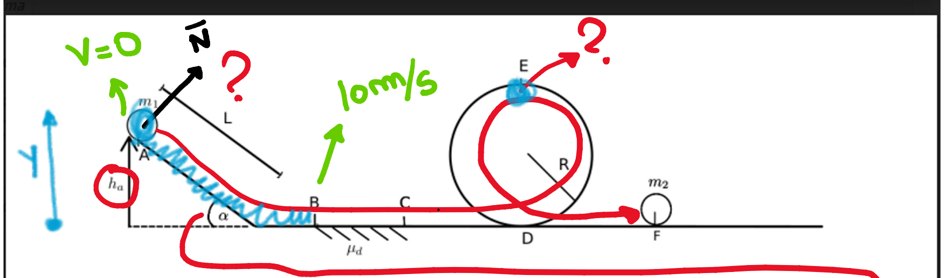
$\Delta E_{M_2}^{F,FF}$, $\Delta E_{M_2}^{i,F} = \underbrace{W_{F_{12}}} = \underbrace{F_{12}}_{\Delta t \ll 1} \overbrace{\Delta x}^{\sim 0} = 0$

Se suelta una masa m_1 desde lo alto de un plano inclinado de ángulo α y longitud L. Luego de realizar el recorrido ABCDEDF (únicamente en la región BC existe rozamiento ~~dinámico~~ con coeficiente μ_d), la masa impacta plásticamente con una segunda masa m_2, la cual se encuentra en reposo (asuma que el choque es totalmente plástico). → "quedan unidos"

a) Calcule la longitud L que debe tener el plano inclinado para que la masa m_1 llegue al punto B con una velocidad v_B. ¿Qué velocidad tiene en C?

b) Determine la velocidad en el punto E. ¿Cuánto vale la fuerza normal en ese punto?

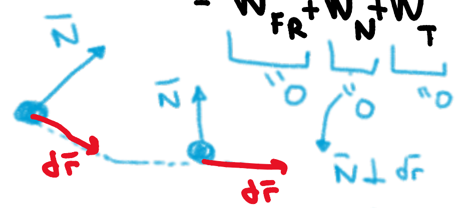
c) Calcule las velocidades de las masas luego del choque.



Datos del problema: $v_B = 10$ m/s, $m_1 = 1$ kg, $m_2 = 1$ kg, μ_d=0.3, $\Delta x_{BC} = 2$ m, $R = 1$ m, $\alpha = 30°$.

a) $\Delta E_M^{A\to B} = W_{FNC}^{A\to B} = 0$

$= \underbrace{W_{FR}^{AB}}_{"0"} + \underbrace{W_N^{AB}}_{"0"} + \underbrace{W_T^{AB}}_{"0"}$



$E_M^B = \frac{1}{2} m_1 \underbrace{V_B^2}_{10\,m/s} + m_1 g \overbrace{h_B}^{"0"}$

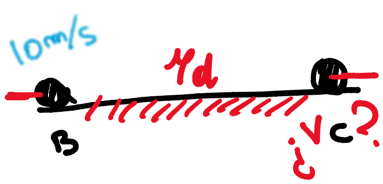
$E_M^A = \frac{1}{2} m_1 \underbrace{V_A^2}_{"0"} + m_1 g h_A$

$\Delta E_M^{AB} = \frac{1}{2} \cancel{m_1} \underbrace{V_B^2}_{10\,m/s} - \cancel{m_1} g h_A = 0 \rightarrow \boxed{h_A = \frac{V_B^2}{2g}} = \frac{(10\,m/s)^2}{2 \cdot 10\,\frac{m}{s^2}} = \frac{100}{20} = 5m$

$\Delta E_M^{iF} = W_{FNC}$

$\operatorname{sen}\alpha = \frac{h_A}{L} \rightarrow L = \frac{h_A}{\operatorname{sen}\alpha} = \frac{5m}{\underbrace{\operatorname{sen}(30)}_{0,5}} = \frac{5m}{0,5} = 10m$

DR



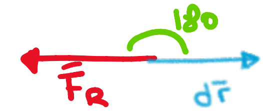
$\underbrace{\Delta E_M^{BC}}_{E_M^C - E_M^B} = W_{FNC}^{BC} = \underbrace{W_N^{BC}}_{"0"\ \vec N \perp d\vec r} + \underbrace{W_{FR}^{BC}}_{-\mu_d \underbrace{m_1 g}_{N_1} L_{BC}} = \overbrace{-\mu_d m_1 g L_{BC}}^{\text{conocido}}$

-1

B ¿V_C?

$$\underbrace{E_M^C - E_M^B}_{\frac{1}{2}m_1 V_{1C}^2 - \frac{1}{2}m_1 \underbrace{V_{1B}^2}_{10\,m/s}}$$

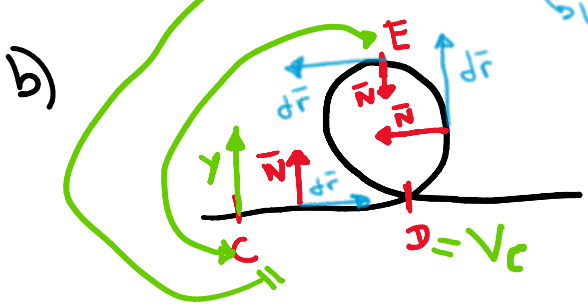
$$\underbrace{\vec{N} \perp d\vec{r}}_{=0} \qquad -\mu_d \underbrace{m_1 g}_{N_1} L_{BC} \qquad |F_R||\Delta x|\underbrace{\cos\gamma}_{-1}$$



$$\frac{1}{2}\cancel{m_1}\left(V_{1C}^2 - V_{1B}^2\right) = -\mu_d \cancel{m_1} g L_{BC}$$

$$\boxed{V_{1C}^2 = \underbrace{V_{1B}^2}_{10\,m/s} - 2\mu_d g L_{BC}}$$

b)



$$\Delta E_M^{EC} = W_{FNC}^{EC} = \overbrace{W_N^{EC}}^{\vec{N}\perp d\vec{r}} + \overbrace{W_{FR}^{EC}}^{=0} = 0$$

$$E_M^E = \frac{1}{2}m_1 V_{1E}^2 + m_1 g \underbrace{h_E}_{=2R}$$

$$E_M^C = \frac{1}{2}m_1 V_{1C}^2 + m_1 g \underbrace{h_C}_{=0}$$

$$\frac{1}{2}\cancel{m_1} V_{1C}^2 = \frac{1}{2}\cancel{m_1} V_{1E}^2 + \cancel{m_1} g 2R$$

$$\boxed{V_{1E}^2 = V_{1C}^2 - 4gR}$$

b)

$V_E = \omega R$

no se

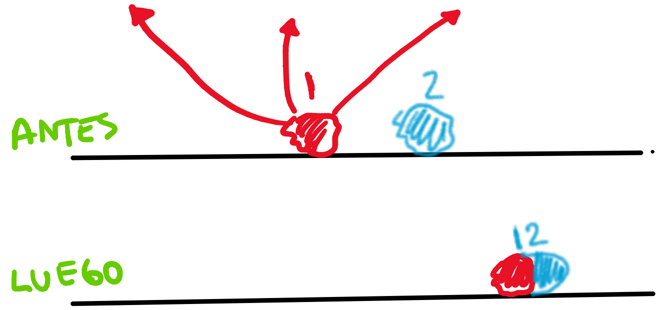
$$= -m_1 \overbrace{\omega^2}^{} R$$

$$\hat{r}: -m_1 g - N_E = -m_1 \frac{V_E^2}{R}$$

$$\boxed{N_E = m_1\left[\frac{V_E^2}{R} - g\right]} = 38\,N$$

(a) $V_C = V_D = V_F$

c)



$S = \{1,2\}$, entonces se conserva el momento lineal

$$m_1 \underbrace{V_{1A}}_{\text{conocido}} + m_2 \underbrace{V_{2A}}_{=0} = m_1 V_{1L} + m_2 V_{2L} = (m_1 + m_2)\underbrace{V_{12L}}_{?}$$

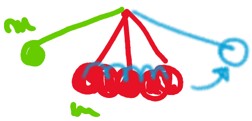
$$V_{1L} = V_{2L} = V_{12L}$$

Conocido $= V_c$ $\quad = 0$

$V_{1L} = V_{2L} = V_{12L}$

Choque plastico "quedan unidas"

$$\boxed{V_{12L} = \frac{m_1}{m_1+m_2} V_{1A} = \frac{m_1}{m_1+m_2} V_{c_1}}$$



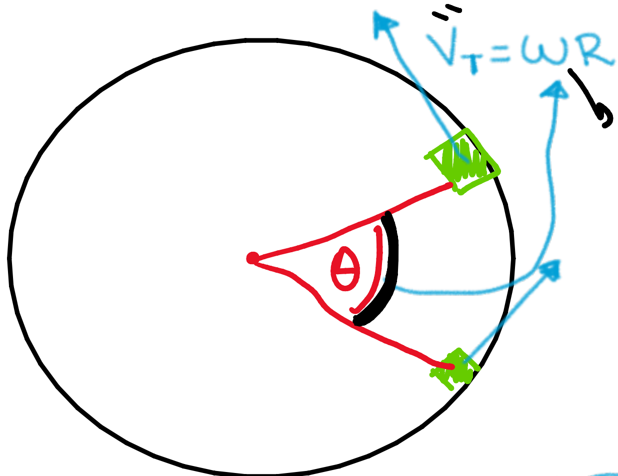
$$\overbrace{\Delta E_c}^{\neq 0} = \overset{= 0}{W_{FT}} = W_{F\,choque} \quad \Delta x \sim 0$$

$$= \underbrace{W_p}_{=0} + \underbrace{W_{F\,choque}}_{\neq 0}$$

$mg\Delta h = 0$

m/s $= V_T = \omega R$ → frecuencia angular

$\frac{RAD}{s} = \frac{Angulo}{s}$



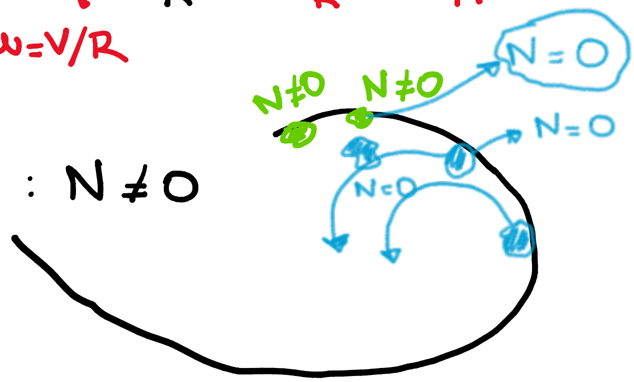
$$\boxed{V = \omega R}$$

$$|a_c| = \omega^2 R = \frac{V^2}{R} = \frac{(\omega R)^2}{R} = \frac{\omega^2 R^2}{R} = \omega^2 R$$

$\omega = V/R$

$$\boxed{V_E = \sqrt{gR}}$$ mínima

Unido al riel : $N \neq 0$



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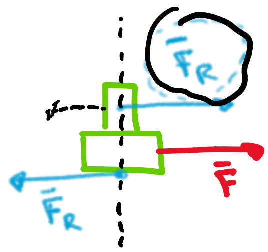
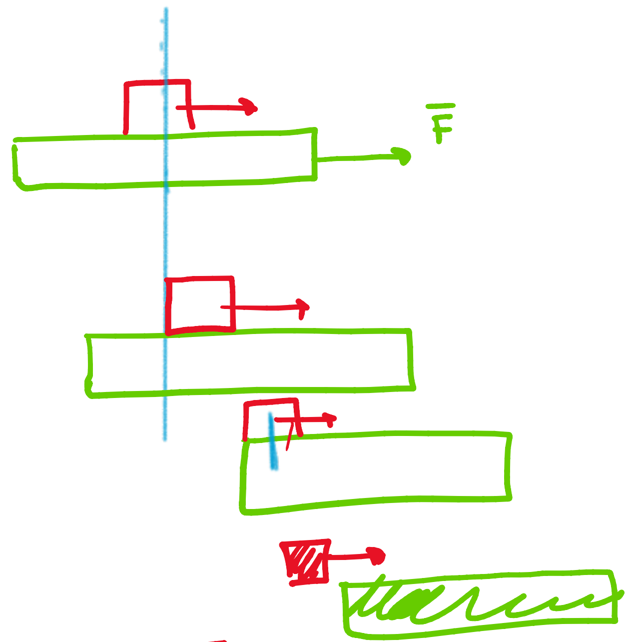
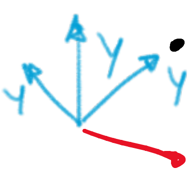




$$\frac{1}{2}m(V_F^2 - V_i^2)$$

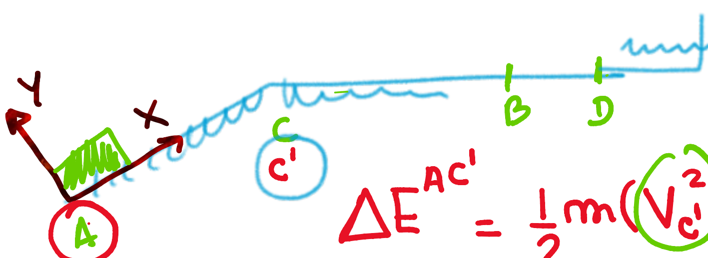
• $\Delta E_c = W_{TF} = W_p + W_{Fe} + \overbrace{W_T + W_N + W_{FR}}^{F_{NC}}$ $\quad -\mu_d m g L$



• $\Delta E_M = W_{FNC}$

$$\frac{1}{2}m(V_F^2 - V_i^2) + mg(h_F - h_i) + \frac{1}{2}k(\Delta x_F^2 - \Delta x_i^2)$$

$$\frac{1}{2}k\underbrace{(x_F - l_0)}_{\Delta x_F}{}^2 - \frac{1}{2}k\underbrace{(x_i - l_0)}_{\Delta x_i}{}^2$$



$$\Delta E^{AC'} = \frac{1}{2}m(V_{C'}^2 - V_A^2) + mg(h_{C'} - h_A)$$

$$= W_{FNC}^{AC'} = \underbrace{W_{FNC}^{AC}}_{-F_R L_{AC}} + \underbrace{W_{FNC}^{CB}}_{-F_R L_{CB}} + \underbrace{W^{BD}}_{0} + \underbrace{W^{DB}}_{0} + \underbrace{W^{BC'}}_{-F_R L_{BC}}$$