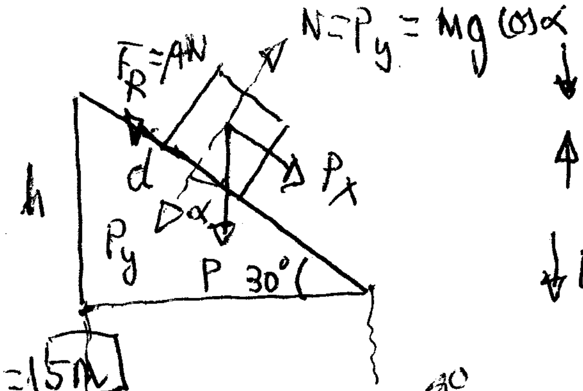
(175)

$$P_x - F_R = m \cdot a = cte$$
$$v^2 = v_0^2 + 2 a s \quad \text{MRUA}$$

a)



$\downarrow E_p$ No toda la $\downarrow E_p$

$\uparrow E_c$ pasa a $\uparrow E_c$;

$\downarrow E_m$ parte se pierde por W_{F_R}

$\operatorname{sen} 30° = \frac{h}{d}$

$h = d \cdot \operatorname{sen} 30° = 3 \cdot \frac{1}{2} = \boxed{1{,}5\,m}$

$$E_{P_A} + \cancel{E_{C_A}} + W_{F_R} = \cancel{E_{P_B}} + E_C$$

$$m g h - F_R \cdot d = \frac{1}{2} m \cdot v^2$$

$$\cancel{m} \cdot g \cdot h - (\mu \underbrace{\cancel{m} g \cdot \cos\alpha}_{N}) \cdot d = \frac{1}{2} \cancel{m} \cdot v^2$$

$$v = \sqrt{2[gh - \mu \cdot g\cos\alpha \cdot d]}$$

$$v = \sqrt{2[10 \cdot 1{,}5 - 0{,}2 \cdot 10(\cos 30°) \cdot 3]}$$

$$v = \sqrt{2 \cdot (15 - 5{,}196)}$$

$$v = 4{,}43 \text{ m/s}$$

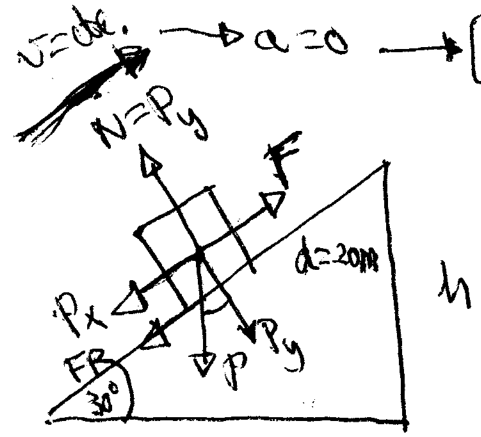
$$W_{F_R} = -F_R \cdot d = -\mu \cdot N \cdot d = -\mu \cdot P_y \cdot d =$$

$$= -\mu \cdot m g [\cos\alpha] \cdot d = -0{,}2 \cdot 5 \cdot 10 (\cos 30°) \cdot 3$$

$$W_{F_R} = -25{,}98 \text{ J}$$

191

$v = cte. \rightarrow a = 0 \rightarrow$ $\boxed{F_{resultante} = 0 \quad F = P_x + F_R}$



HAY ROZAMIENTO

$\boxed{\mu = 0'1}$

$\text{sen } 30° = \frac{h}{d}$

$h = d \cdot \text{sen } 30°$

$h = 20 \cdot 0'5 = 10m$.

apartados a) y b)

$P_x = m \cdot g \cdot \text{sen } \alpha = 200 \cdot 9'8 \cdot \text{sen } 30° = 980N$.

$F_R = \mu N = \mu mg \cdot \cos \alpha = 0'1 \cdot 200 \cdot 9'8 \cdot \frac{\sqrt{3}}{2} = 169'74N$

$F = P_x + F_R = 980N + 169'74N = 1149'74N$.

Teorema de las fuerzas vivas $\Rightarrow W_{total} = \cancel{\Delta E_c} \rightarrow 0$. $\boxed{\text{ya que } v = cte}$

$W_{P_x} = -P_x \cdot d = 980N \cdot 20m = \boxed{-19600J}$

$W_{F_R} = -F_R \cdot d = 169'74N \cdot 20m = \boxed{-3394'8J}$

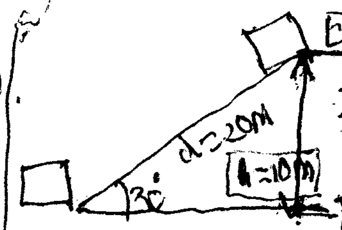
$W_F = F \cdot d = 1149'74 \cdot 20m = \boxed{22994'8J}$

$W_{total} = \Delta E_c = 0$

$W_F + W_{P_x} + W_{F_R} = 0$. $\rightarrow$ Comprobamos que el incremento de E_p es de 19600 J

$\boxed{22994'8J} - \boxed{19600J} \boxed{-3394'8J} = 0$.

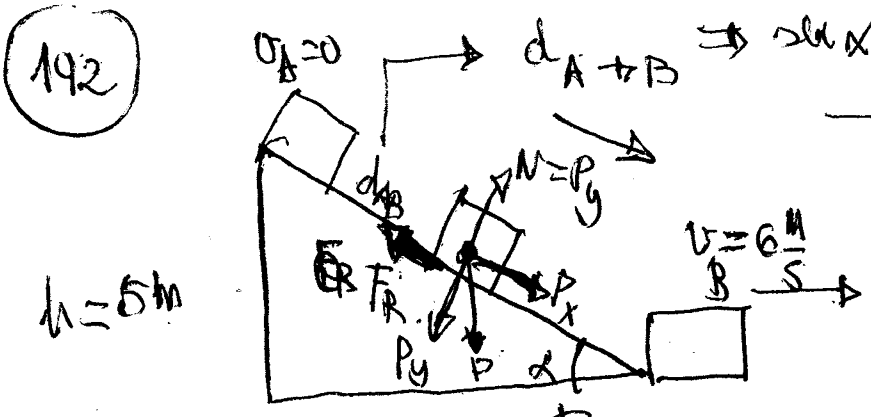
La Fuerza F realiza un trabajo que se utiliza en incrementar la E_p y en vencer al rozamiento



$E_p = m \cdot g \cdot h = 200 \cdot 9'8 \cdot 10 = 19600J$

$E_{p_A} = mg\cancel{h} = 0$

192



$\rightarrow d_{A \to B} \Rightarrow \operatorname{sen}\alpha = \frac{h}{d_{AB}} \Rightarrow d_{AB} = \frac{h}{\operatorname{sen}\alpha}$

La $E_p \downarrow$, parte de esa disminución pasa a incrementar la E_c y parte se pierde por el rozamiento transformándose en calor

$E_M A > E_M B$

$d_{AB} = \frac{h}{\operatorname{sen}\alpha} \Rightarrow \boxed{h = d_{A \to B} \cdot \operatorname{sen}\alpha}$

Trabajo realizado por la fuerza gravitatoria (peso) $\Rightarrow W_{P_x} = P_x \cdot d_{AB}$

$W_{P_x} = m \cdot g \boxed{(\operatorname{sen}\alpha) \cdot d_{AB}}$

Coincide como era de esperar con la disminución de E_p $\Rightarrow W_{P_x} = m \cdot g \cdot h$

$W_{P_x} = 2 \cdot 9'8 \cdot 5 = 98 J$

El W_{F_R} se hará por balance energético (no conocemos el ángulo de inclinación α)

$W_{total} = \Delta E_c$ (teorema de las fuerzas vivas)

$W_{P_x} + W_{F_R} = \frac{1}{2} m v_B^2 - \frac{1}{2} m \cdot \cancel{v_A^2}$ (parte del reposo)

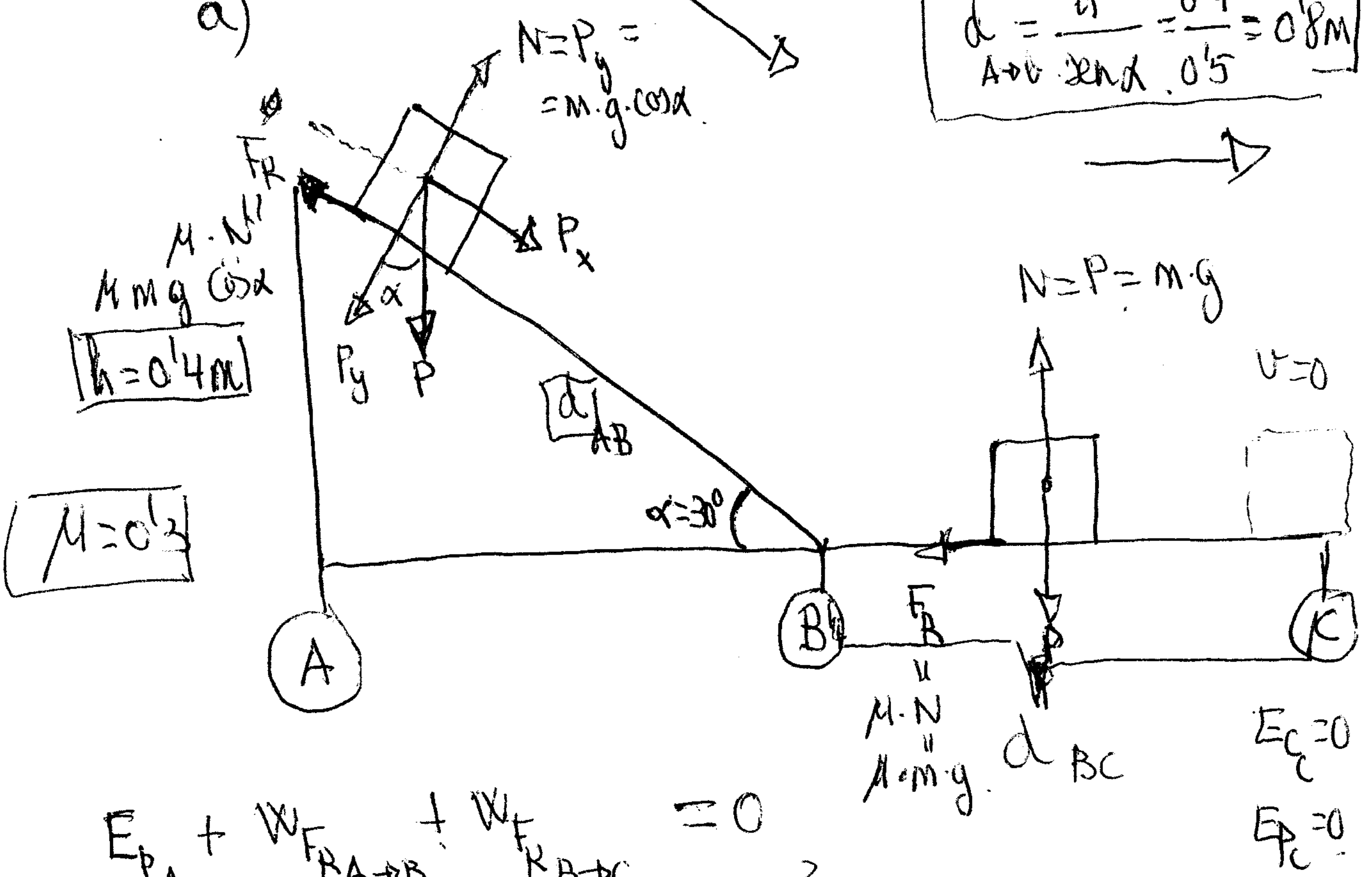
$W_{F_R} = \frac{1}{2} m \cdot v^2 - W_{P_x} = \frac{1}{\cancel{2}} \cancel{2} \cdot 6^2 - 98 = \boxed{-62 J}$

200

a)

$$\operatorname{sen}\alpha = \frac{h}{d_{A\to B}}$$

$$d_{A\to B} = \frac{h}{\operatorname{sen}\alpha} = \frac{0'4}{0'5} = 0'8\,m$$



$$E_{p_A} + W_{F_{R A\to B}} + W_{F_{R B\to C}} = 0$$

$$m\cdot g\cdot h - F_{R A\to B}\cdot d_{AB} - F_{R B\to C}\cdot d_{BC} = 0 \quad ?$$

$$m\,g\,h - [\mu\, m\, g\, \cos\alpha]\cdot d_{AB} - \mu\, m\, g\, d_{BC} = 0 \quad ?$$

$$m\,g\,h = [\mu\, m\, g\cdot\cos\alpha]\cdot d_{AB} + \mu\, m\, g\, d_{BC}$$

$$\cancel{m}\,\cancel{g}\,h = \mu\cdot\cancel{m}\cdot\cancel{g}\,[(\cos\alpha)\cdot d_{AB} + d_{BC}]$$

$$h = \mu\cdot(\cos\alpha)\cdot d_{AB} + \mu\, d_{BC}$$

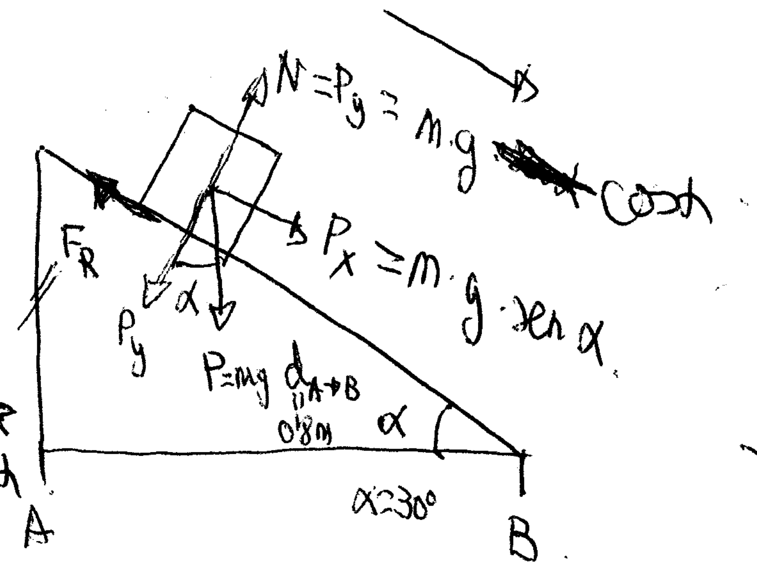
$$h - \mu\,(\cos\alpha)\cdot d_{AB} = \mu\, d_{BC}$$

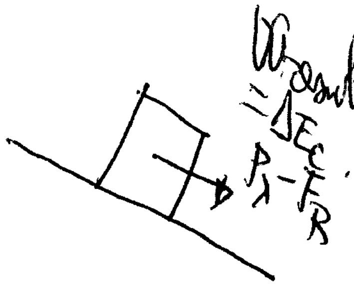
$$d_{BC} = \frac{h - \mu\cdot(\cos\alpha)\cdot d_{AB}}{\mu} = \frac{0'4 - 0'3\cdot(\cos 30)\cdot 0'8}{0'3} = 0'64\,m$$

200

b)

$F_R = \mu \cdot N = \mu\, m\, g \cdot \cos\alpha$





$$W_{P_x} = P_x \cdot d_{A\to B} = [m \cdot g \operatorname{sen}\alpha] \cdot d_{A\to B} = 5 \cdot 10 \cdot \frac{1}{2} \cdot 0'8 = \boxed{20\,J}$$

$$W_{F_R} = -F_R \cdot d_{A\to B} = \mu\, m g [\cos\alpha] \cdot d_{A\to B} = -0'3 \cdot 5 \cdot 10 \cdot \frac{\sqrt{3}}{2} \cdot 0'8 = \boxed{-10'39\,J}$$

$$W_{P_y} = P_y \cdot d \cdot \cos 90^\circ = 0$$

$$W_N = N \cdot d \cdot \cos 90^\circ = 0$$

Teorema de las fuerzas vivas

$$W_{F\,resultante} = \Delta E_c$$

$$\boxed{W_{total} = \Delta E_c}$$

$$W_{P_x} + W_{F_R} + W_{P_y} + W_N = \Delta E_c$$

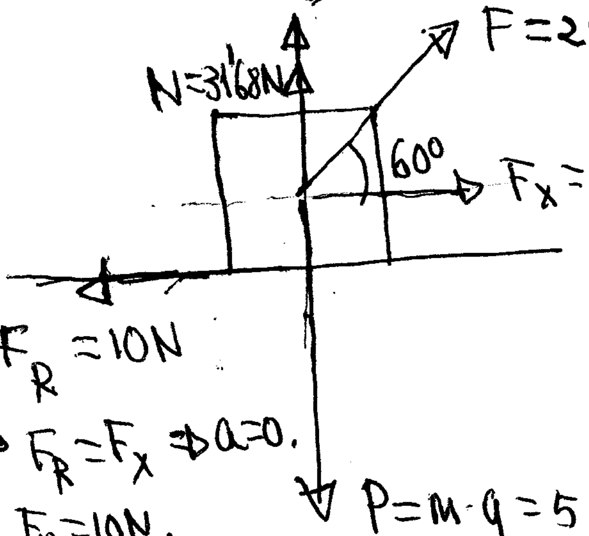
No toda la $\downarrow E_p$ pasa a E_c

$\downarrow E_p$ $\boxed{20\,J} - \boxed{10'39\,J} + 0 + 0 = \Delta E_c$

$$\Delta E_c = 9'61\,J$$

(204) a) $\boxed{v = cte}$

$F_y = F \cdot sen\,60° = 20 \cdot \frac{\sqrt{3}}{2} = 17'32N.$



Como su v = cte, su a = 0, y por ello Fresultante = 0

$\rightarrow F_R = F_x \Rightarrow a = 0.$

$F_R = 10N.$

¡OJO!

$N + F_y = P$

$N = P - F_y$

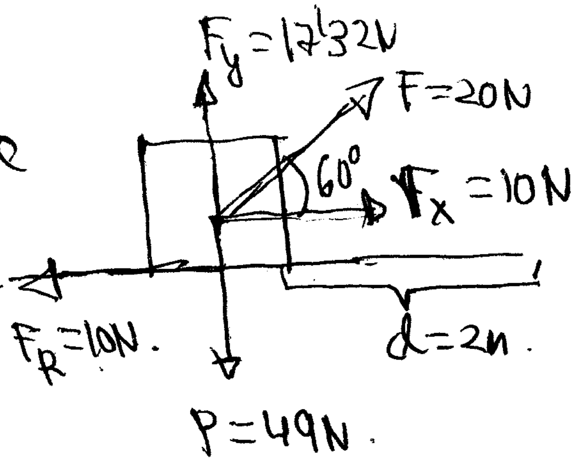
$N = 49 - 17'32 = \boxed{31'68N}$

$F_R = \mu \cdot N$

$\mu = \frac{F_R}{N} = \frac{10}{31'68} = \boxed{0'31}$

b) v = cte

No cambia su Ec.



El Wtotal es nulo

$W_{total} = \Delta E_c = 0$

Teorema de las fuerzas vivas

$W_F = F \cdot d \cdot \cos 60° = 20 \cdot 2 \cdot \frac{1}{2} = 20J \Rightarrow \begin{cases} \boxed{W_{F_x} = 20J} \\ W_{F_y} = 0 \end{cases}$

$W_{F_R} = F_R \cdot d \cdot \cos 180° = 10N \cdot 2m \cdot (-1) = -20J$

$\boxed{W_{F_R} = -20J}$

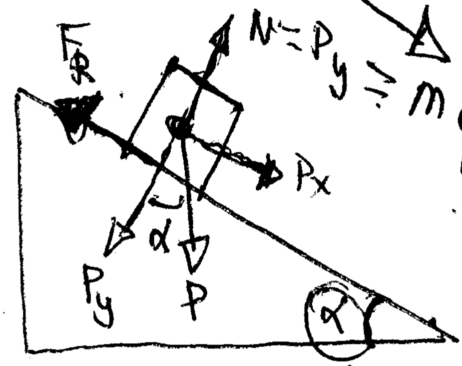
$W_P = P \cdot d \cdot \cancel{\cos 90°}^{0} = 0.$

$W_{total} = 0 = \Delta E_c$

205

$\mu = 0'2$

HAY ROZAMIENTO.



$N = P_y = m\,g\cos\alpha$

α?

Condición mínima para que el cuerpo descienda

$$P_x = F_R$$

$$m \cdot g \cdot \operatorname{sen}\alpha = \mu N$$

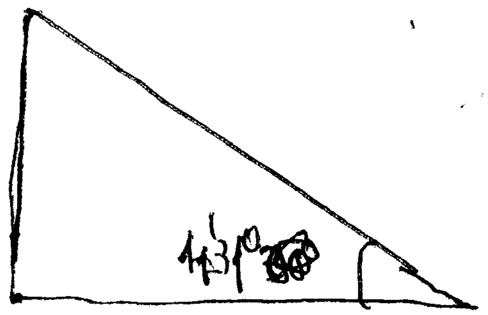
$$\cancel{m} \cdot \cancel{g} \cdot \operatorname{sen}\alpha = \mu \cdot \cancel{m} \cdot \cancel{g} \cdot \cos\alpha$$

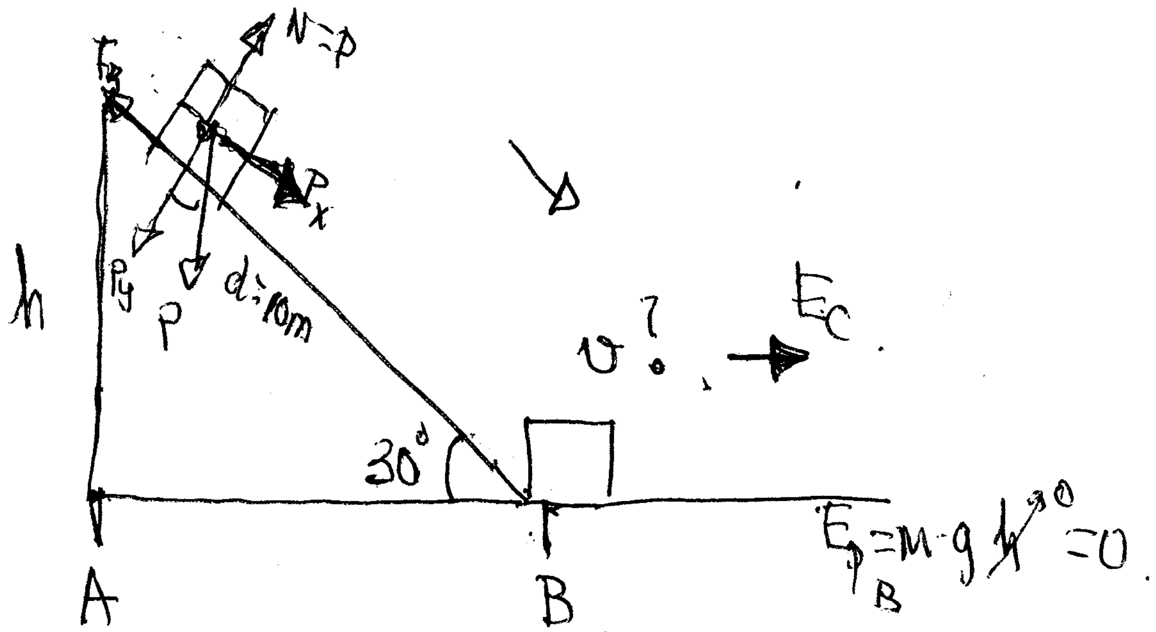
$$\frac{\operatorname{sen}\alpha}{\cos\alpha} = \mu$$

$$\operatorname{tg}\alpha = \mu$$

$$\alpha = \operatorname{arctg}\mu = \operatorname{arctg} 0'2 = \boxed{11'31^\circ}$$

b)





$$E_{P_A} + W_{F_R} = E_{C_B}$$

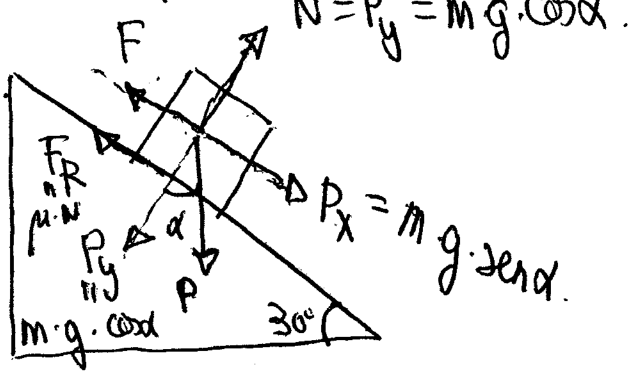
$$m \cdot g \cdot h - F_R \cdot d = \frac{1}{2} m \, v_B^2$$

$$\cancel{m} \cdot g \cdot h - \mu \overbrace{\boxed{\cancel{m} \cdot g \cdot \cos\alpha}}^{N = P_y} \cdot d = \frac{1}{2} \cancel{m} \cdot v_B^2$$

$$v_B = \sqrt{2 g \cdot h - 2 \mu g (\cos\alpha) \cdot d} = 8 \ m/s.$$

(212)

$\boxed{v = cte} \Rightarrow \boxed{a = 0}$



$\mu = 0'2$

$$\overset{?}{F} + F_R = P_x$$

$$F + \mu N = m \cdot g \cdot sen\,\alpha$$

$$F + \mu\, m \cdot g \cdot \cos\alpha = m \cdot g \cdot sen\,\alpha$$

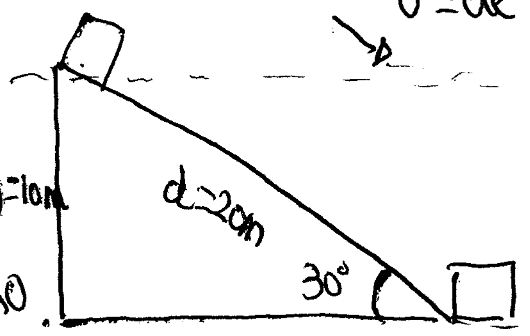
$$F = m \cdot g \cdot sen\,\alpha - \mu\, m\,g \cdot \cos\alpha$$

$$F = m \cdot g \cdot (sen\,\alpha - \mu \cos\alpha)$$

$$F = 100 \cdot 9'8 \cdot (sen\,30° - 0'2 \cdot \cos 30°)$$

$$F = 320'26\,N$$

212 b)



$E_{P_A} = m \cdot g \cdot h = 100 \cdot 9'8 \cdot 10$

$E_{P_A} = 9800J$

$E_{P_B} = 0$

$\sin 30° = \frac{h}{d}$

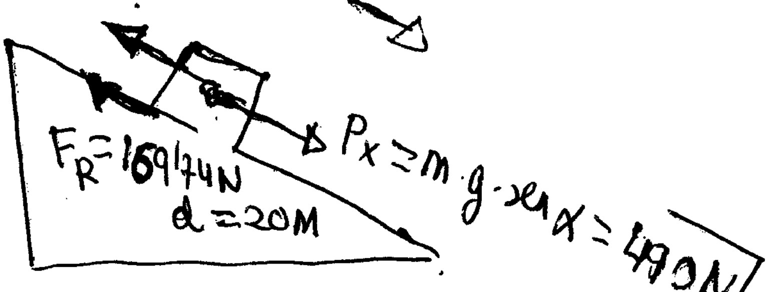
$h = d \cdot \sin 30°$

$h = 20 \cdot \frac{1}{2}$

$h = 10m$

La E_p disminuye en 9800J

Toda la disminución de E_p (trabajo realizado por P_x) ~~se~~ emplea en vencer al trabajo realizado por la fuerza de rozamiento y al trabajo realizado por la fuerza F, no en incrementar la Ec, la cual permanece cte al ser la velocidad constante.



Teorema de las fuerzas vivas $\rightarrow W_{total} = \Delta E_c$ $\xrightarrow{}$ $F_{resultante} = 0$

$W_{total} = 0$

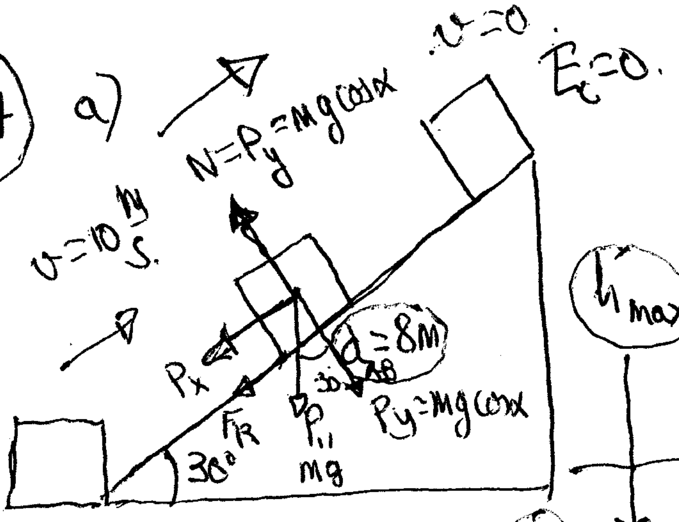
$W_{P_x} + W_F + W_{F_R} = 0$

$P_x \cdot d - F \cdot d - F_R \cdot d = 0$

$490 \cdot 20 - 320'26 \cdot 20 - 169'74 \cdot 20 = 0$

$9800J - 6405'2J - 3394'8 = 0$

(217) a)



$$E_{C_A} + W_{F_R} = E_{P_{hmax}}$$

$$\frac{1}{2} m v_A^2 - F_R \cdot d_{AB} = m\cdot g\, h_{max}$$

h_{max}

B $\rightarrow$ $E_{M_B} = E_{P_B} + \cancel{E_{C_B}}^{\,0}$

$$\text{sen}\,30^\circ = \frac{h_{max}}{d_{AB}}$$

A

$E_M = \cancel{E_{P_A}}^{\,0} + E_{C_A}$

A

$$E_{m_A} > E_{m_B} \qquad h_{max} = d_{AB}\cdot \text{sen}\,30^\circ$$

$$\frac{1}{2} m\cdot v_A^2 - [\mu m g\cdot \cos\alpha]\cdot d_{AB} = m\cdot g\cdot d_{AB}\cdot \text{sen}\,30^\circ$$

$$\frac{1}{2}\, m\cdot v_A^2 = \mu m g\cdot d_{AB}\cdot \cos\alpha + m g\cdot d_{AB}\cdot \text{sen}\,30^\circ$$

$$\frac{1}{2}\cancel{m}\, v_A^2 - \cancel{m} g\, d_{AB}\cdot \text{sen}\,30^\circ = \mu\cdot \cancel{m}\cdot g\cdot d_{AB}\cdot \cos\alpha$$

$$\mu = \frac{\frac{1}{2} v_A^2 - g\cdot d_{AB}\cdot \text{sen}\,30^\circ}{g\cdot d_{AB}\cdot \cos 30^\circ} = \frac{\frac{1}{2}\,10^2 - 9'8\cdot 8\cdot \frac{1}{2}}{9'8\cdot 8\cdot \frac{\sqrt{3}}{2}} = 0'16.$$

$E_{C_A} = \frac{1}{2} m\cdot v_A^2 = \frac{1}{2}\,2\cdot 10^2 = 100\,J$ $\xrightarrow{E_c \downarrow}$ $E_{C_B} = \frac{1}{2} m \cancel{v_B}^{\,0\,2} = 0\,J$

la $E_c \downarrow$ en 100J

$E_{P_A} = m\cdot g\, \cancel{h}^{\,0} = 0$ $\xrightarrow{E_p \uparrow}$ $E_{P_B} = m g\, h$ ($h = d_{AB}\cdot \text{sen}\,30^\circ$)

la $E_p \uparrow$ en 78'4J

$E_{P_B} = 2\cdot 9'8\cdot 8\cdot \frac{1}{2} = 78'4\,J$

No toda la disminución de Ec pasa a incrementar la E_p, se pierden por rozamiento 100J − 78'4J = 21'6J

$E_{M_A}(E_{P_A} + E_{C_A}) > E_{M_B}(E_{P_B} + E_{C_B})$

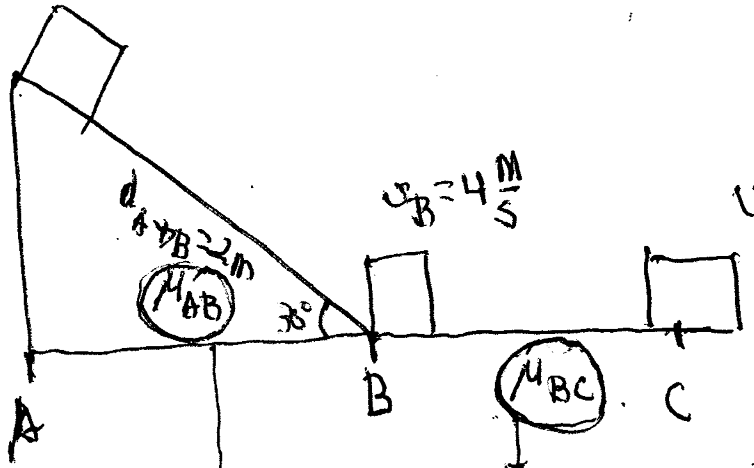
100J > 78'4J

LA EM DISMINUYE (NO SE CONSERVA) AL ACTUAR UNA FUERZA NO CONSERVATIVA

(218)

HAY ROZAMIENTO EN AMBOS CASOS

a)



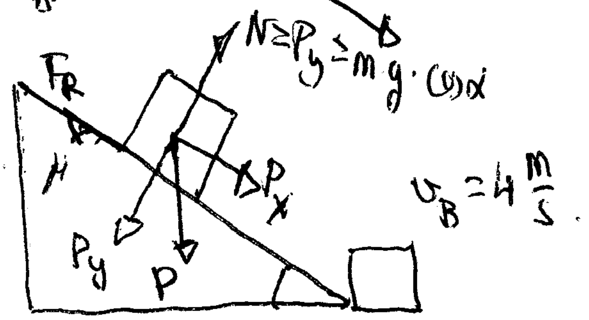
h

$sen\,30° = \frac{h}{d_{AB}}$

$\boxed{h = d_{AB} \cdot sen\,30°}$

$v_A = 0$

→ A priori no se si son iguales pero puedo comprobarlo.



h

$h = d_{AB} \cdot sen\,30°$

$$E_{P_A} + W_{F_{R\,A\to B}} = E_{C_B}.$$

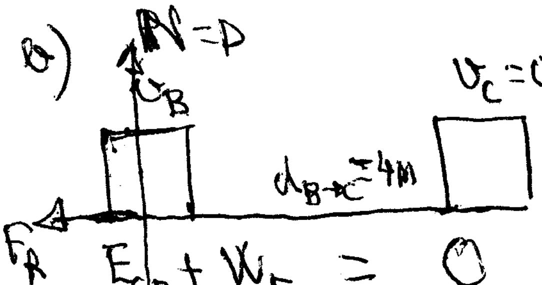
$$m \cdot g\,h - F_R \cdot d_{AB} = \frac{1}{2} m \cdot v_B^2$$

$$\cancel{m}\,g\,d_{AB} \cdot sen\,30° - \overset{?}{\mu_{A B}}\,\cancel{m}\,g\,(\cos 30°)\,d_{AB} = \frac{1}{2}\cancel{m}\,v_B^2$$

$$g\,d_{AB} \cdot sen\,30° - \frac{1}{2} v_B^2 = \overset{?}{\mu_{AB}} \cdot g\,(\cos 30°) \cdot d_{AB}$$

$$\mu_{AB} = \frac{g \cdot d_{AB} \cdot sen\,30° - \frac{1}{2} v_B^2}{g \cdot d_{AB} \cdot \cos 30°} = \frac{9'8 \cdot 2 \cdot \frac{1}{2} - \frac{1}{2} 4^2}{9'8 \cdot 2 \cdot \sqrt{3}} = 0'106$$

b)



$$E_{C_B} + W_{F_R} = 0$$

$$\frac{1}{2} m \cdot v_B^2 - F_R \cdot d_{B\to C} = 0$$

→ REALMENTE PIDE CALCULAR $\mu_{B\to C}$!

calculamos el valor del coeficiente de rozamiento $\mu_{B\to C}$.

$$\frac{1}{2} m\,v_B^2 = F_R \cdot d_{B\to C}$$

$$\frac{1}{2}\cancel{m} \cdot v_B^2 = \mu_{BC}\,\cancel{m}\,g\,d_{B\to C}$$

$$\mu_{B\to C} = \frac{\frac{1}{2} v_B^2}{g\,d_{BC}} = \frac{\frac{1}{2} 4^2}{9'8 \cdot 4} = 0'2$$

$\mu_{AB} = 0'106$

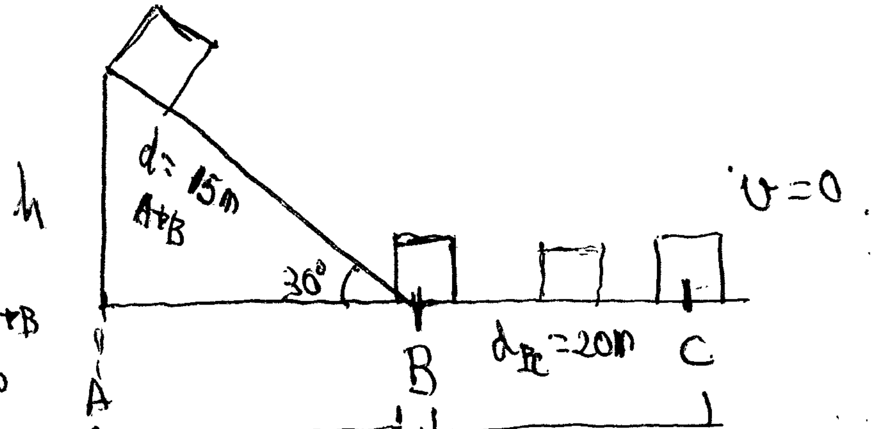
$\mu_{BC} = 0'2$

La F_R sería $= F_R = \mu \cdot m \cdot g = 0'2 \cdot m \cdot 9'8 =$

$F_R = 1'96\,(m)\,(N)$

NO SABEMOS LA MASA

(243) b)



$\operatorname{sen} 30^\circ = \dfrac{h}{d_{A\to B}}$

$h = d_{A\to B} \cdot \operatorname{sen} 30^\circ$

$$\underbrace{E_{p_A} = E_{c_B}}_{\text{SIN ROZAMIENTO}} \qquad \underbrace{E_{c_B} + W_{F_{R\,B\to C}} = 0}_{\text{CON ROZAMIENTO.}}$$

$$\boxed{E_{p_A} + W_{F_{R\,B\to C}} = 0}$$

$E_{pA} + W_{F_{R\,B\to C}} = 0$

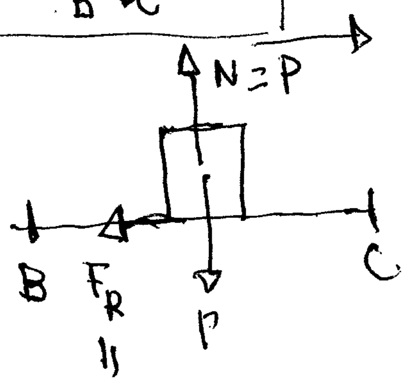
$m \cdot g \cdot h - F_R \cdot d_{BC} = 0$

$m \cdot g \cdot d_{A\to B} \operatorname{sen} 30^\circ - \mu m g\, d_{B\to C} = 0$

$\cancel{m} \cdot \cancel{g}\, d_{A\to B} \operatorname{sen} 30^\circ = \mu \cancel{m} \cancel{g} \cdot d_{B\to C}$

$\mu = \dfrac{d_{A\to B} \cdot \operatorname{sen} 30^\circ}{d_{B\to C}}$

$\mu = \dfrac{15 \cdot 0'5}{20} = \boxed{0'375}$



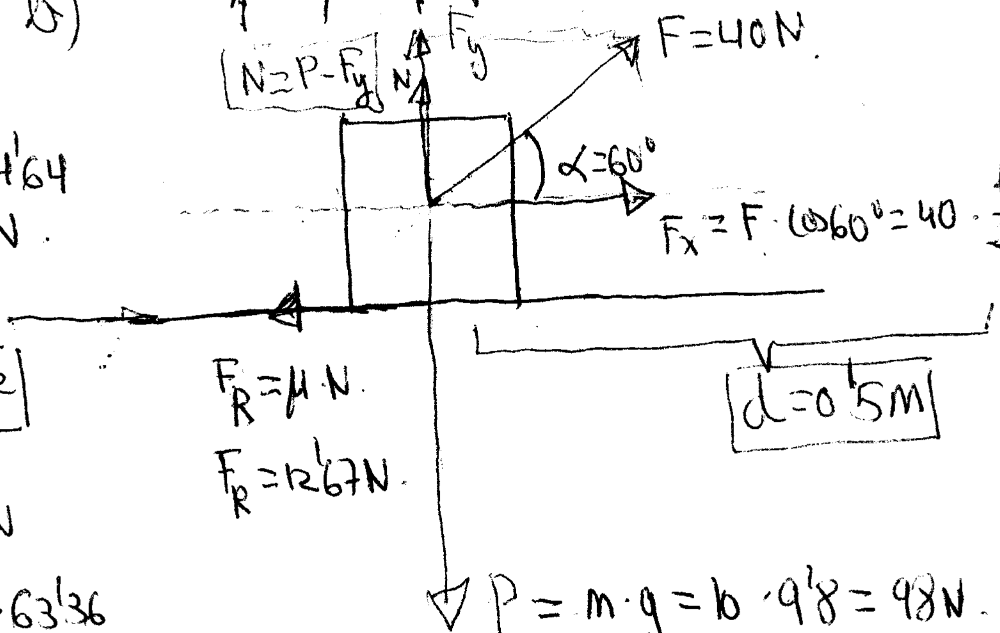
$F_R = \mu \cdot N$

$F_R = \mu m \cdot g$

(244)

$P = N + F_y$

b)



$F_y = F \cdot sen\,60^\circ = 40 \cdot \frac{\sqrt{3}}{2} = 34'64N$

$F_x = F \cdot \cos 60^\circ = 40 \cdot \frac{1}{2} = 20N$

$P = m \cdot g = 10 \cdot 9'8 = 98N$

$N = P - F_y$

$N = 98 - 34'64$

$N = 63'36N$

$F_R = \mu \cdot N$

$F_R = 0'2 \cdot 63'36$

$\boxed{F_R = 12'67N}$

$\boxed{W_{total} = \Delta E_c}$

$W_{F_x} = F_x\, d = 20N \cdot 0'5m = 10J$

$W_{F_R} = -F_R \cdot d = -12'67 \cdot 0'5 = -6'33J$

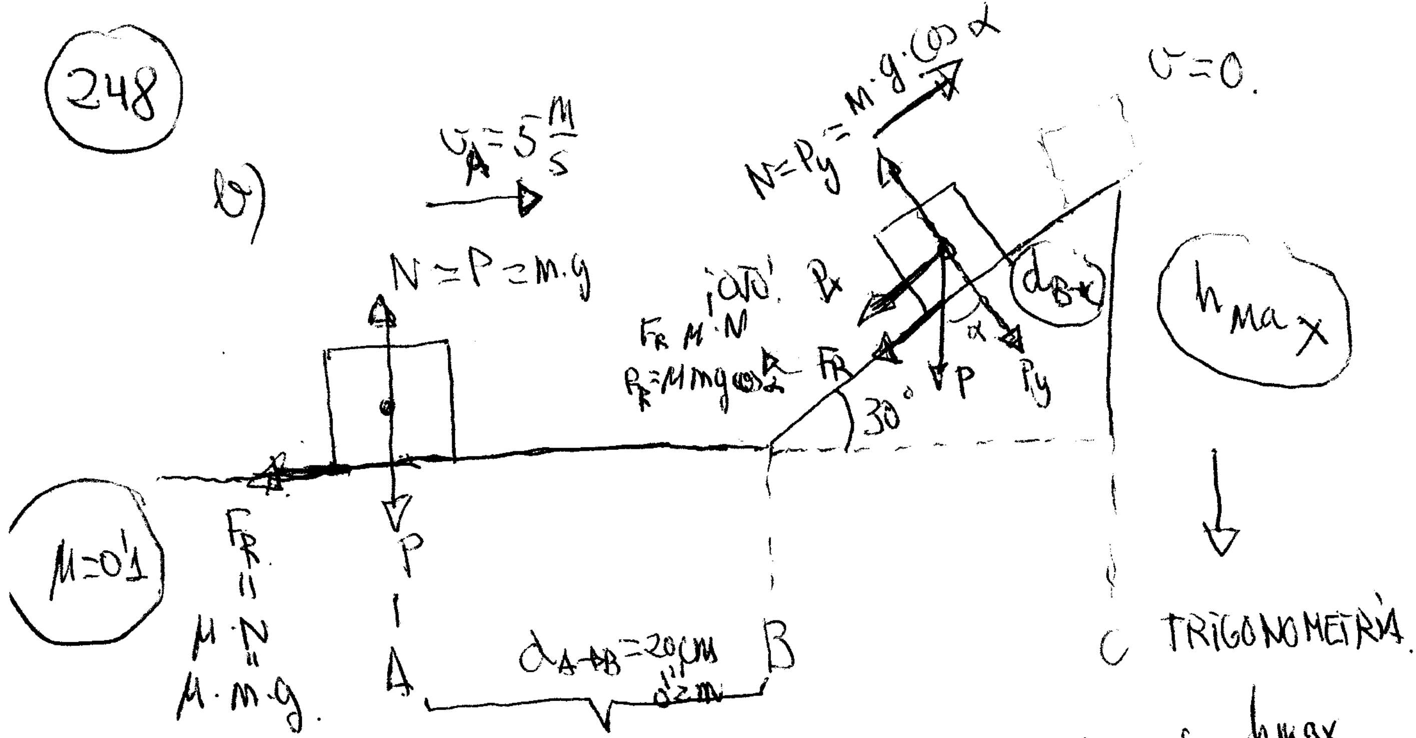
$W_{F_x} + W_{F_R} = \Delta E_c$

$10J - 6'33J = \Delta E_c$

$\Delta E_c = 3'67J \rightarrow$ La E_c se incrementa en $3'67J$

248

b)



TRIGONOMETRÍA

$$\operatorname{sen} 30° = \frac{h_{max}}{d_{B\to C}}$$

$$d_{B\to C} = \frac{h_{max}}{\operatorname{sen} 30°}$$

$$\boxed{d_{B\to C} = 2\,h_{max}}$$

$$E_{C_A} + W_{F_{R_{A\to B}}} + W_{F_{R_{B\to C}}} = E_{P_C} \ ?$$

$$\frac{1}{2} m \cdot v_A^2 - F_R \cdot d_{A\to B} - F_R' \cdot d_{B\to C} = m \cdot g \cdot h_{max}$$

$$\frac{1}{2} m v_A^2 - \mu m g \cdot d_{A\to B} - [\mu m g \cdot \cos\alpha] \cdot d_{B\to C} = m \cdot g \cdot h_{max} \ ?$$

La escribo en función de h_{max} para despejarla.

$$\frac{1}{2} m v_A^2 - \mu m g\, d_{A\to B} - [\mu m g \cdot \cos\alpha] \cdot 2 h_{max} = m g \cdot h_{max}$$

$$\frac{1}{2} \cancel{m} v_A^2 - \mu \cancel{m} g\, d_{A\to B} = \cancel{m} g\, h_{max} + [\mu \cancel{m} \cdot g \cdot \cos\alpha] \cdot 2 h_{max}$$

$$\frac{1}{2} v_A^2 - \mu \cdot g \cdot d_{A\to B} = h_{max} \cdot [g + 2\mu g \cdot \cos\alpha]$$

$$h_{max} = \frac{\frac{1}{2} v_A^2 - \mu g\, d_{A\to B}}{g + 2\mu \cdot g \cdot \cos\alpha} = \frac{\frac{1}{2} 5^2 - 0'1 \cdot 9'8 \cdot 0'2}{9'8 + 2 \cdot 0'1 \cdot 9'8 \cdot \cos 30°} = \boxed{1'07\,m}$$

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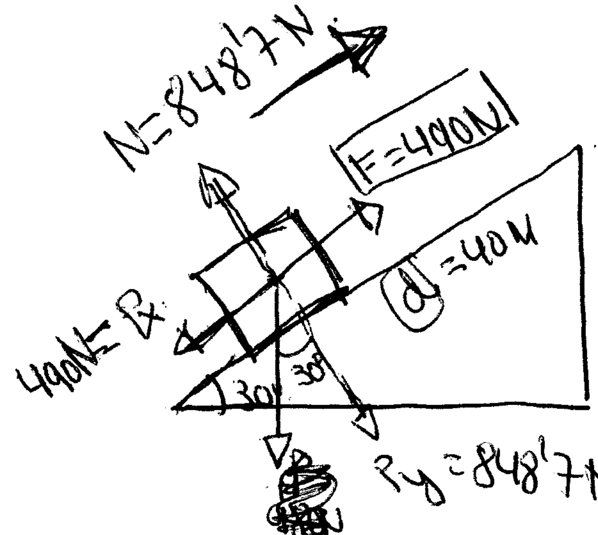


$P = m \cdot g = 100kg \cdot 9'8 \frac{m}{s^2} = 980N$

$P_x = m\,g \cdot sen\,30° = 490N$

$P_y = m \cdot g \cdot cos\,30° = 848'7N$

$\boxed{h = 20m}$

$sen\,30° = \frac{h}{d}$

$d = \frac{h}{sen\,30°}$ $\frac{1}{2}$

$d = 2h = 2 \cdot 20 =$

$\boxed{= 40\ m}$

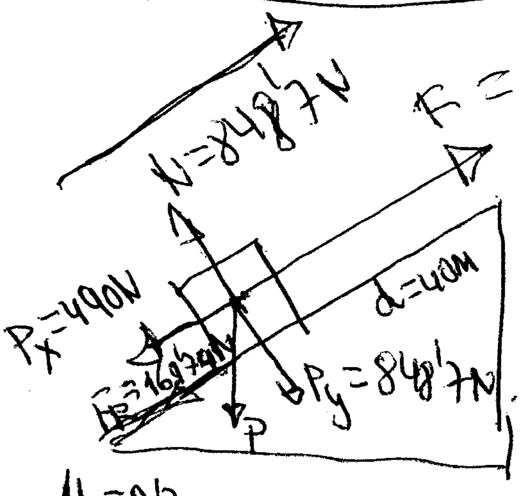
a) Sin rozamiento

$W_F = F \cdot d$

$W_F = 490N \cdot 40\ m$

$\boxed{W_F = 19600J}$

b) Con rozamiento



$F = P_x + F_R = 490 + 169'74 =$

$F = 659'74\ N$

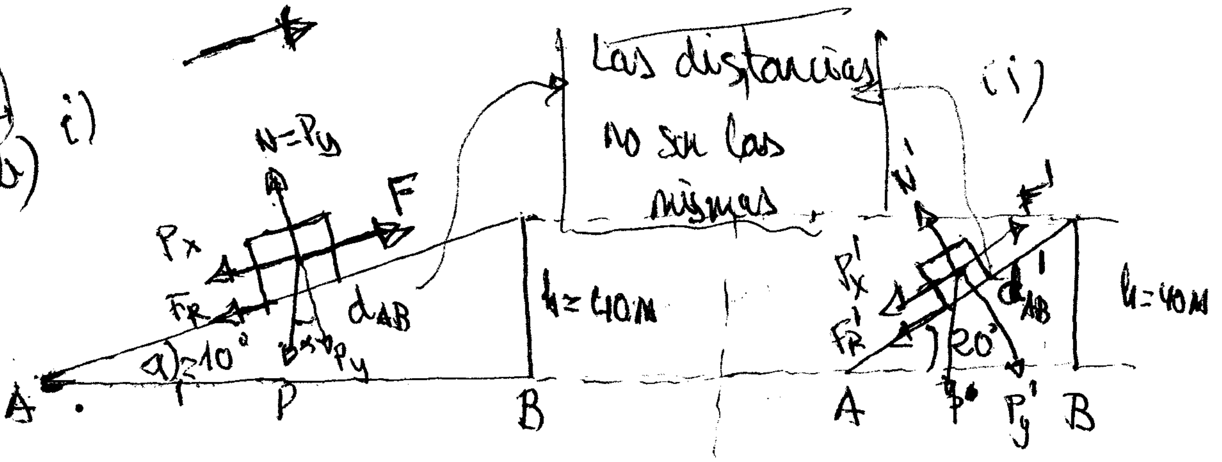
$W_F = F \cdot d$

$W_F\ 659'74 \cdot 40 = \boxed{26389'6J}$

$\mu = 0'2$

$F_R = \mu \cdot N = 0'2 \cdot 848'7 = \boxed{169'74N}$

252 b) i)



La fuerza F mínima necesaria tendría que valer para ascender

$$F = P_x + F_R$$

$$F = m g \operatorname{sen} \alpha_1 + \mu m g \cos \alpha_1$$

$$F = m \cdot g \cdot (\operatorname{sen} \alpha_1 + \mu \cdot \cos \alpha_1)$$

$$F = 1000 \cdot 9'8 \cdot (\operatorname{sen} 10° + 0'3 \cdot \cos 10°)$$

$$F = 4547'2 \text{ N}$$

$$W_F = F \cdot d_{AB}$$

$$\operatorname{sen} \alpha_1 = \frac{h}{d_{AB}} \qquad d_{AB} = \frac{h}{\operatorname{sen} \alpha_1}$$

$$W_F = F \cdot \frac{h}{\operatorname{sen} 10°} = 4547'2 \cdot \frac{40}{0'17}$$

$$\boxed{W_F = 1.069.929'41 \text{ J}}$$

$$F' = P_x' + F_R'$$

$$F' = m \cdot g \operatorname{sen} \alpha_2 + \mu m \cdot g \cdot \cos \alpha_2$$

$$F' = m \cdot g \cdot (\operatorname{sen} \alpha_2 + \mu \cdot \cos \alpha_2)$$

$$F' = 1000 \cdot 9'8 \cdot (\operatorname{sen} 20° + 0'3 \cdot \cos 20°)$$

$$F' = 6095'6 \text{ N}$$

$$\operatorname{sen} \alpha_2 = \frac{h}{d'_{AB}}$$

$$W_F' = F' \cdot d'_{AB} \rightarrow d'_{AB} = \frac{h}{\operatorname{sen} \alpha_2}$$

$$W_F' = F' \cdot \frac{h}{\operatorname{sen} 20°} = 6095'6 \cdot \frac{40}{0'34}$$

$$\boxed{W_F' = 717.129'41 \text{ J}}$$

Teorema de las Fuerzas vivas

$$W_F + W_{P_x} + W_{F_R} = \Delta E_c = 0$$

(trabajo mínimo necesario)

$$\uparrow \; - \boxed{mg \cdot h} \; \boxed{- F_R \cdot d_{AB}} = 0$$

IGUAL EN AMBOS CASOS

La pérdida energética por rozamiento será mayor aquí al recorrer más distancia.

Teorema de las Fuerzas vivas

$$W_F' + W_{P_x'} + W_{F_R'} = 0$$

$$\downarrow \; + \boxed{mg \cdot h} \; \boxed{- F_R' d'_{AB}} = 0$$

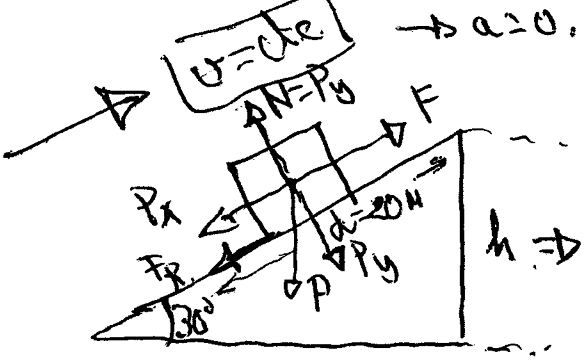
La pérdida energética por aquí es menor al ser la distancia menor.

(254) a) No $E_c = \frac{1}{2} m \cdot v^2$ → módulo.

Si, depende del sist de referencia

No, solo si actúan F conservativas

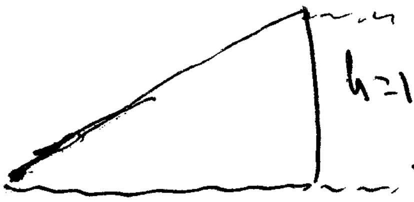
b) $\boxed{v = cte}$ → $a = 0$.



$h \Rightarrow \operatorname{sen} 30° = \frac{h}{d} \Rightarrow h = d \cdot \operatorname{sen} 30°$

$h = 20 \cdot \frac{1}{2}$

$\boxed{h = 10\,m}$



$E_{Ph} = m \cdot g\, h = 100 \cdot 9'8 \cdot 10 = \boxed{9800\,J}$

$E_p = m \cdot g \cdot \cancel{h}^{0} = 0$

Ese es el incremento de E_p.

$F = P_x + F_R$

$F = mg \cdot \operatorname{sen} 30° + \mu \cdot \underset{P_y}{N}$

$F = m \cdot g \operatorname{sen} 30° + \mu \cdot m \cdot g \cdot \cos 30°$.

$F = m \cdot g \left(\operatorname{sen} 30° + \mu \cdot \cos 30°\right) = 100 \cdot 9'8 \cdot \left(\frac{1}{2} + 0'2 \cdot \frac{\sqrt{3}}{2}\right)$

$F = 659'74\,N$.

$W = F \cdot d \cdot \cancel{\cos 0°}^{1} = 659'74\,N \cdot 20\,m = \boxed{13.194'82\,J}$

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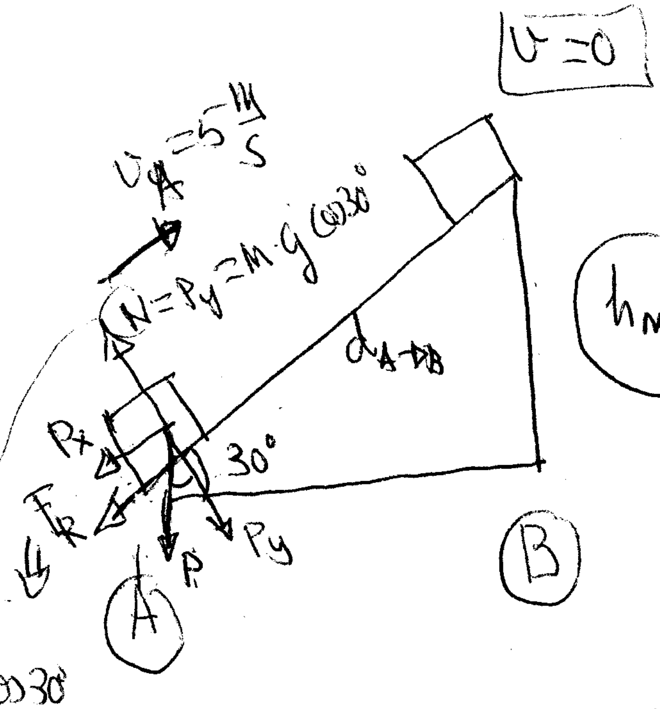
b)



h_{max}

$\rightarrow \operatorname{sen} 30^\circ = \dfrac{h_{max}}{d_{A\to B}}$

$d_{A\to B} = \dfrac{h_{max}}{\operatorname{sen} 30^\circ}$

$d_{A\to B} = \dfrac{h_{max}}{1/2}$

$\boxed{d_{A\to B} = 2h_{max}}$

$F_R = \mu \cdot N$

$F_R = \mu\, mg\cos 30^\circ$

$\to 0$ llega a la hmax y se para.

$$\cancel{E_{P_A}} + E_{C_A} + W_{F_{R\,A\to B}} = E_{P_B} + \cancel{E_{C_B}}$$

0

$$\frac{1}{2} m\cdot v_A^2 - F_R\cdot d_{AB} = m\cdot g\, h_{max}\ ?$$

$$\frac{1}{2} m\cdot v_A^2 - [\mu\, mg\cdot\cos 30^\circ]\cdot d_{AB} = m\cdot g\, h_{max}\ ?$$

hago el cambio para tener una única incógnita

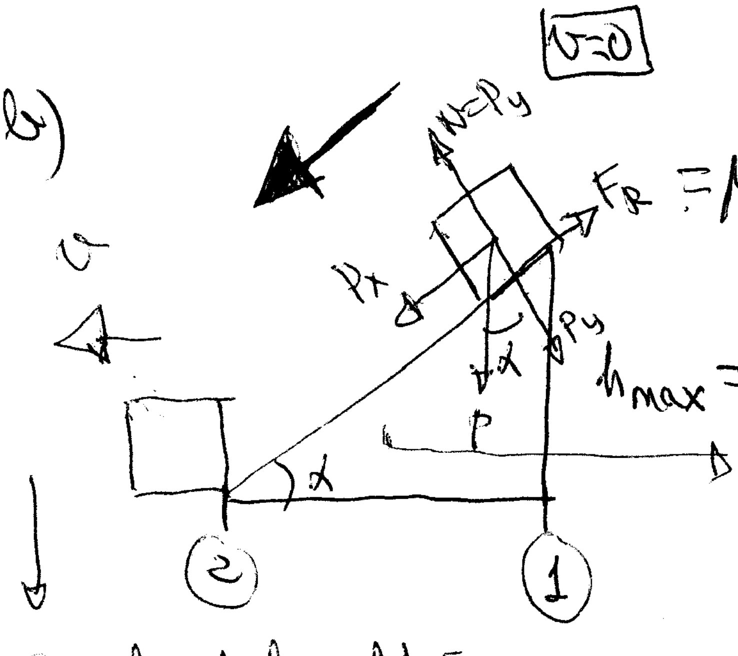
$$\frac{1}{2} m\cdot v_A^2 - [\mu\, mg\cdot\cos 30^\circ]\cdot 2h_{max} = m\cdot g\, h_{max}$$

$$\frac{1}{2} \cancel{m}\cdot v_A^2 = \cancel{m}\, g\, h_{max} + [\mu\, \cancel{m}\, g\,\cos 30^\circ]\cdot 2\, h_{max}$$

$$\frac{1}{2} v_A^2 = g\, h_{max}\left(1 + [\mu\cdot\cos 30^\circ]\cdot 2\right)$$

$$h_{max} = \frac{\frac{1}{2} v_A^2}{g\cdot(1 + 2\mu\cdot\cos 30^\circ)} = \frac{\frac{1}{2}\, 5^2}{9'8\cdot\left(1 + \cancel{2}\cdot 0'1\cdot\frac{\sqrt{3}}{\cancel{2}}\right)} = \boxed{1'08\,m}$$

b)



$F_R = \mu \cdot N = \mu \cdot P_y = \mu m g \cdot \cos\alpha$

$h_{max} = 1'08\, m$. $\operatorname{sen}\alpha = \frac{h_{max}}{d_{A\to B}}$

$d_{A\to B} = \frac{h_{max}}{\operatorname{sen} 30°}$

$d_{A\to B} = \frac{1'08}{1/2} = 2'16\, m$

Su velocidad saldrá menor que los 5 m/s con los que ascendió.

$E_{p_1} + W_{F_R} = E_{c_2}$

$\cancel{m} \cdot g \cdot h_{max} - [\mu \cancel{m} g \cdot \cos\alpha] \cdot d_{AB} = \frac{1}{2} \cancel{m} v_2'^2$ ¿?

$v_2' = \sqrt{2 [g\, h_{max} - \mu g \cdot (\cos\alpha) \cdot d_{A\to B}]}$

$v_2' = \sqrt{2 \cdot [9'8 \cdot 1'08 - 0'1 \cdot 9'8 \cdot \frac{\sqrt{3}}{2} \cdot 2'16]}$

$v_2' = 4'18\, m/s$.