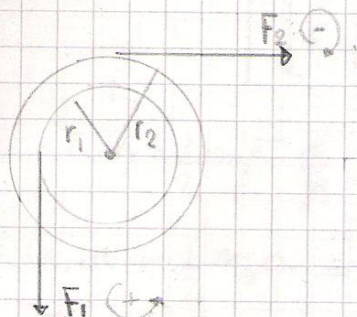


CINEMÁTICA DEL C. RÍGIDOMOMENTO.

② PAG 30.

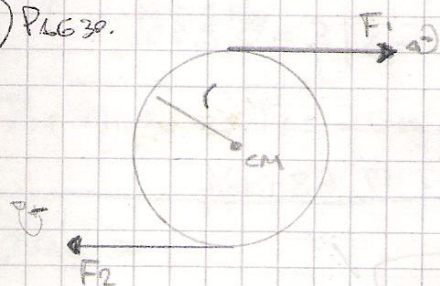


$$\Sigma M = I \epsilon$$

$$(F_1 \cdot r_1) - (F_2 \cdot r_2) = M = I \cdot \epsilon$$

$$M_1 - M_2$$

③ PAG 30.



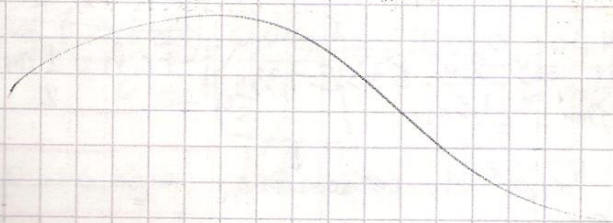
$$\Sigma M = I \cdot \epsilon$$

$$-r(F_1 + F_2) = \frac{1}{2} m r^2 \cdot \frac{a}{r}$$

$$-(F_1 + F_2) = \frac{1}{2} m \cdot a$$

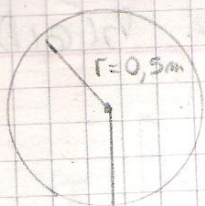
MCUV con ESE DE ROTACIÓN = CM

- ④ SE PUEDE APLICAR MOMENTO AL PRINCIPIO, PERO LUEGO EL CUERPO YA ADQUIRIÓ CIERTA ACCELERACIÓN Y NO ES NECESARIO NI SIGNIFICA QUE POR ELLO TENGA QUE HABER UNA FUERZA PARA APLICAR MOMENTO CONSTANTE.





5) PAG 30.



$m = 1000 \text{ kg}$   
 $h = 0,5 \text{ m}$   
 $\omega_0 = 60 \text{ rpm} (6,28 \text{ rad/s})$   
 $\Delta t = 10 \text{ s}$   
 $M = 98 \text{ Nm}$

$\Sigma M = I \cdot \epsilon$

$\omega = \omega_0 + \epsilon \cdot t$

$\frac{\omega_f - \omega_0}{t} = \epsilon$

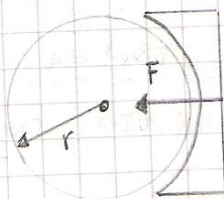
$M = \frac{1}{2} m h^2 \cdot \epsilon$

$\frac{80 \text{ Nm}}{\frac{1}{2} \cdot 1000 \text{ kg} \cdot 0,25 \text{ m}^2} = \epsilon \Rightarrow \frac{80 \text{ Nm}}{125 \text{ kg m}^2} = \epsilon \Rightarrow \epsilon = 0,64 \text{ m/s}^2$

$\omega_f = 6,28 \text{ rad/s} + 0,64 \text{ m/s}^2 \cdot 10 \text{ s} \Rightarrow \omega_f = 12,68 \text{ rad/s}$

$\omega = \frac{n \cdot \pi}{30} \Rightarrow \frac{\omega \cdot 30}{\pi} = n \Rightarrow n = 121 \text{ rpm}$

6) PAG 30



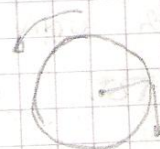
$r = 0,3 \text{ m}$   
 $m = 10 \text{ kg}$   
 $\omega_0 = 300 \text{ rpm} (31,41 \text{ rad/s})$

$F = 10 \text{ N}$   
 $\mu = 0,2$

$N = ?$

$N = \frac{A \epsilon}{2 \pi}$

$\frac{v_{\text{g}} \text{ m/s}^2}{v_{\text{g}} \text{ m}} = \frac{1}{s^2}$



$F_{rd} = \mu \cdot F = 0,2 \cdot 10 \text{ N}$   
 $\Rightarrow 2N = F_r$

①  $-F_r \cdot h = \frac{1}{2} m h^2 \cdot \epsilon$

$\Sigma M = I \cdot \epsilon$

$\frac{-(\mu \cdot F)}{\frac{1}{2} m h} = \epsilon \Rightarrow \epsilon = \frac{0,2 \cdot 10 \text{ N}}{5 \text{ kg} \cdot 0,3 \text{ m}} \Rightarrow \frac{2 \text{ N}}{1,5 \text{ kg m}} = \epsilon \Rightarrow \epsilon = 1,33 \frac{1}{s^2}$

$-F_r \cdot h = \frac{1}{2} m h^2 \cdot \epsilon$

DESACOLE RA.

$\omega^2 = \omega_0^2 + 2 \epsilon \Delta \theta \Rightarrow \frac{-\omega_0^2}{2 \epsilon} = \Delta \theta \Rightarrow \Delta \theta = \frac{-(31,41 \text{ rad/s})^2}{2 \cdot 1,33 \frac{1}{s^2}} \Rightarrow \Delta \theta = \frac{986,58 \text{ rad}^2}{2,66 \frac{1}{s^2}} \Rightarrow \Delta \theta = 370,89 \text{ rad}$

$\Rightarrow \Delta \theta = 370,89 \text{ rad}$

$N = \frac{\Delta \theta}{2 \pi} \Rightarrow N = \frac{370,89 \text{ rad}}{2 \pi} \Rightarrow N = 59 \text{ VOLTAS}$



⑦ PÁG. 30

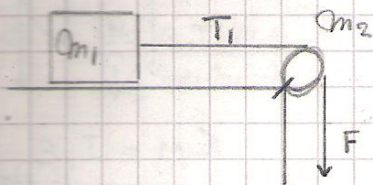
$m_1 = 20 \text{ kg}$

$m_2 = 40 \text{ kg}$

$F = 200 \text{ N}$

$a = ?$

$T_1 = ?$



$$① \quad F \cdot R - T_1 \cdot R = \frac{1}{2} m_2 R^2 \cdot \frac{a}{R}$$

$$F - m_1 \cdot a = \frac{1}{2} m_2 a \Rightarrow F = a \left( \frac{1}{2} m_2 + m_1 \right)$$

$$a = \frac{F}{\frac{1}{2} m_2 + m_1} \Rightarrow a = \frac{200 \text{ N}}{20 \text{ kg} + 20 \text{ kg}} \Rightarrow a = 5 \text{ m/s}^2$$

$$T_1 = m_1 \cdot a \Rightarrow T_1 = 20 \text{ kg} \cdot 5 \text{ m/s}^2 \Rightarrow T_1 = 100 \text{ N}$$

$\Sigma M = I \cdot \epsilon$

$$F \cdot R - T_1 \cdot R = \frac{1}{2} m_2 R^2 \cdot \frac{a}{R} \quad ①$$

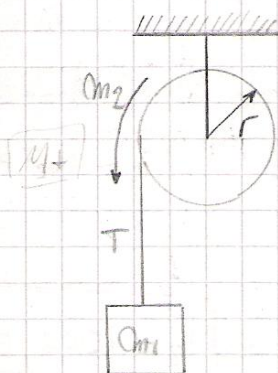
⑧ PÁG. 30

$m_1 = 2 \text{ kg}$

$a = 6 \text{ m/s}^2$

$r = 0,20 \text{ m}$

$I = ?$



$m_1 g - T = m_1 a$

$T = m_1 (g - a)$

$$T \cdot R = I \cdot \epsilon \Rightarrow \frac{T \cdot R^2}{a} = I \Rightarrow \frac{m_1 (g - a) \cdot R^2}{a} = I$$

$$\Rightarrow I = \frac{2 \text{ kg} (3,8 \text{ m/s}^2) \cdot 0,04 \text{ m}^2}{6 \text{ m/s}^2} \Rightarrow I = \frac{0,304 \text{ kg} \cdot \text{m}^2/\text{s}^2}{6 \text{ m/s}^2}$$

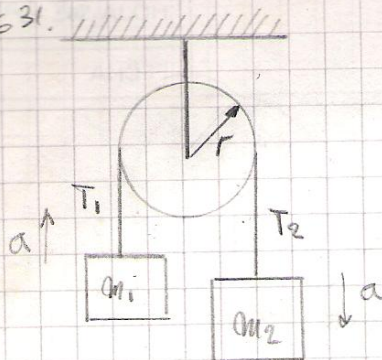
$$I = 0,0506 \text{ kg} \cdot \text{m}^2$$

$$50,6 \cdot 10^{-3} \text{ kg} \cdot \text{m}^2$$

$$T \cdot R = I \cdot \epsilon \quad ①$$



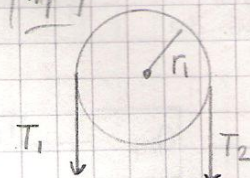
9) 9.6.31.



$$\begin{aligned} a &= ? \\ T_1 &= ? \\ T_2 &= ? \end{aligned}$$

$$\begin{aligned} m_1 &= 80 \text{ kg} \\ m_2 &= 150 \text{ kg} \\ m_p &= 50 \text{ kg} \end{aligned}$$

$m_p$



$$M_{T_2} > M_{T_1}$$

$$\sum M = I \cdot \epsilon$$

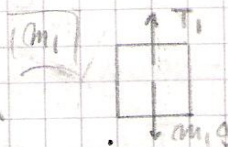
USO ECUACIÓN 1 Y DESARROLLO  $T_1, T_2, \dots$

$$T_2 \cdot R - T_1 \cdot R = \frac{1}{2} m_p \cdot R^2 \cdot \epsilon$$

$$a) T_2 \cdot R - T_1 \cdot R = \frac{1}{2} m_p R^2 \cdot \frac{a}{R}$$

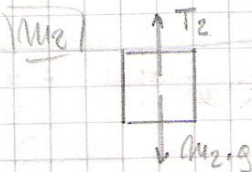
$$T_2 - T_1 = \frac{1}{2} m_p \cdot a \Rightarrow m_2 g - m_2 a - [m_1 g + m_1 a] = \frac{1}{2} m_p \cdot a$$

$$m_2 g - m_1 g = \frac{1}{2} m_p a + m_2 a + m_1 a$$



$$T_1 - m_1 \cdot g = m_1 \cdot a$$

$$T_1 = m_1 (g + a) \quad 2$$



$$m_2 g - T_2 = m_2 \cdot a$$

$$T_2 = m_2 (g - a) \quad 3$$

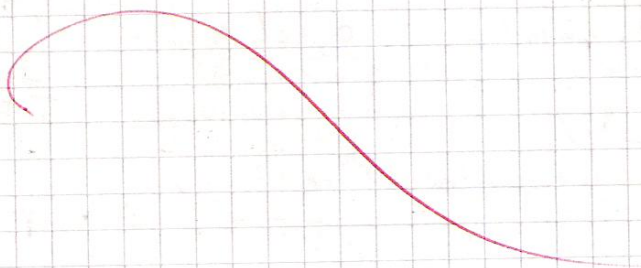
$$\frac{m_2 g + m_1 g}{\frac{1}{2} m_p + m_1 + m_2} = a \Rightarrow a = \frac{9.8 \text{ m/s}^2 (150 \text{ kg} - 80 \text{ kg})}{25 \text{ kg} + 80 \text{ kg} + 150 \text{ kg}}$$

$$a = \frac{686 \text{ kg m/s}^2}{255 \text{ kg}} \Rightarrow a = 2.69 \text{ m/s}^2 \quad \checkmark$$

$$b) T_1 = m_1 (g + a) \Rightarrow T_1 = 80 \text{ kg} (9.8 \text{ m/s}^2 + 2.69 \text{ m/s}^2) \Rightarrow T_1 = 999 \text{ N}$$

$$T_2 = m_2 (g - a) \Rightarrow T_2 = 150 \text{ kg} \cdot (9.8 \text{ m/s}^2 - 2.69 \text{ m/s}^2) \Rightarrow T_2 = 1066.5 \text{ N}$$

\* SIGUE EN EL EJERCICIO SIGUIENTES.

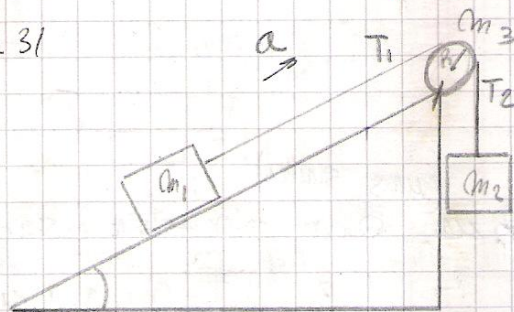




- 10) LA FÓRMULA LA DESDÉS EN EL EJERCICIO ANTERIOR (QUE ES IGUAL A ESTE)

$$a = \frac{m_2 g - m_1 g}{\frac{1}{2} m_1 + m_1 + m_2} \Rightarrow a = \frac{g (m_2 - m_1)}{\frac{1}{2} m_1 + m_1 + m_2}$$

11) PÁG. 31



$$\begin{aligned} m_1 &= 10 \text{ kg} \\ m_2 &= 10 \text{ kg} \\ \alpha &= 30^\circ \\ a &= 2 \text{ m/s}^2 \end{aligned}$$

$$R = 0,25 \text{ m}$$

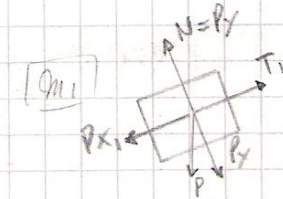
$$\begin{aligned} T_1 &=? \\ T_2 &=? \\ I &=? \end{aligned}$$

$$P_{x1} = P \cdot \sin \alpha$$

USANDO BCU (3) QUEDA...

$$\frac{R^2 (T_2 - T_1)}{a} = I$$

$$\frac{R^2 (m_2 g - m_2 a - m_1 a - m_1 g \sin \alpha)}{a} = I$$



$$T_1 - P_{x1} = m_1 \cdot a$$

$$T_1 = m_1 \cdot a + m_1 g \sin \alpha \quad (1)$$

$$\frac{\text{kg m/s}^2 \cdot \text{m}^2}{\text{m/s}^2} = \text{kg m}^2$$

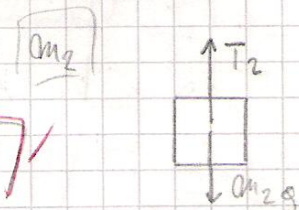
$$\frac{0,0625 \text{ m} (98 \text{ N} - 2a - 20 \text{ N} - 49 \text{ N})}{2 \text{ m/s}^2} = I$$

$$I = \frac{0,9625 \text{ kg m/s}^2 \cdot \text{m}^2}{2 \text{ m/s}^2} \Rightarrow I = 0,28125 \text{ kg m}^2$$

EL PROF DIJO QUE ESTE RESULTADO ES VÁLIDO.

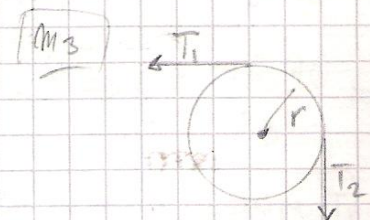
$$T_1 = m_1 \cdot a + m_1 g \sin \alpha \Rightarrow T_1 = 69 \text{ N}$$

$$T_2 = m_2 (g - a) \Rightarrow T_2 = 78 \text{ N}$$



$$m_2 g - T_2 = m_2 \cdot a$$

$$T_2 = m_2 (g - a) \quad (2)$$



$$T_2 \cdot h - T_1 \cdot h = I \cdot \frac{a}{R} \quad (3)$$



13) PAG. 31

$$T_1 = ?$$

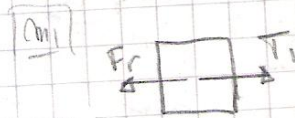
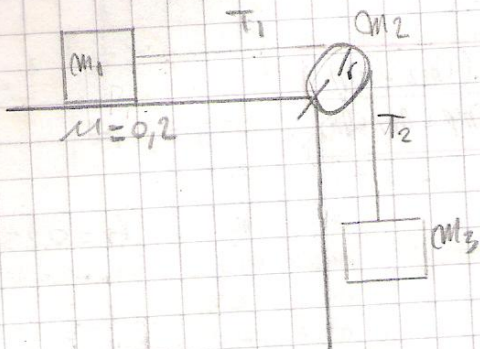
$$T_2 = ?$$

$$\mu = 0,2$$

$$m_1 = 3 \text{ kg}$$

$$m_3 = 6 \text{ kg}$$

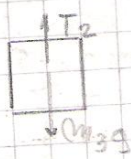
$$a = 2 \text{ m/s}^2$$



$$-F_r + T_1 = m_1 a$$

$$T_1 = m_1 a + \mu m_1 g$$

$$T_1 = 11,88 \text{ N}$$



$$m_3 g - T_2 = m_3 a$$

$$T_2 = m_3 (g - a)$$

$$T_2 = 46,8 \text{ N}$$



$$\frac{a}{R} = \epsilon \Rightarrow a = \epsilon \cdot R$$

HOJA N° 21

FECHA

14) PÁG 32

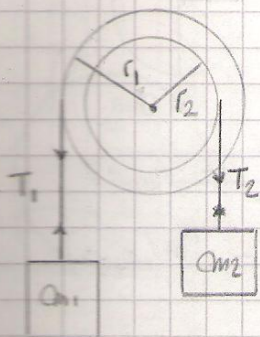
$$I = 40 \text{ kg m}^2$$

$$R_1 = 1,2 \text{ m}$$

$$R_2 = 0,4 \text{ m}$$

$$m_1 = 24 \text{ kg}$$

$$m_2 = ?$$



$$T_1 R_1 - T_2 R_2 = I \cdot \epsilon$$

$$R_1 (m_1 g - m_1 \epsilon R_1) - [R_2 (m_2 g + m_2 \epsilon R_2)] = I \cdot \epsilon$$

$$R_1 m_1 g - m_1 \epsilon R_1^2 - R_2 m_2 g - m_2 \epsilon R_2^2 = I \cdot \epsilon$$

$$R_1 m_1 g - R_2 m_2 g = I \cdot \epsilon + m_1 \epsilon R_1^2 + m_2 \epsilon R_2^2 \quad | \epsilon = 0 |$$

$$R_1 m_1 g = R_2 m_2 g$$

$$\frac{R_1 m_1 g}{R_2 g} = m_2 \Rightarrow m_2 = \frac{282,24 \text{ kg m/s}^2}{3,92 \text{ m/s}^2} \Rightarrow m_2 = 72 \text{ kg}$$

$$\text{Se da } m_2 = 12 \text{ kg} \Rightarrow (m_2 = 84 \text{ kg}) \dots$$

$$T_2 R_2 - T_1 R_1 = I \cdot \epsilon$$

$$R_2 (m_2 g - m_2 a) - [R_1 (m_1 g + m_1 a)] = I \epsilon$$

$$R_2 m_2 g - R_2^2 m_2 \cdot \epsilon - R_1 m_1 g - R_1^2 m_1 \epsilon = I \epsilon$$

$$R_2 m_2 g - R_1 m_1 g = \epsilon (I + R_2^2 m_2 + R_1^2 m_1)$$

$$\frac{R_2 m_2 g - R_1 m_1 g}{I + R_2^2 m_2 + R_1^2 m_1} = \epsilon \Rightarrow \frac{329,28 - 282,24}{40 + 13,44 + 34,56} = \epsilon \Rightarrow \epsilon = \frac{46,76}{88} \Rightarrow \epsilon = 0,53$$

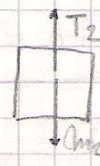
$$T_1 = m_1 g + m_1 \epsilon R_1 \Rightarrow T_1 = 235,20 \text{ kg m/s}^2 + 15,26 \text{ kg m/s}^2 = 250 \text{ N} = T_1$$

$$T_2 = m_2 g - m_2 \epsilon R_2 \Rightarrow T_2 = 823,2 \text{ kg m/s}^2 - 17,80 \text{ kg m/s}^2 = 805 \text{ N} = T_2$$



$$m_1 g - T_1 = m_1 a$$

$$T_1 = m_1 (g - a) \quad | \textcircled{1}$$



$$T_2 - m_2 g = m_2 a$$

$$T_2 = m_2 (g + a) \quad | \textcircled{2}$$

$$T_1 - m_1 g = m_1 a$$

$$T_1 = m_1 (g + a) \quad | \textcircled{1}$$

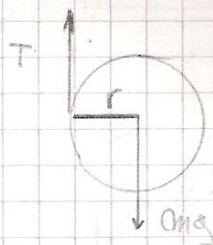
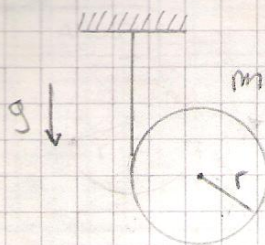
$$m_2 g - T_2 = m_2 a$$

$$T_2 = m_2 (g - a) \quad | \textcircled{2}$$



15) P. 32

$$m = 5 \text{ kg}$$



DJ ECU 2 ...

$$+T = \frac{1}{2} m \cdot a$$

$$+ (m \cdot g - m \cdot a) = \frac{1}{2} m \cdot a$$

$$+ m \cdot g = \frac{3}{2} m \cdot a \Rightarrow + \frac{m \cdot g}{\frac{3}{2} m} = a \Rightarrow a = 6,53 \text{ m/s}^2$$

$$T = m \cdot g - m \cdot a \Rightarrow T = 16,35 \text{ N}$$

$$\Sigma F = m \cdot a$$

$$m \cdot g - T = m \cdot a$$

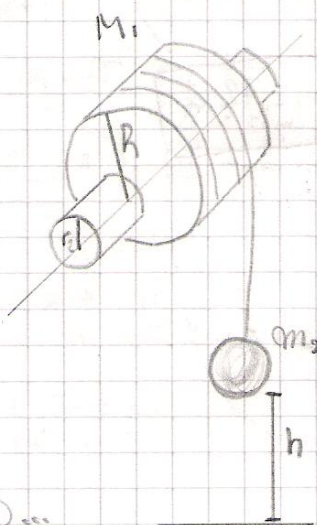
$$T = m(g - a)$$

$$\Sigma M^{\text{cm}} = I^{\text{cm}} \cdot \epsilon$$

$$+ R \cdot T = \frac{1}{2} m R^2 \cdot \frac{a}{R}$$

$$\frac{1}{2} m (R^2 + r^2) = I$$

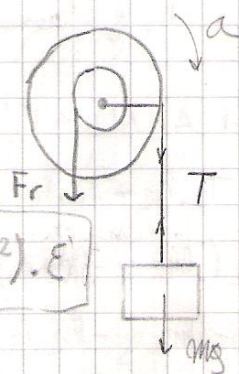
16) P. 32



$$R = r$$

$$r_2 = \frac{R}{2}$$

$$2) T \cdot h - F_r \cdot r = \frac{1}{2} m (R^2 + r^2) \cdot \epsilon$$



$$y = y_0 + v_0 t + \frac{1}{2} a t^2$$

$$y_0 = \frac{1}{2} a t^2$$

$$y_0 = a$$

$$\frac{1}{2} t^2$$

$$\frac{1}{2} t^2$$

DJ ECU 2 ...

$$R (m_2 g - m_2 a) - F_r \cdot r = \left( \frac{1}{2} m_1 R^2 + \frac{1}{2} m_2 r^2 \right) \cdot \frac{a}{R}$$

$$- F_r \cdot r = \frac{1}{2} m_1 R^2 \frac{a}{R} + \frac{1}{2} m_2 \left( \frac{R}{2} \right)^2 \frac{a}{R} - (R m_2 g - R m_2 a)$$

$$- F_r \cdot r = \frac{5}{8} m_1 R \frac{h}{\frac{1}{2} t^2} - R (m_2 g - m_2 \frac{h}{\frac{1}{2} t^2}) \Rightarrow M F_r = R \left[ \frac{5}{4} m_1 \frac{h}{t^2} - \frac{m_2 2h}{t^2} + m_2 g \right]$$

$$\Sigma F = m \cdot a$$

$$m_2 g - T = m_2 a$$

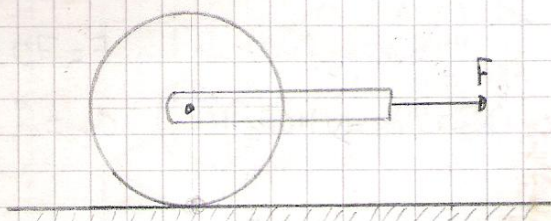
$$T = m_2 (g - a)$$



$F = 3\text{ N}$

$$M = 2\text{ kg}$$

$$R = 30\text{ cm} (0,3\text{ m})$$



a)  $F_r = ?$

b)  $\begin{cases} F_{\text{max}} = ? \\ \mu = 0,2 \end{cases}$

TRASLACIÓN

$F - F_r = M a$

$$\Sigma M^{\text{cm}} = I^{\text{cm}} \cdot \epsilon \Rightarrow F_r \cdot R = \frac{1}{2} M R^2 \cdot \frac{a}{R} \quad (2)$$

$$-M a + F = \frac{1}{2} M a$$

$$F = \frac{3}{2} M a \Rightarrow \frac{F}{3/2 M} = a \Rightarrow a = 1\text{ m/s}^2$$

a)

$$(1) F_r = -M a + F \Rightarrow F_r = -2\text{ kg} + 3\text{ N} \Rightarrow F_r = 1\text{ N}$$

b)

DE ECU (2) ...

✗

$$F_r = \frac{1}{2} M a \Rightarrow \frac{\mu \cdot M g}{\frac{1}{2} M} = a \Rightarrow a = 3,92\text{ m/s}^2$$

DE ECU (1) ...

$$F = M \cdot a + F_r \Rightarrow F = 7,84 + 3,92 \Rightarrow F = 11,76\text{ N}$$

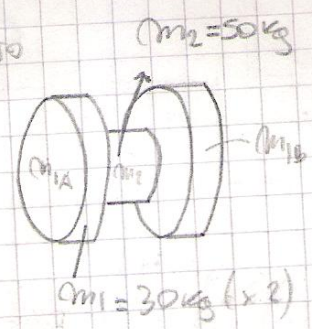
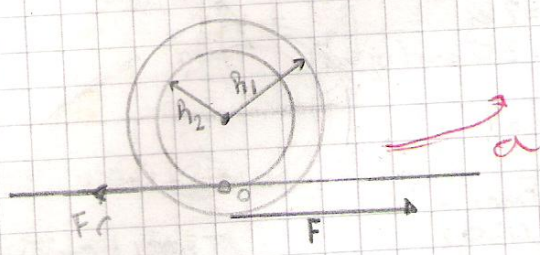
✗ SE CALCULA  $a$  CONTEMPLANDO  $F_r$   
PARA LUEGO USAR ESA  $a$  EN LA  
ECU DE TRASLACIÓN.



$$\frac{1}{2} m r^2 + m r^2$$

22 PÁG. 33

HAY ROZAMIENTO



- $m_1 = 30 \text{ kg}$
- $m_2 = 50 \text{ kg}$
- $r_1 = 1 \text{ m}$
- $r_2 = 0,5 \text{ m}$
- $F = 70 \text{ N}$
- $a = ?$

$$m_1 = 30 \text{ kg} (\times 2)$$

$$m_T = m_2 + 2m_1 \Rightarrow 110 \text{ kg}$$

SACO LA  $I_T$  DE LA PIEZA, TENIENDO EN CUENTA EL EIR.

$$I_{m_1}^{EIR} = \left[ \frac{1}{2} m_1 r_1^2 + m_1 r_2^2 \right] 2$$

$$I_{m_2}^{EIR} = \frac{1}{2} m_2 r_2^2 + m_2 r_2^2 \Rightarrow \frac{3}{2} m_2 r_2^2$$

$$I_T = I_{m_1}^{EIR} + I_{m_2}^{EIR} \Rightarrow I_T = \left[ \frac{1}{2} m_1 r_1^2 + m_1 r_2^2 \right] 2 + \frac{3}{2} m_2 r_2^2 \Rightarrow I_T = 45 + 18,75$$

$$I_T = 63,75 \text{ Kg m}^2$$

AHORA...  $\Sigma M^{EIR} = I_T \cdot a$

$$F \cdot (r_1 - r_2) = I_T \cdot \frac{a}{(r_1 - r_2)}$$

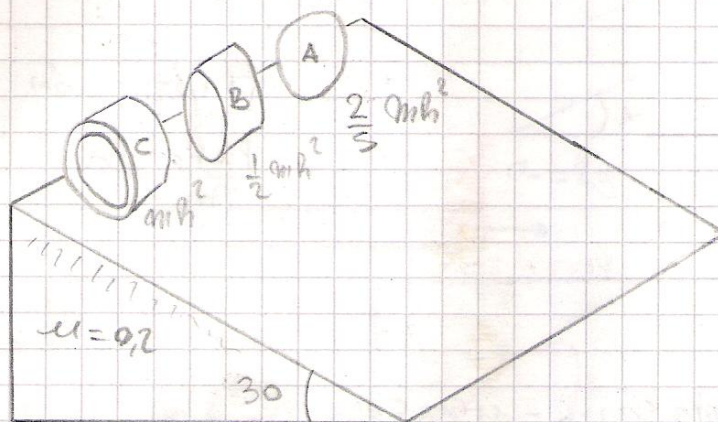
$$\frac{F \cdot (r_1 - r_2)^2}{I_T} = a \Rightarrow a = \frac{17,5 \text{ N m}^2}{63,75 \text{ Kg m}^2} \Rightarrow a = 0,27 \text{ m/s}^2$$

EN EL SENTIDO DE  
TORQUE EL MOMENTO  
(ANTI ROTARIO)



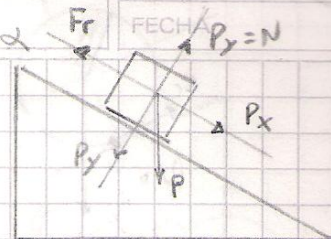


(25) PÁG. 34



$$P_x = m g \cdot \sin \alpha$$

$$F_r = \mu m g \cos \alpha$$



$$P_x - F_r = m \cdot a$$

$$F_r = -(m \cdot a) + P_x$$

(A)  $F_r \cdot R = \frac{2}{5} m \cdot R^2 \cdot \frac{a}{R}$

3 Fr

$$\mu m g \cos \alpha = \frac{2}{5} m \cdot a \Rightarrow a = \frac{5}{2} \mu g \cos \alpha \rightarrow 4,24 \text{ m/s}^2$$

2 m

(B)  $F_r \cdot R = \frac{1}{2} m \cdot R^2 \cdot \frac{a}{R}$

$\frac{15}{4} = 3,75$

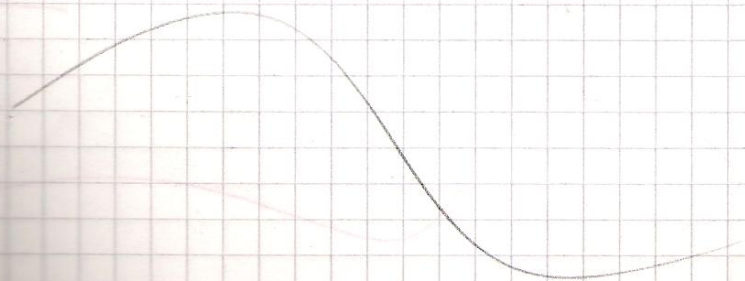
$$\mu m g \cos \alpha = \frac{1}{2} m \cdot a \Rightarrow a = 2 \mu g \cos \alpha \rightarrow 3,39 \text{ m/s}^2$$

(C)  $F_r \cdot R = m \cdot R^2 \cdot \frac{a}{R}$

$$\mu m g \cos \alpha = m \cdot a$$

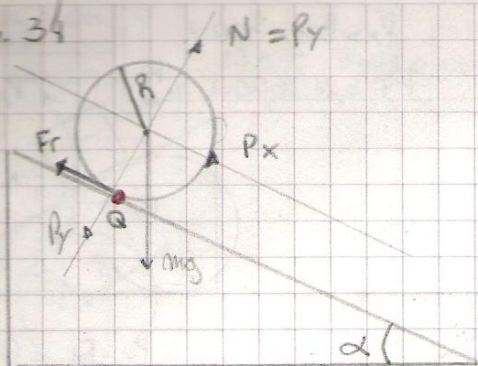
$$a = \mu g \cos \alpha \rightarrow 1,69 \text{ m/s}^2$$

• RTA LLEGAN PRIMERO A, LUEGO B, LUEGO C.





26 PÁG. 34



$$P_x = mg \sin \alpha$$

$$P_y = mg \cos \alpha = N$$

$$F_r = \mu \cdot mg \cos \alpha$$

TRASLACIÓN

$$\frac{P - F_r}{m} = a$$

$$\Sigma M^Q = I^Q \cdot \epsilon$$

$$P_x \cdot h = \frac{3}{2} m h^2 \frac{a}{h}$$

$$mg \sin \alpha = \frac{3}{2} m \left( \frac{mg \sin \alpha - \mu mg \cos \alpha}{m} \right)$$

$$mg \sin \alpha = \frac{3}{2} mg \sin \alpha - \frac{3}{2} \mu mg \cos \alpha$$

$$\sin \alpha - \frac{3}{2} \sin \alpha = -\frac{3}{2} \mu \cos \alpha$$

$$\frac{-1/2 \sin \alpha}{-3/2 \cos \alpha} = \mu \Rightarrow \boxed{\mu = \frac{1}{3} \tan \alpha} \quad \checkmark \quad (\text{DESDE EIR})$$

DESDE CM ...

$$F_r \cdot h = \frac{1}{2} m h^2 \frac{a}{h} \Rightarrow \mu \cdot mg \cos \alpha = \frac{1}{2} m \left( \frac{mg \sin \alpha - \mu mg \cos \alpha}{m} \right)$$

$$\mu \cos \alpha = \frac{1}{2} \sin \alpha - \frac{1}{2} \mu \cos \alpha$$

$$\frac{3}{2} \mu \cos \alpha = \frac{1}{2} \sin \alpha \Rightarrow \mu = \frac{\frac{1}{2} \sin \alpha}{\frac{3}{2} \cos \alpha} \Rightarrow \boxed{\mu = \frac{1}{3} \tan \alpha} \quad \checkmark$$

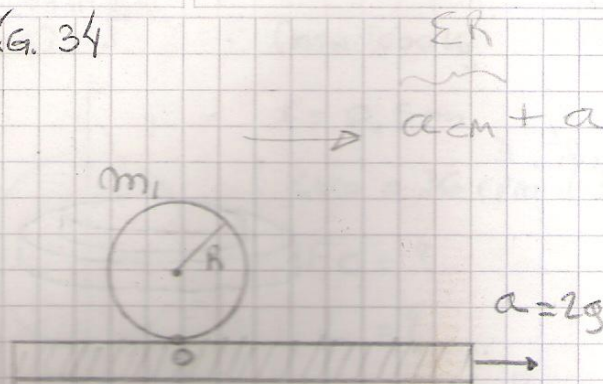


$$\frac{1}{2} m R^2 + m(2R^2)$$

HOJA N°

FECHA

(27) PÁG. 34



③  $\Sigma M = I \cdot \epsilon$

$$mg \cdot R = \frac{3}{2} m R^2 \cdot \frac{a}{R}$$

$$g = \frac{3}{2} \frac{mg - \mu mg}{m}$$

$$2g = 3 \frac{mg - \mu mg}{m}$$

$$2mg = 3mg - \mu mg$$

$$\frac{2}{3} = \mu$$

$$F \cdot R = \frac{1}{2} m R^2 \left( \frac{1}{2} R \epsilon + a \right)$$

$$\mu g = \frac{1}{2} R \left( \frac{1}{2} R \frac{a}{R} + a \right)$$

$$mg - \mu mg = ma$$

$$+ \mu mg = m(g - a)$$

$$| F = m(g - a) |$$

$$\frac{mg - \mu mg}{m} = a$$

TRASECCIÓN

$$F = m \cdot a_{cm}$$

$$\frac{F}{m} = a_{cm}$$

ROTACIÓN

$$F \cdot R = \frac{1}{2} m R^2 \cdot \epsilon$$

$$m \cdot a_{cm} = \frac{1}{2} m R \epsilon$$

$$a_{cm} = \frac{1}{2} R \epsilon$$