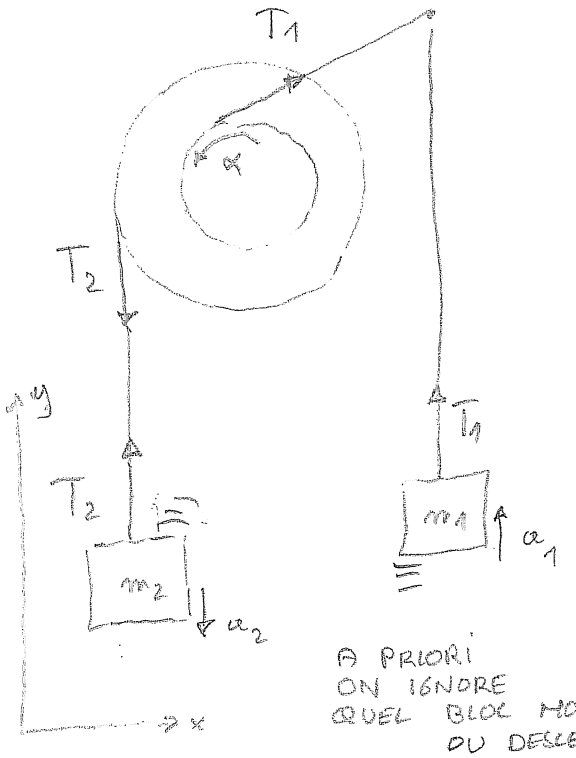
51



$I_\alpha = \Sigma M$

3 CORPS

1 POULIE

$I_\alpha = R_2 T_2 - R_1 T_1$ (1)

2 BLOCS

$m_2 a_2 = m_2 g - T_2$ (2)

$m_1 a_1 = T_1 - m_1 g$ (3)

$m\vec{a} = \Sigma \vec{F}$

A PRIORI ON IGNORE QUEL BLOC MONTE OU DESCEND !

LE SIGNE FOURNIRA LA SOLUTION

CINEMATIQUE

(4) $\alpha R_1 = a_1$

(5) $\alpha R_2 = a_2$

5 INCONNUES $\alpha, a_1, a_2, T_1, T_2$

5 EQUATIONS

(4) DS (2) $\quad m_2 R_2 \alpha = m_2 g - T_2$

(5) DS (3) $\quad m_1 R_1 \alpha = T_1 - m_1 g$

$T_2 = m_2 (g - R_2 \alpha)$

$T_1 = m_1 (g + R_1 \alpha)$

EN INJECTANT TOUT DANS (1) :

$I_\alpha = R_2 m_2 (g - R_2 \alpha) - R_1 m_1 (g + R_1 \alpha)$

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

$$\alpha = \frac{(R_2 m_2 - R_1 m_1)}{(I + m_1 R_1^2 + m_2 R_2^2)}$$

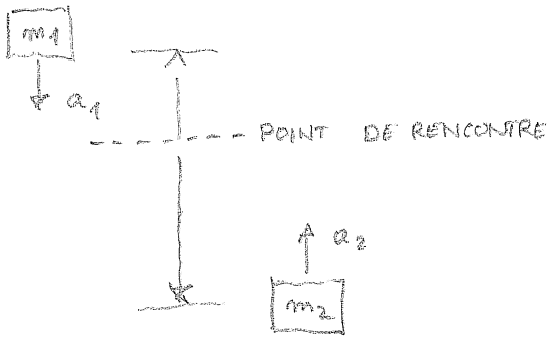
VALEURS NUMERIQUE

$\alpha = 10{,}548$ rad/sec^2

$a_1 = 0{,}52742$ m/s^2

$a_2 = 1{,}0548$ m/s^2

INSTANT OU LES 2 BLOCS SONT A LA MEME HAUTEUR



$$h = (a_1 + a_2)\frac{t^2}{2}$$

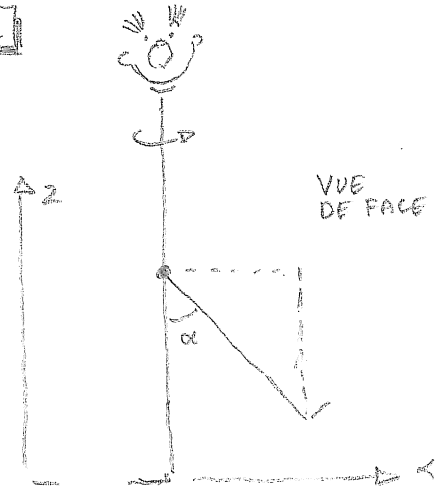
$\sum$ DISTANCES PARCOURUES PAR LES 2 BLOCS !

$$t = \sqrt{\frac{2h}{a_1 + a_2}}$$

VALEUR NUMERIQUE

$t = 1{,}39$ s

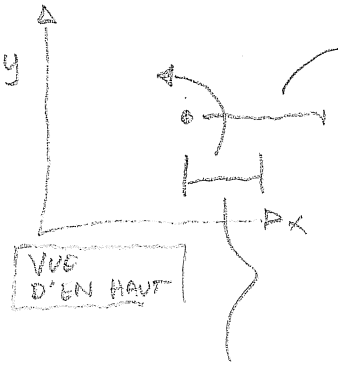
52



$$I_h = I + m h^2$$

INERTIE BARRE CM — THEOREME DES AXES //

$$I_h = \frac{1}{12} m (L \sin\alpha)^2 + m \left(\frac{L \sin\alpha}{2}\right)^2$$



ROTATION D'UNE BARRE DE LONGUEUR $L \sin\alpha$

UN RARE EXERCICE EN 3D !

$$I_h' = \left(\frac{1}{12} + \frac{1}{4}\right) m L^2 \sin^2\alpha$$

$$I_h = \frac{1+3}{12} m L^2 \sin^2\alpha$$

$$h = \frac{L \sin\alpha}{2}$$

$$I_h = \frac{1}{3} m L^2 \sin^2\alpha$$

ETAT INITIAL

$K = 0$
$U = 0$

ETAT FINAL

INERTIE POULIE

$$K = \frac{1}{2}\left(\frac{1}{2} m_p R_p^2\right)\omega^2 + \frac{1}{2} m_b \underbrace{R_p^2 \omega^2}_{(\text{VITESSE BLOC})^2}$$

$$U = -m_b g L \sin\theta$$

LE BLOC EST DESCENDU

PAS DE FROTTEMENT !

→ CONSERVATION ENERGIE MECANIQUE

$$\underbrace{R_p^2 \omega^2}_{v^2} = \frac{m_b g L \sin\theta}{\left[\frac{1}{4} m_p + \frac{1}{2} m_b\right]}$$

$$v = \sqrt{\frac{4 m_b g L \sin\theta}{m_p + 2 m_b}}$$

VALEUR NUMERIQUE

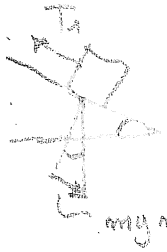
$v = 2{,}8 \text{ m/s}$

ACCELERATION ?

$$\left(\underbrace{\tfrac{1}{2} m_p R_p^2}_{I}\right)\alpha = R_p T$$

POULIE

BLOC



$$m_b R_p \alpha = m_b g \sin\theta - T$$

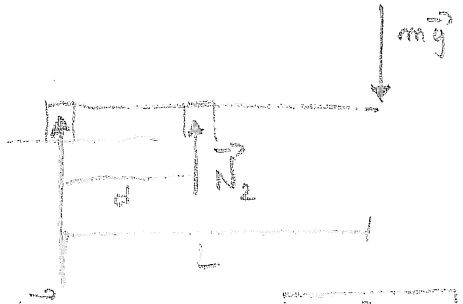
2 EQUATIONS
2 INCONNUES α, T

$$\alpha = \frac{\sin\theta\, m_b g}{\frac{1}{2} m_p R_p + m_b R_p}$$

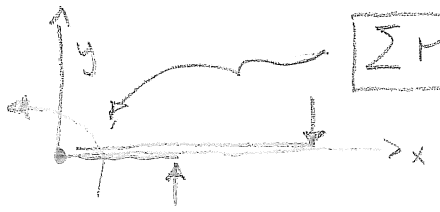
VALEUR NUMERIQUE

$\alpha = 7{,}83 \text{ rad/s}^2$

54



$\boxed{\sum \vec{F} = 0}$ $\quad N_1 + N_2 = mg$

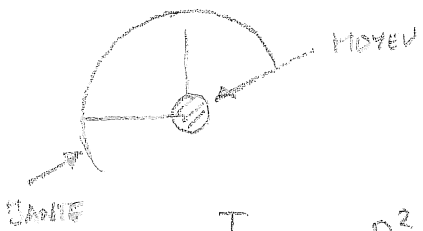


$\boxed{\sum H = 0}$ $\quad N_2 d - mgL = 0$

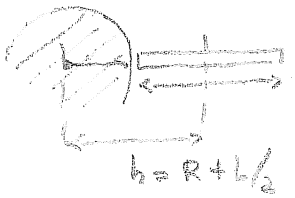
EQUILIBRE DE ROTATION A L'ORIGINE (PAR EXEMPLE !)

$$\boxed{\begin{aligned} N_2 &= mgL/d \\ N_1 &= mg(1 - L/d) \end{aligned}}$$

55



$$I = \underbrace{\frac{m_1 R_1^2}{2}}_{\text{CYLINDRE PLEIN}} + \underbrace{m_3 R_3^2}_{\text{CYLINDRE CREUX}} + 4\left(\underbrace{m_2 \frac{L^2}{12}}_{\text{BARRE}} + \underbrace{m_2 \left(R_1 + L/2\right)^2}_{\text{THEOREME DES AXES //}}\right)$$



$$= 4 + 72 + 4\left[\frac{16}{12} + \underbrace{\left(2+2\right)^2}_{16}\right]$$

$$I = 4 + 72 + 4\left(\frac{4}{3} + 16\right) = 145{,}3$$

$\boxed{I = 145{,}3 \text{ kg m}^2}$ $\quad \boxed{m = 8 \text{ kg}}$ $\quad \boxed{k = \sqrt{\frac{I}{m}} = 4{,}26 \text{ m}}$

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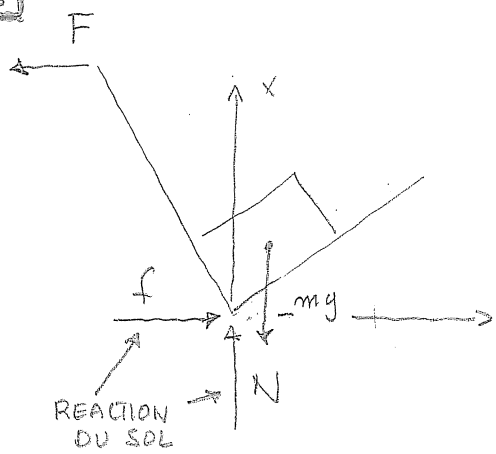
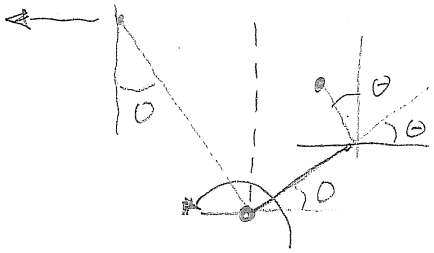


IL FAUT EN FAIT TIRER SUR LE DIABLE

LE DESSIN DE L'ENONCE EST TROMPEUR !

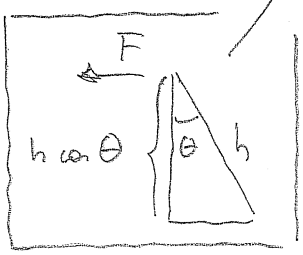
ON PEUT INVERSER LE DESSIN ET OBTENIR UN RESULTAT NEGATIF

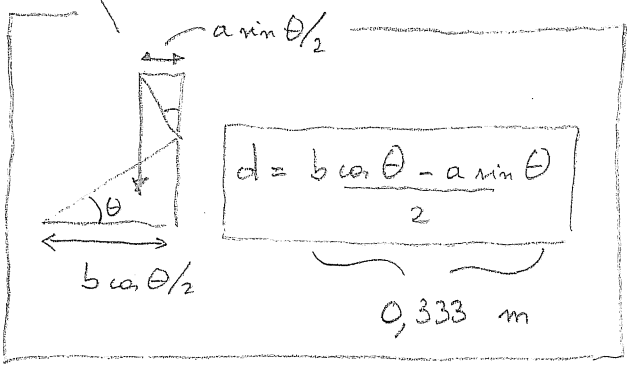
$\sum M = 0$!



TRIGONOMETRIE !
TRICKY !

$$F h \cos\theta - mgd = 0$$





$$d = \frac{b\cos\theta - a\sin\theta}{2}$$

0,333 m

$$F = \frac{mgd}{h\cos\theta}$$

VALEUR NUMERIQUE

$F = 68,6$ N