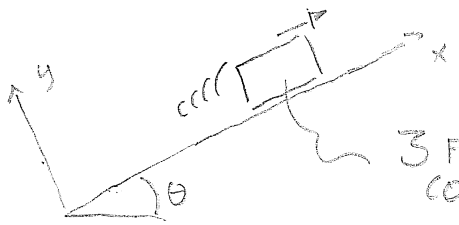
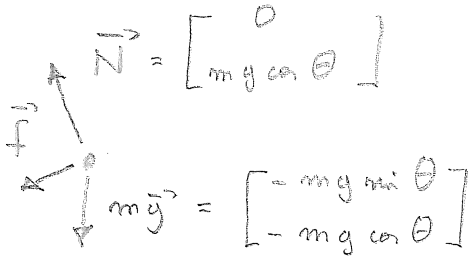
32



3 FORCES CONSTANTES



IL Y A DU TRAVAIL POUR LA GRAVITE ET LE FROTTEMENT

$$\underbrace{\Delta\left(\frac{1}{2}mv^2\right)}_{0-\frac{1}{2}mv^2} = \underbrace{-d\,\mu_c\,mg\cos\theta}_{\text{TRAVAIL FORCE FROTTEMENT}} \underbrace{-\,d\,mg\sin\theta}_{\text{TRAVAIL GRAVITE}}$$

$\frac{1}{2}mv^2$: VITESSE INITIALE !

$$\frac{1}{2}v^2 = d\,g\,(\mu_c\cos\theta + \sin\theta)$$

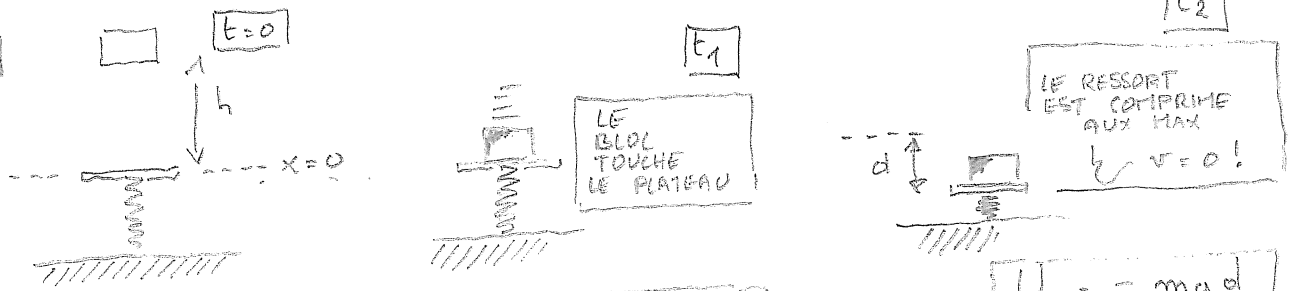
$$\boxed{d = \frac{v^2}{2g(\mu_c\cos\theta + \sin\theta)}}$$

VALEURS NUMERIQUES

$$d = \frac{4\times 4}{2\times 9{,}81\,(0{,}6\,\sqrt{3}/2 + 1/2)}$$

$0{,}8$

33



$t=0$	t_1	t_2
$U_g = mgh$	$U_g = 0$	$U_g = -mgd$
$U_1 = 0$	$U_1 = 0$	$U_1 = k\,d^2/2$
$K = 0$	$K = \frac{mv^2}{2} = mgh$	$K = 0$

CONSERVATION ENERGIE MECANIQUE CAR CONSERVATION ENERGIE MECANIQUE !

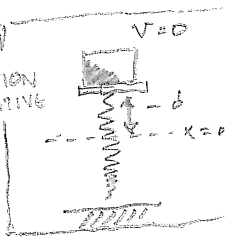
• CONSERVATION ENERGIE MECANIQUE

$$mgh = -mgd + k\,d^2/2$$

$0{,}5$ $9{,}81$ $0{,}6$ 120

$$60\,d^2 - 4{,}9\,d - 2{,}94 = 0$$

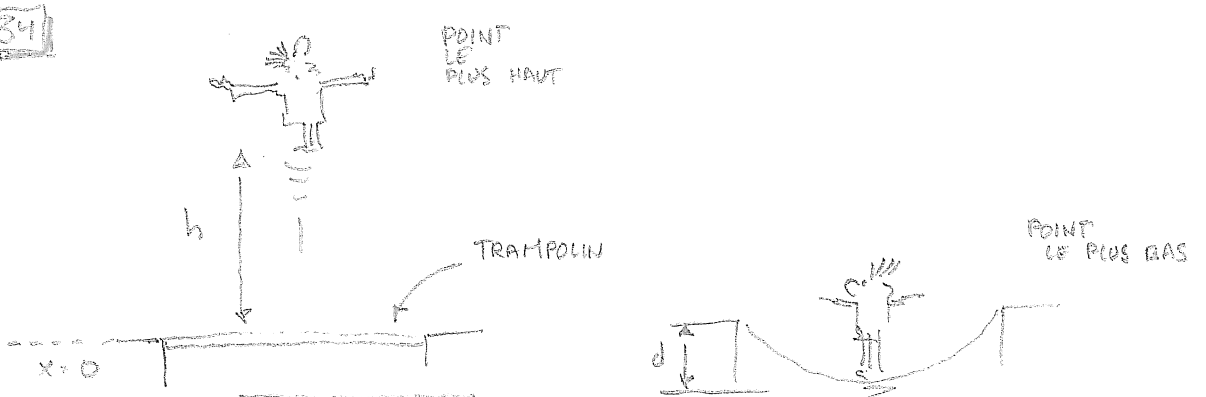
A EXCLURE !



SOLUTION POSITIVE

$$\boxed{d = 0{,}27\ m}$$

34



$U_g = mgh$
$U_r = 0$
$K = 0$

ETAT INITIAL

$U_g = -mgd$
$U_r = k d^2/2$
$K = 0$

ETAT FINAL

CONSERVATION ENERGIE MECANIQUE

$mgh = -mgd + k d^2/2$

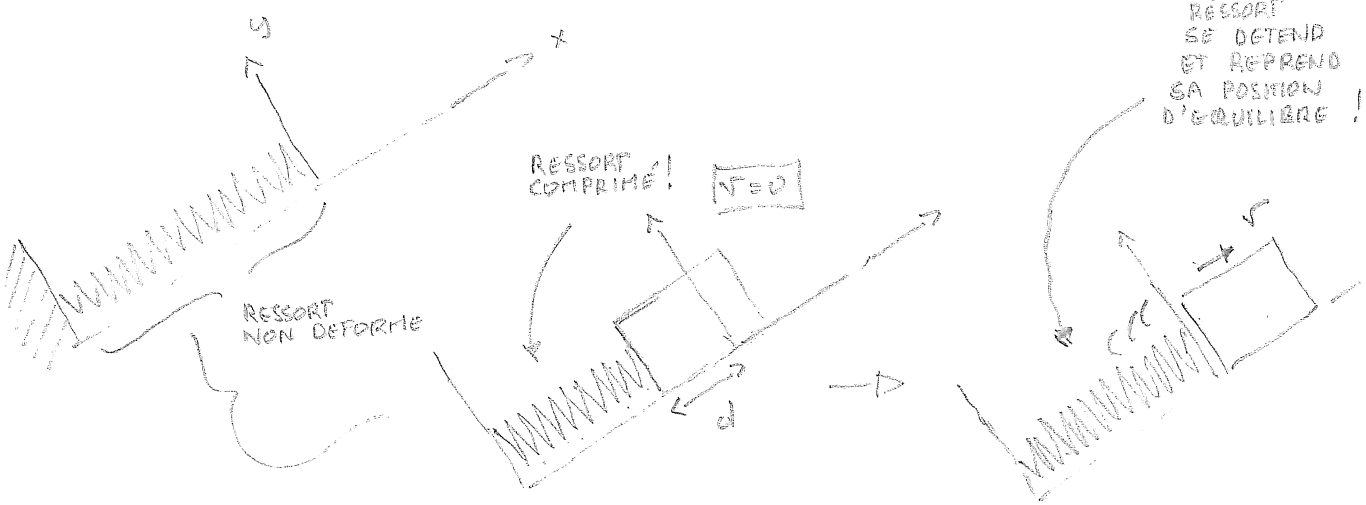
$$\frac{2mg(h+d)}{d^2} = k$$

CHECK DIMENSION !

VALEUR NUMERIQUE

$$\frac{2 * 68 * 9{,}81 * 3{,}45}{0{,}45 * 0{,}45} = 22700 \text{ N/m}$$

35



ETAT INITIAL

$$U_g = -mgd\sin\theta$$
$$U_r = kd^2/2$$
$$K = 0$$

$$\rightarrow \quad U_g = 0 \quad U_r = 0 \quad K = mv^2/2$$

ETAT FINAL

ATTENTION IL FAUT TENIR COMPTE DU FROTTEMENT !!

$$\Delta K + \Delta U = \vec{f}\cdot\vec{d}$$

TRAVAIL DU FROTTEMENT

$$\begin{bmatrix} -\mu\, mg\cos\theta \\ 0 \end{bmatrix} \cdot \begin{bmatrix} d \\ 0 \end{bmatrix}$$

$\frac{1}{2}mv^2$ — $mgd\sin\theta - kd^2/2$

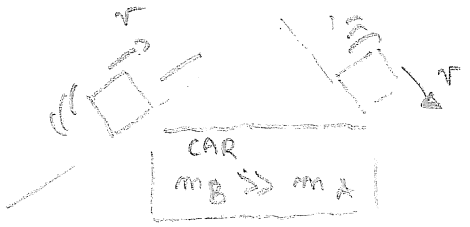
$$\frac{1}{2}mv^2 + mgd\sin\theta - kd^2/2 = -\mu_c mgd\cos\theta$$

$$v^2 = -2gd(\mu_c\cos\theta + \sin\theta) + kd^2/m$$

$$v = \sqrt{\frac{kd^2}{m} - 2gd(\mu_c\cos\theta + \sin\theta)}$$

VALEUR NUMERIQUE $v = 1{,}96\ m/s$

36



ETAT INITIAL

$K = 0$

$U_y = 0$

ETAT FINAL

$K = (m_A + m_B) v^2/2$

$U_y = m_A g d \sin\alpha - m_B g d \sin\beta$

LE BLOC A EST MONTE

LE BLOC B EST DESCENDU !

PAS DE FROTTEMENT !

CONSERVATION ENERGIE MECANIQUE

$$(m_A + m_B)\frac{v^2}{2} + m_A g d \sin\alpha - m_B g d \sin\beta = 0$$

$$v = \sqrt{\frac{2gd}{(m_A + m_B)}\left[m_B \sin\beta - m_A \sin\alpha\right]}$$

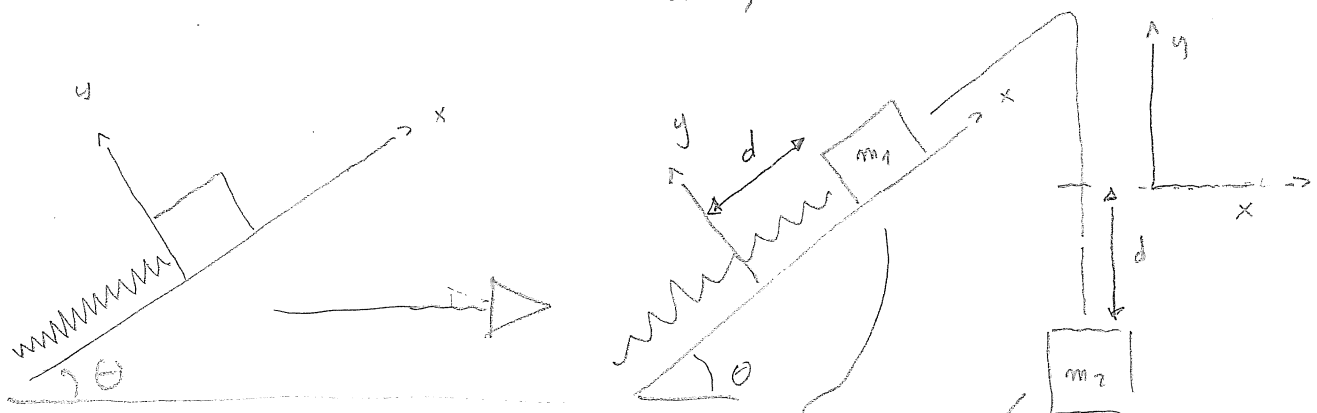
VALEURS NUMERIQUE

$$v = \sqrt{\frac{2 \times 9.81 \times 0.4}{9}\left(5 \sin(60°) - 4 \sin(30°)\right)}$$

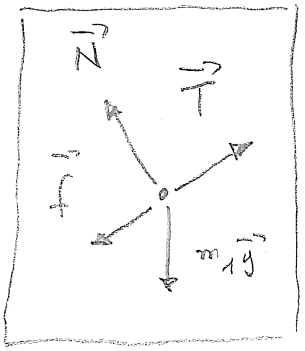
1,43 m/s

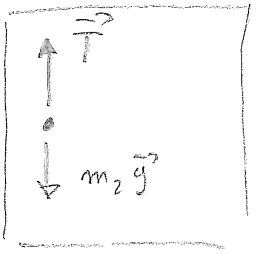
37

$d = 0{,}2\ m$



SYSTEME
= ENSEMBLE
DES 2 BLOCS





ETAT INITIAL

$U_g = 0$

$U_r = 0$

$K = 0$

ETAT FINAL

$U_g = \underbrace{m_1 g d \sin\theta}_{\text{LA MASSE EST MONTEE}} - \underbrace{m_2 g d}_{\text{LA MASSE EST DESCENDUE}}$

$U_g \nearrow$ $U_g \searrow$

$U_r = \frac{1}{2} k d^2$

$K = \frac{1}{2}(m_1 + m_2) v^2$

$\Delta K + \Delta U = \vec{f} \cdot \vec{d}$

$\vec{f} \cdot \vec{d} = -\mu_c m_1 g \cos\theta\, d$

$$\frac{1}{2}(m_1 + m_2) v^2 + m_1 g d \sin\theta - m_2 g d + \frac{1}{2} k d^2 = -\mu_c m_1 g \cos\theta\, d$$

$$v = \sqrt{\frac{2}{(m_1 + m_2)} \left[m_1 g d (-\mu \cos\theta - \sin\theta) + m_2 g d - \frac{1}{2} k d^2 \right]}$$

VALEUR NUMERIQUE

$v = 1{,}5\ m/s$