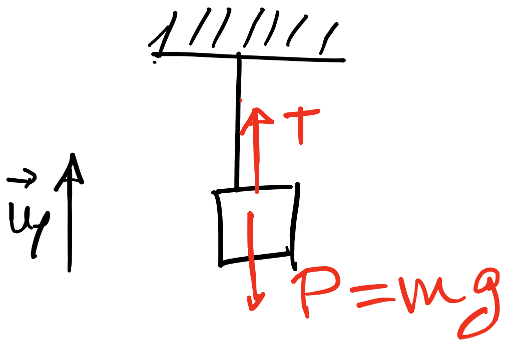
29/04/2020

Applicazioni delle leggi di Newton

↳ RHK CAP. 5

• Tensione



$$\sum_i \vec{F}_i = 0$$

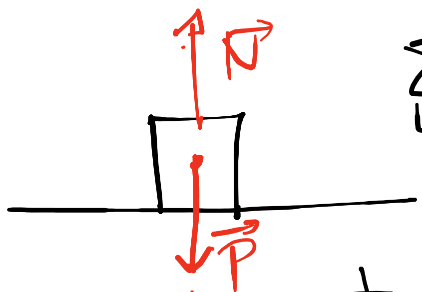
↓

fermo ⟹ $\vec{a}=0$

$$\vec{T}+\vec{P}=0$$

$$T=mg$$

• Forza Normale



$$\sum_i \vec{F}_i = 0$$

$\vec{N}$ forza normale → forza dalla superficie sul corpo

$$\vec{N}+\vec{P}=0 \Rightarrow |\vec{N}|=mg$$

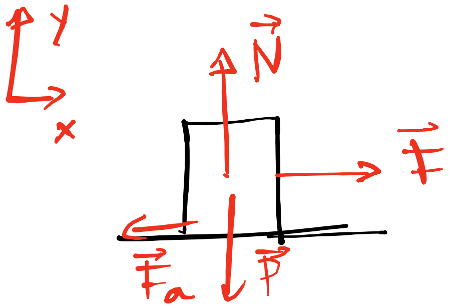
• Forza Attrito

↳ { attrito cinetico ⟶ μ_K

Attrito statico $\rightarrow \mu_s$

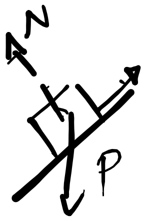
$$\vec{F}_a = \mu \vec{N}$$

↳ coef. di attrito tra 2 superficie



se in moto $\rightarrow F_a = \mu_k N$

$$\vec{F}_a = -\mu_k m g \, \vec{u}_x$$

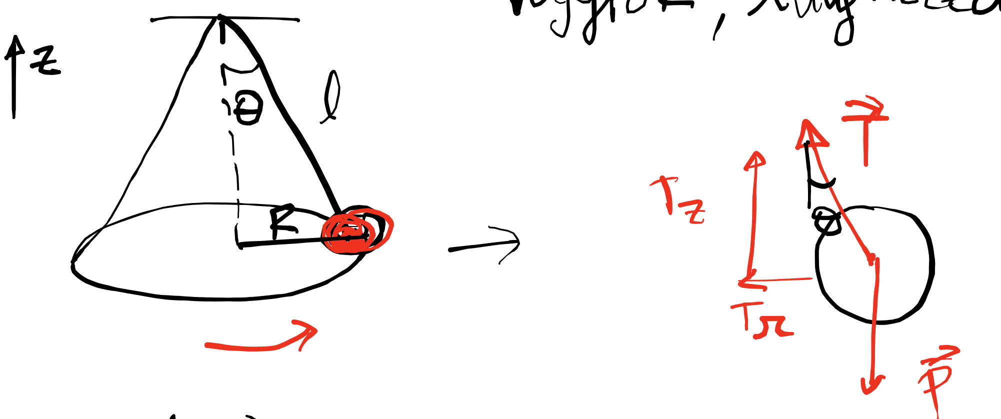


se fermo $\rightarrow \vec{F}_a = \mu_s N$

$$\boxed{\mu_s \geq \mu_k}$$

- Pendolo Conico $\rightarrow$ M. Circolare Uniforme

raggio R, lunghezza l, θ



$$\frac{R}{l} = \sin\theta$$

$$\begin{cases} \vec{T} = |\vec{T}| \cos\theta \, \vec{u}_z - |\vec{T}| \sin\theta \, \vec{u}_r \\ \vec{P} = -mg \, \vec{u}_z \end{cases}$$

$$\sum_i \vec{F}_i = m\vec{a} \Rightarrow \begin{cases} |\vec{T}| \sin\theta = m a_c \Leftrightarrow a_c = \frac{mg}{\cos\theta} \frac{\sin\theta}{m} \\ |\vec{T}| \cos\theta = mg \Leftrightarrow |\vec{T}| = \frac{mg}{\cos\theta} \end{cases}$$

$$\boxed{a_c = g \operatorname{tg}\theta}$$

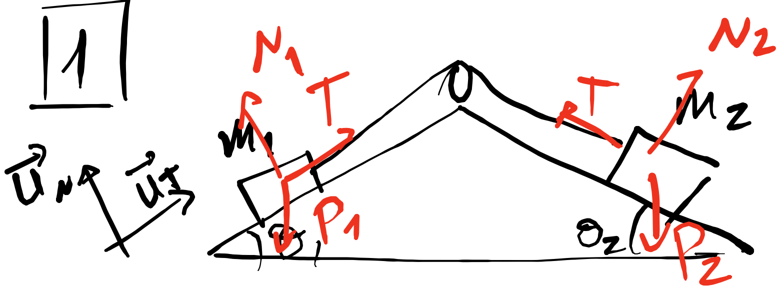
$$a_c = v^2/R \rightarrow v = \sqrt{R g \operatorname{tg}\theta} \Leftrightarrow \boxed{v = \sqrt{g l \frac{\sin^2\theta}{\cos\theta}}}$$

Periodo del moto circolare uniforme

$$v = \frac{2\pi R}{T} \rightarrow \boxed{T = 2\pi \sqrt{\frac{l\cos\theta}{g}}}$$

FAK, Pag 118, Problemi

$\boxed{1}$



→ accelerazione

→ tensione

$$\begin{cases} \text{corpo 1} & T - |P_1|\sin\theta_1 = m_1 a \\ \text{corpo 2} & -T + |P_2|\sin\theta_2 = m_2 a \end{cases}$$

$$\begin{cases} -m_2 a + m_2 g \sin\theta_2 - m_1 g \sin\theta_1 = m_1 a \\ T = -m_2 a + m_2 g \sin\theta_2 \end{cases}$$

$$a(m_1+m_2) = (+m_2\sin\theta_2 - m_1\sin\theta_1)g$$

$$\left[a = g \frac{m_2\sin\theta_2 - m_1\sin\theta_1}{m_1+m_2} \right.$$

$$T = -m_2 \quad g \frac{-m_1\sin\theta_1 + m_2\sin\theta_2}{} + m_2 g \sin\theta$$

$$m_1 + m_2$$

$$\boxed{T = \frac{m_1 m_2 g}{m_1 + m_2}(\sin\theta_1 + \sin\theta_2)}$$

(b) $m_1 = 3.70\ kg$ $\quad m_2 = 4.86\ kg$

$\theta_1 = 28°$ $\quad \theta_2 = 42°$

$$\vec{a} = g \, \frac{-3.70 \sin 28 + 4.86 \sin 42}{3.70 + 4.86} = +1.74 \, \vec{u}_T \ (m/s^2)$$

$g \downarrow$ $9.8\ m/s^2$

(c) m_1 accelera in salita $\quad a > 0$

" " discesa $\quad a < 0$

m_1 non accelera $\quad a = 0$

$$a = \frac{-m_1 \sin\theta_1 + m_2 \sin\theta_2}{m_1 + m_2} \, g$$

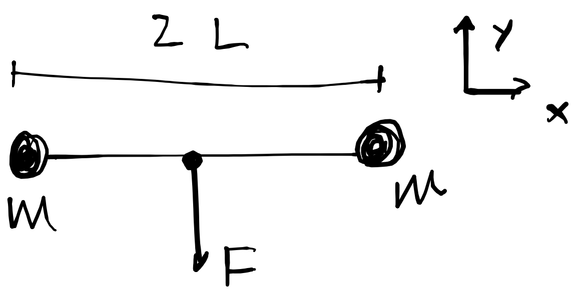
$a > 0 \Rightarrow m_1 \sin\theta_1 < m_2 \sin\theta_2$

$$m_2 > m_1 \frac{\sin\theta_1}{\sin\theta_2}$$

$$a < 0 \Rightarrow m_2 < m_1 \frac{\sin\theta_1}{\sin\theta_2}$$

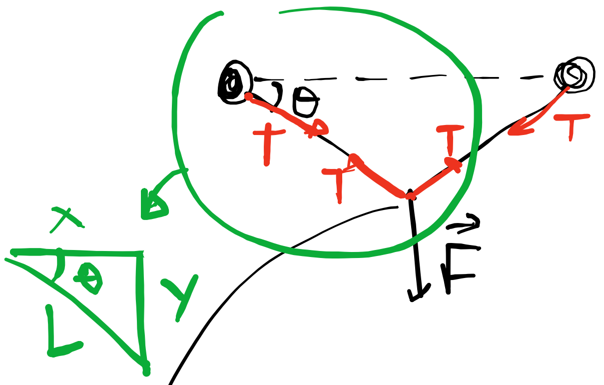
$a = 0$ $\qquad m_2 = m_1 \dfrac{\sin\theta_1}{\sin\theta_2} = 2.6\,kg$

$\boxed{3}$



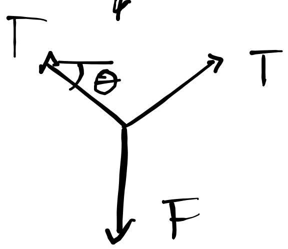
dimostrare che

$$a_x = \frac{F}{2m}\,\frac{x}{\sqrt{L^2-x^2}}$$



$$\vec{T} = m\vec{a}$$

$$\begin{cases} T_x = m a_x \\ T_y = m a_y \end{cases} \Rightarrow \boxed{|T|\cos\theta = m a_x}$$



$$2T_y = F \Rightarrow \boxed{T = \frac{F/2}{\sin\theta}}$$

$$a_x = \frac{F/2}{m\sin\theta}\cos\theta$$

(teor. Pitagora)

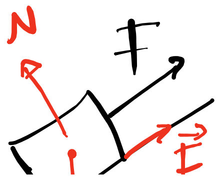
$$x^2 + y^2 = L^2$$

$$\cos\theta = x/L$$
$$\sin\theta = y/L$$

$$\rightarrow \frac{\cos\theta}{\sin\theta} = \frac{x}{y} = \frac{x}{\sqrt{L^2-x^2}}$$

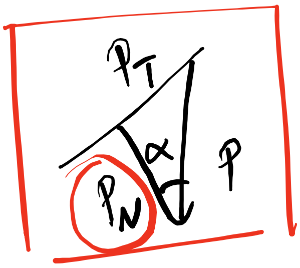
$$\boxed{a_x = \frac{F}{2m}\,\frac{x}{\sqrt{L^2-x^2}}}$$

$\boxed{5}$



$m = 7.96\,kg \qquad \mu_s = 0.25;\ \mu_k = 0.15$

$$\begin{cases} \vec{u}_T: & F + F_a - P_T = 0 \\ \vec{u}_N: & N - P_N = 0 \end{cases}$$

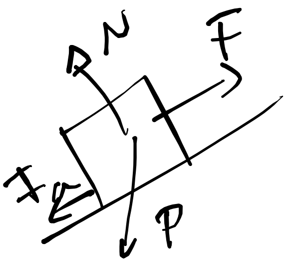


$$\begin{cases} F + \mu_s N - \underbrace{mg \sin\alpha}_{P_T} = 0 \\ N = \underbrace{mg}_{P_N} \cos\alpha \end{cases}$$

$$F = mg \sin\alpha - \mu_s mg \cos\alpha$$

$$\boxed{F = mg(\sin\alpha - \mu_s \cos\alpha)}$$

(B)



$$\vec{u}_T: \quad F - P_T - F_a = m \underset{\substack{\downarrow \\ 0}}{a_T}$$

$$F = P + F_a = P + \mu_s N$$

$$\boxed{F = mg(\sin\alpha + \mu_s \cos\alpha)}$$

(C) F tale che blocco sale a $\underbrace{\vec{v} \text{ costante}}_{a_T = 0}$

$$\vec{u}_T \Rightarrow F - P_T - F_a = 0$$

statico

$$F = mg(\sin\alpha + \mu_k \cos\alpha) = \underline{\underline{40.11\,N}}$$

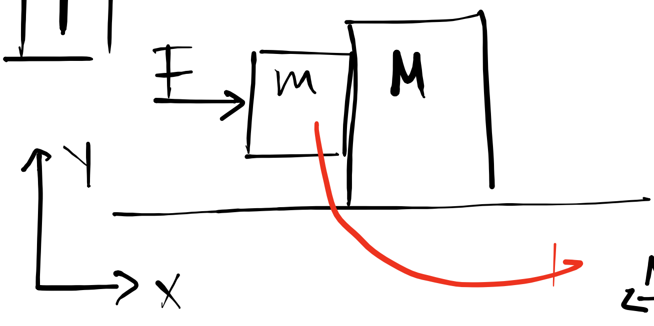
$$F_a = \mu_k N = \mu_k mg \cos\alpha$$

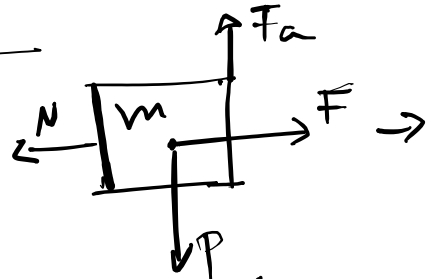
$$N - P_N = 0$$

$$N = P_N = mg\cos\alpha$$

$\boxed{9}$

?F_{min}?

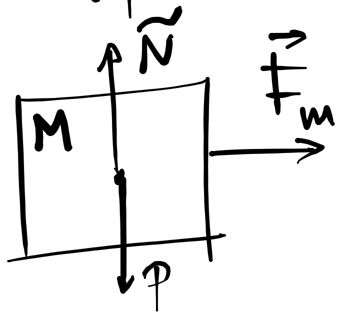




corpo m

$$\begin{cases} \vec{u}_y & F_a - P = 0 \quad \boxed{1} \\ \vec{u}_x & F - N = m a_x \end{cases}$$

$$|F_{Mm}| = |N| = |F_{mM}|$$



$$\vec{F}_{mM} = N$$

$$\boxed{M a_x = N}$$

$$\to a_x = N/M$$

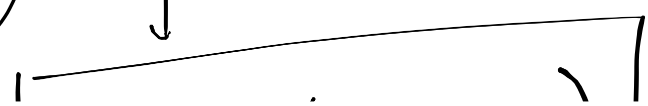
$$\mu N = mg$$

$$F = N + m a_x$$

$$F = N + m\frac{N}{M} = \frac{mg}{\mu} + \frac{m^2}{M}\frac{g}{\mu}$$

da $\boxed{1}$ $\mu_s N = mg$

$$N = mg$$



$\overline{\mu_s}\ \sigma$

$$\boxed{F = \frac{mg}{\mu}\left(1 + m/M\right)}$$