$$\begin{cases} s = \cancel{s_0} + v_i t - \frac{1}{2} a t^2 \\ \cancel{v} = v_i - a t \end{cases}$$

$$\begin{cases} s = v_i t - \frac{1}{2} a t^2 \\ 0 = v_i - a t \end{cases} \rightarrow t = \frac{v_i}{a}$$

(1)

$$F = ma$$

$$\begin{cases} s = v_i \cdot \frac{v_i}{a} - \frac{1}{2} a \cdot \left(\frac{v_i}{a}\right)^2 \\ t = \frac{v_i}{a} \end{cases}$$

$$\begin{cases} s = \frac{v_i^2}{a} - \frac{1}{2} \frac{v_i^2}{a} \\ t = \frac{v_i}{a} \end{cases}$$

$$\begin{cases} s = \frac{1}{2} \frac{v_i^2}{a} \\ t = \frac{v_i}{a} \end{cases}$$

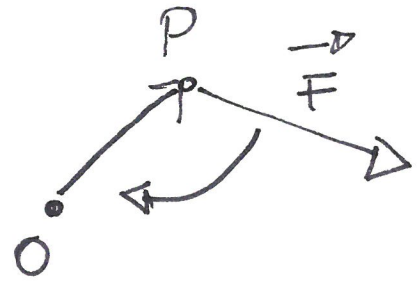
$$\begin{cases} a = \frac{v_i^2}{2s} = \frac{(20\,m/s)^2}{2 \cdot 30\,m} = 6{,}7\,m/s^2 \\ t = \frac{v_i}{a} \end{cases}$$

$$F = ma$$

$$= 900\,kg \cdot 6{,}7\,m/s^2$$

$$= 6000\,N$$

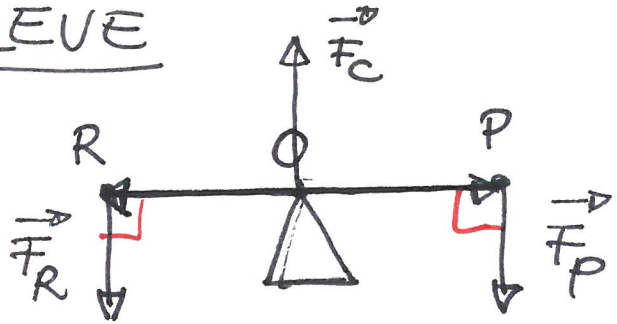
$\vec{M} = \vec{OP} \times \vec{F}$ OP distanza tra il Polo e il punto di applicazione di F



$$\sum_{i=1}^{N} \vec{F}_i = 0$$ Eq. TRASLAZIONALE

$$\sum_{i=1}^{N} \vec{M}_i = 0$$ Eq. ROTAZIONALE

LEVE

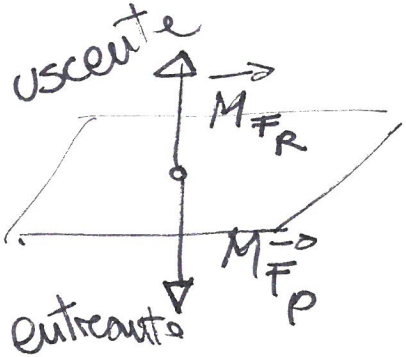


1° genere $\quad \sum \vec{F} = 0$

$$\sum \vec{M} = 0 \qquad \vec{M}_{F_R} + \vec{M}_{F_P} + \vec{M}_{F_C} = 0$$

$$\vec{OR} \times \vec{F}_R + \vec{OP} \times \vec{F}_P + \vec{OO} \times \vec{F}_C = 0$$

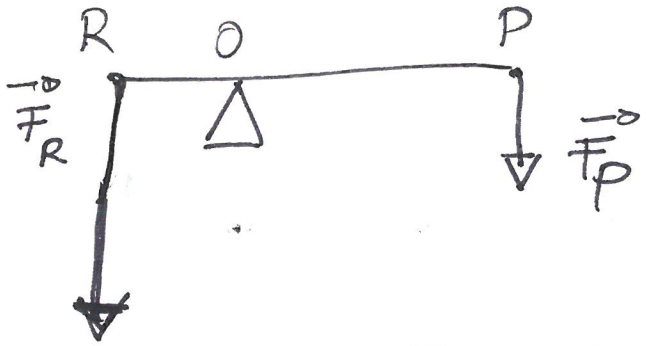
$\vec{OO}$ e $\vec{F}_C$ nulli



$$+ OR \cdot F_R \cdot \underbrace{\sin\frac{\pi}{2}}_{=1} - OP \cdot F_P \underbrace{\sin\frac{\pi}{2}}_{=1} = 0$$

$$OR \cdot F_R - OP\, F_P = 0$$

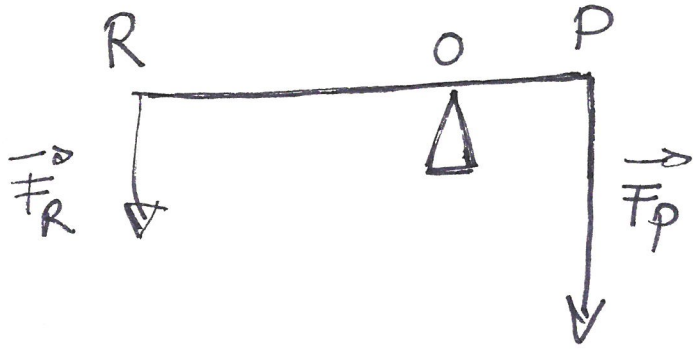
$$OR \cdot F_R = OP \cdot F_P$$



F_R = RESISTENZA

F_P = POTENZA

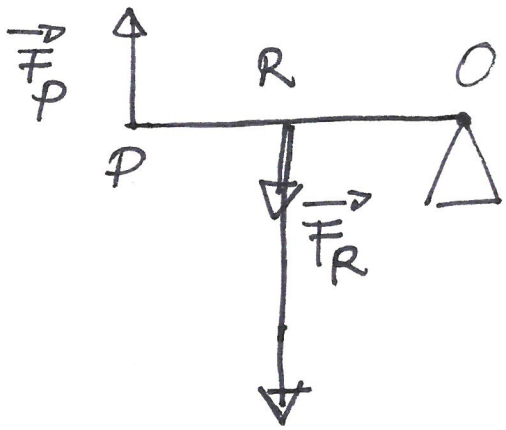
$F_P < F_R$ VANTAGGIOSA perche' $OR < OP$



$F_P > F_R$ SVANTAGGIOSA

perche' $OR > OP$

2° genere



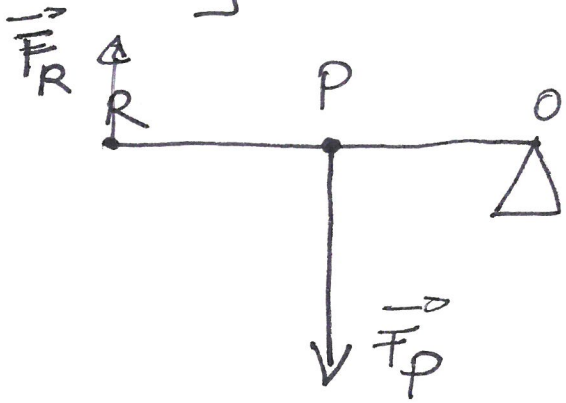
Resistenza intermedia

sempre vantaggiosa

$OP > OR \longrightarrow F_P < F_R$

sempre

3° genere



Potenza intermedia

sempre svantaggiosa

$OP < OR \longrightarrow F_P > F_R$

CONSERVAZIONE DELL'ENERGIA

Sistema isolato: no scambio di materia/energia

$$L_{TOT} = \Delta E_k$$

$$L_{cons} + L_{non\ cons} = \Delta E_k$$

$$-\Delta U - \Delta I = \Delta E_k$$

$$\boxed{\Delta E_k + \Delta U + \Delta I = 0}$$

Cons. energia

$$L_{cons} = -\Delta U$$

$$L_{non\ cons} = -\Delta I$$

$$I = (E_k + U)_{interazione} + (E_k + U)_{interno}$$

$$E_{k_f} - E_{k_i} + U_f - U_i + I_f - I_i = 0$$

$$\boxed{E_{k_f} + U_f + I_f = E_{k_i} + U_i + I_i}$$

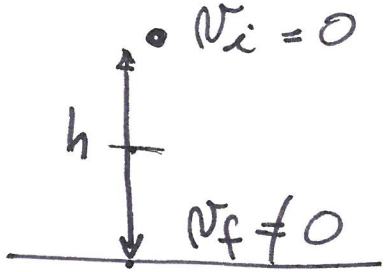
$$L_{non\ cons} = \vec{F}_a \cdot \vec{s} = F_a \cdot s \cos\pi = -F_a \cdot s$$

$$L_{non\ cons} < 0 \qquad I_f - I_i > 0$$

$$\Delta E_k + \Delta U + \Delta I = 0$$

se agiscono solo F conservative $\Delta I = 0$

$$\boxed{\Delta E_k + \Delta U = 0}$$



$E_{k_i} = 0 \quad U_i = mgh$

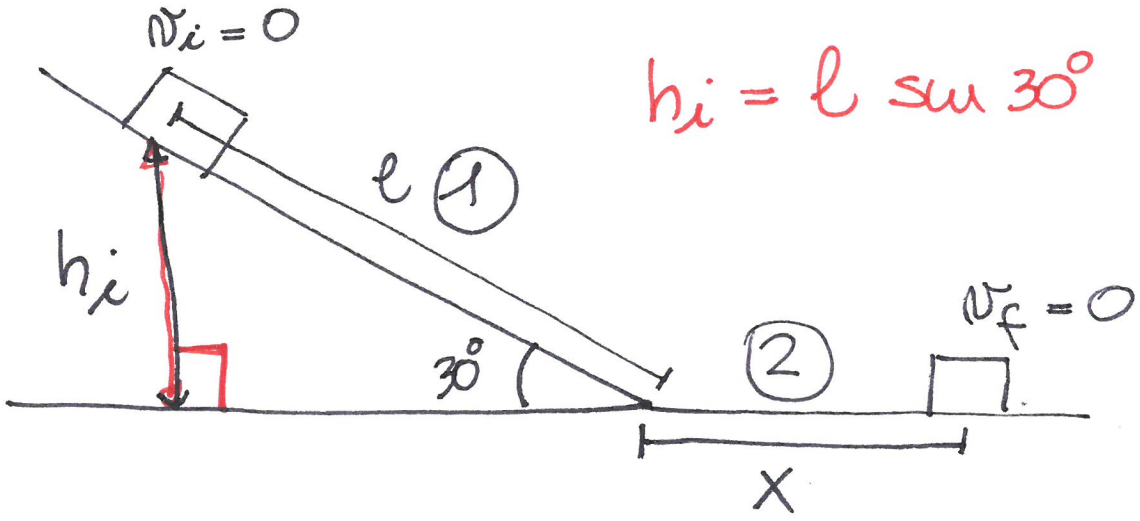
$E_{k_f} = \frac{1}{2} m v_f^2 \quad U_f = 0$

se il sistema non è isolato $\Delta E_k + \Delta U + \Delta I = L_{est}$

$v_i = 0$ $\quad \ell = 300\ m$ $\quad \mu_d = 0,2$

$h_i = \ell \sin 30°$

$X = ?$



$$F_a = \mu_d F_c$$

$$N = \mu_d \cdot N$$

$$\mu_d = \frac{N}{N} \quad \text{adimens.}$$

$$\Delta E_k + \Delta U + \Delta I = 0$$

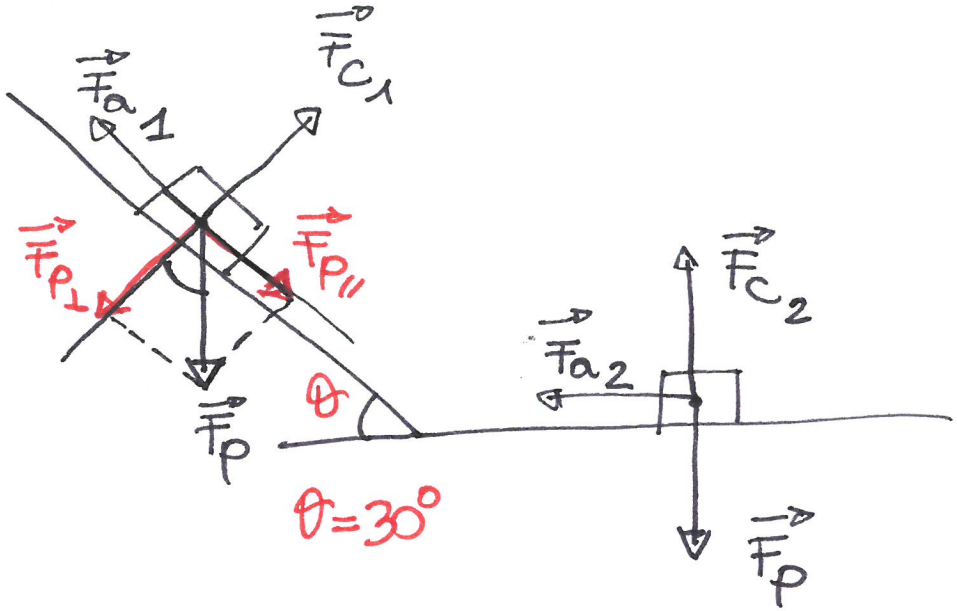
$$\Delta E_k = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 = 0$$

$$\Delta U = U_f - U_i = mgh_f - mgh_i = -mgh_i$$

$$\Delta I = -L_{NCONS}$$

$$-\Delta I = L_{NON\ CONS}$$

$$L_{NON\ CONS} = L_{F_a} = L_{F_{a_1}} + L_{F_{a_2}}$$



$$F_{a_2} = \mu_d F_{C_2} = \mu_d F_P = \mu_d mg$$

$$F_{a_1} = \mu_d F_{C_1} = \mu_d F_{P_\perp} = \mu_d F_P \cos\theta = \mu_d mg \cos\theta$$

$$L_{F_{a_1}} + L_{F_{a_2}} = \vec{F}_{a_1} \cdot \vec{\ell} + \vec{F}_{a_2} \cdot \vec{x} = F_{a_1} \cdot \ell \underbrace{\cos\pi}_{=-1} + F_{a_2} \cdot x \underbrace{\cos 0}_{=1}$$

$$L_{F_{a1}} + L_{F_{a2}} = -\mu_d mg\cos\theta \cdot \ell - \mu_d mg \cdot x$$

$$= -(\mu_d mg\cos\theta \cdot \ell + \mu_d mgx)$$

$$\cancel{\Delta E_k} + \Delta U + \Delta I = 0$$

$$-mgh_i + \mu_d mg\cos\theta\,\ell + \mu_d mgx = 0$$

$$x = \frac{gh - \mu_d g\cos\theta\,\ell}{\mu_d g} = \frac{h - \mu_d\cos\theta\,\ell}{\mu_d}$$

$$= \frac{\ell\,\mathrm{sen}\,30° - \mu_d\cos 30°\,\ell}{\mu_d} =$$

$$= \frac{(300\,m)\,\mathrm{sen}\,30° - 0{,}2\cdot\cos 30°\cdot(300\,m)}{0{,}2}$$

$$= 490{,}2\,m$$