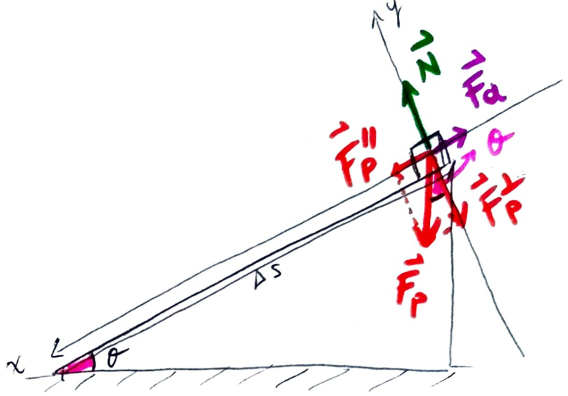
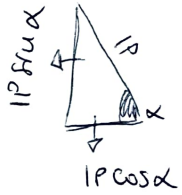
1 DATI

$m = 3.00\,kg$
$v_i = 0\,m/s$
$\vartheta = 30°$
$\Delta s = 2.0\,m$
$\Delta t = 1.50\,s$

RICHIESTE

$a = ?$
$v_f = ?$
$|\vec{F}_a| = ?$
$\mu_d = ?$





SOLUZIONE

- $\begin{cases} v_f = v_i + at \\ s_f = s_0 + v_i t + \frac{1}{2}at^2 \end{cases} \rightarrow \begin{cases} v_f = at \\ \Delta s = \frac{1}{2}at^2 \end{cases} \rightarrow a = \frac{2\cdot\Delta s}{t^2} = \frac{2\times(2.0\,m)}{(1.50\,s)^2} = 1.78\,m/s^2$

  $\rightarrow v_f = \left(1.78\,\frac{m}{s^2}\right)(1.50\,s) = 2.67\,m/s$

- $\sum_i \vec{F}_i = m\vec{a}$
  - asse y $\rightarrow \sum_i F_{i,y} = 0 \rightarrow F_P^{\perp} = N$
  - asse x $\rightarrow \sum_i F_{i,x} = ma \rightarrow \vec{F}_P'' + \vec{F}_a = m\vec{a}$

  $+F_P'' - F_a = ma \rightarrow F_a = F_P'' - ma$

  $F_a = m\cdot g\sin\vartheta - ma = m(g\sin\vartheta - a)$

  $F_a = 9.37\,N$

  $F_P'' - \mu_d F_P^{\perp} = ma$

  $\mu_d = \frac{F_P'' - ma}{F_P^{\perp}}$

- $F_a = \mu_d F_P^{\perp} = \mu_d\, m\cdot g\cos\vartheta \rightarrow \mu_d = \frac{F_a}{mg\cos\vartheta}[\dots] = 0.368$

(2) DATI

$m = 5.0\,g = 5.0 \times 10^{-3}\,kg$

$h = 3.5R$

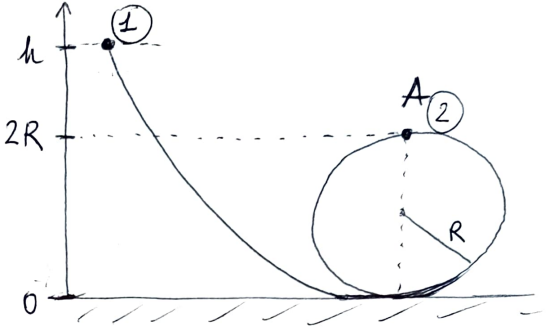
$R = 1.2\,m$

$v_0 = 0\,m/s$

RICHIESTE

$v_A = ?$

$|\vec{N}| = ?$



SOLUZIONE

- $E_1 = E_2$

$$E_1 = E_P^{(1)} + \cancel{E_K^{(1)}} = mgh$$

$$E_2 = E_P^{(2)} + E_K^{(2)} = mg2R + \frac{1}{2}mv_A^2$$

$$E_1 = E_2$$

$$mgh = mg2R + \frac{1}{2}mv_A^2$$

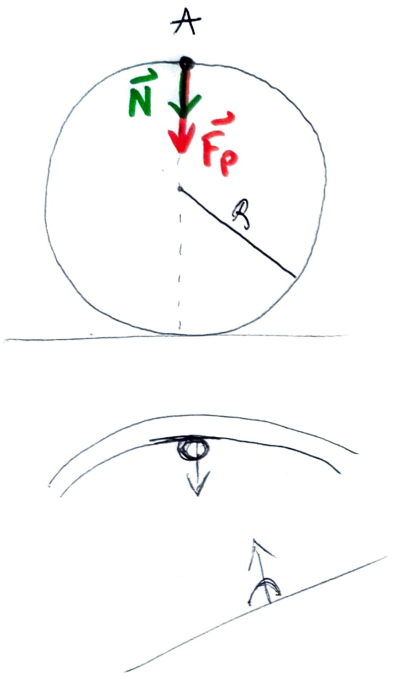
$$\frac{1}{2}\cancel{m}v_A^2 = \cancel{m}gh - \cancel{m}g2R$$

$$\frac{1}{2}v_A^2 = g3.5R - g2R$$

$$= 1.5gR$$

$$\frac{1}{2}v_A^2 = \frac{3}{2}gR \quad \triangleright \quad v_A = \sqrt{3gR}$$

$$v_A = 5.94\,m/s$$



$$\sum \vec{F} = m\,a \quad \rightarrow \quad \vec{F}_P + \vec{N} = m\,\vec{a}_r \qquad \left(a_r = a_c = \frac{v^2}{R}\right)$$

$$F_P + N = m\,\frac{v_A^2}{R}$$

$$N = m\,\frac{v^2}{R} - mg = m\left(\frac{v^2}{R} - g\right) = 0.098\,N$$

$p = mv$ Quantità di moto

$F \cdot \Delta t = \Delta p$ Teorema dell'impulso

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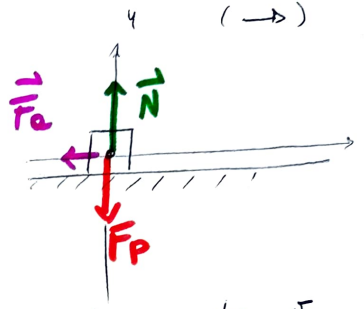
(3) **DATI**

m
v_i
μ_d
$v_f = 0$

RICHIESTE

$t_f = ?$
$x_f = ?$

SOLUZIONE



$\begin{cases} -F_a = ma \\ -\mu_d m g = ma \end{cases}$

- Moto unif. accelerato (a<0)

$\begin{cases} v_f = v_i - a t_f \\ x_f = x_i + v_i t_f - \frac{1}{2} a t_f^2 \end{cases}$

$v_f = v_i - a t_f \rightarrow 0 = v_i - a t_f \rightarrow a t_f = v_i \rightarrow t_f = \frac{v_i}{a} = \frac{v_i}{\mu_d g}$

$x_f = \frac{v_i^2}{\mu_d g} - \frac{1}{2} \mu_d g \frac{v_i^2}{\mu_d^2 g^2} = \frac{1}{2} \frac{v_i^2}{\mu_d g}$

- $(F \Delta t = \Delta p) \rightarrow F_a t_f = m v_f - m v_i \rightarrow (-\mu_d m g) t_f = -m v_i \rightarrow t_f = \frac{v_i}{\mu_d g}$

$L = \Delta E_K \rightarrow F_a (x_f - x_0) = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 \rightarrow (\mu_d m g) x_f = \frac{1}{2} m v_i^2$

$[L = \vec{F} \cdot \vec{s} = |F| \cdot |s| \cos\theta]$

$\rightarrow x_f = \frac{1}{2} \frac{v_i^2}{\mu_d g}$

4 DATI

$m_1 = 1800\ kg$

$v_{i,1} = 0\ m/s$ $\quad v_{i,1} = 20\ m/s$

$m_2 = 900\ kg$

$v_{i,2} = 20\ m/s$ $\quad v_{i,2} = 0\ m/s$

RICHIESTA

$v_f = ?$ $\quad v_f = ?$

SOLUZIONE

$p_i = p_f$

- $p_i = m_1 v_{i,1} + m_2 v_{i,2} = m_2 v_{i,2}$
- $p_f = M v_f = (m_1 + m_2) v_f$

$p_i = p_f$

$\frac{m_2 v_{i,2}}{m_1 + m_2} = \frac{(m_1 + m_2) v_f}{m_1 + m_2}$

$$v_f = \frac{m_2}{m_1 + m_2} v_{i,2} = [\dots] = 6.67\ m/s$$

- $p_i = m_1 v_{i,1}$
- $p_f = (m_1 + m_2) v_f$

$p_i = p_f \quad \triangleright \quad m_1 v_{i,1} = (m_1 + m_2) v_f$

$$v_f = \frac{m_1}{m_1 + m_2} v_{i,1} = [\dots] = 13.33\ m/s$$

5 **DATI**

$m_1 = 1500\ kg$

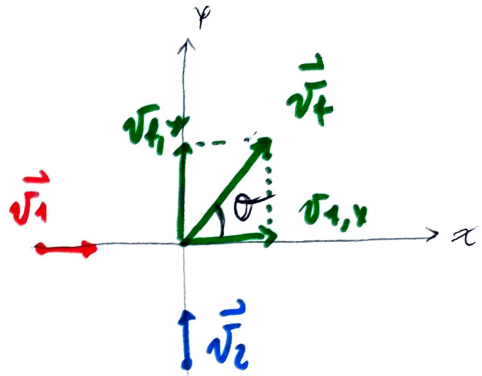
$v_{i,1} = 25.0\ m/s$

$m_2 = 2500\ kg$

$v_{i,2} = 20.0\ m/s$

RICHIESTA

$\vec{v}_f = ?$



SOLUZIONE

$\vec{p}_i = \vec{p}_f$

asse x: $p_{i,x} = p_{f,x} \rightarrow m_1 v_{i,1} = (m_1 + m_2) v_{f,x}$

asse y: $p_{i,y} = p_{f,y} \rightarrow m_2 v_{i,2} = (m_1 + m_2) v_{f,y}$

$$\begin{cases} v_{f,x} = \dfrac{m_1}{m_1 + m_2} v_{i,1} \\ v_{f,y} = \dfrac{m_2}{m_1 + m_2} v_{i,2} \end{cases} \rightarrow \begin{cases} v_{f,x} = 9.375\ m/s \\ v_{f,y} = 12.5\ m/s \end{cases}$$

$$|\vec{v}_f| = \sqrt{v_{f,x}^2 + v_{f,y}^2} = [\dots] = 15.6\ m/s$$

$$\tan\theta = \frac{v_{f,y}}{v_{f,x}} = 1.33 \rightarrow \theta = \tan^{-1}(1.33) = 53.1°$$

$\vec{v}_f = (9.37\hat{i} + 12.5\hat{j})\ m/s$