Lancio da piano inclinato

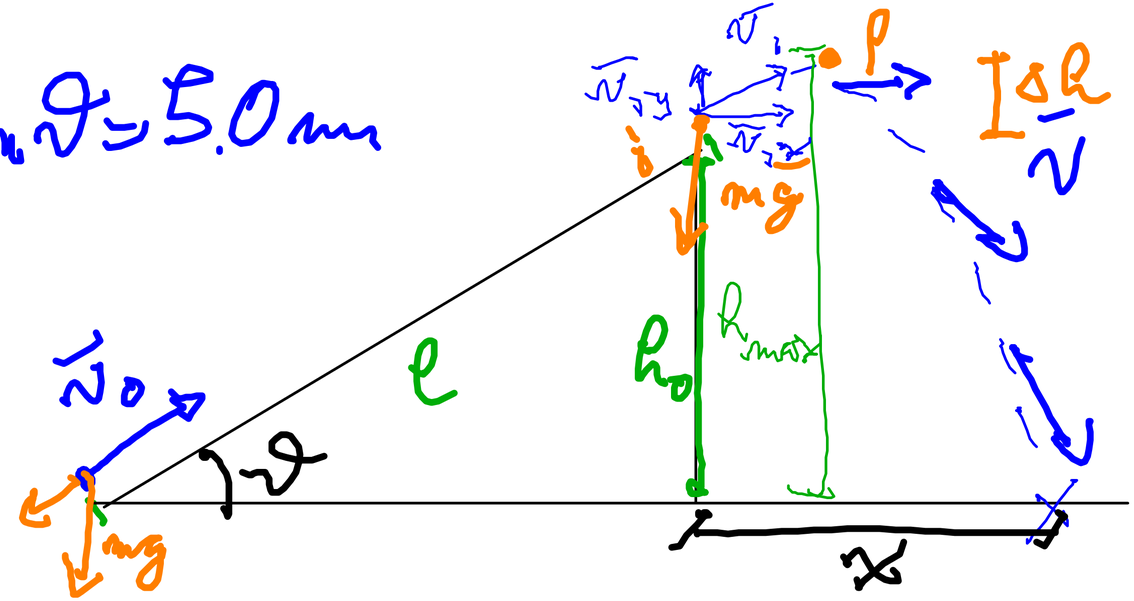
$v_0 = 10\ m/s$, $\vartheta = 30°$

$\ell = 10\ m$

a) $v_1 = ?$ b) $h_{max} = ?$

c) t di caduta $= ?$ d) gittata $= ?$

$h_0 = \ell \sin\vartheta = 5.0\ m$



a) $E_i = E_p$

$$\frac{1}{2}m v_0^2 = \frac{1}{2}m v_1^2 + mgh_0$$

$$\frac{v_0^2}{2} - gh_0 = \frac{v_1^2}{m} \rightarrow v_1 = \sqrt{v_0^2 - 2gh_0}$$

$$= 1.38\ m/s = \boxed{1.4\ m/s}$$

$E_i = E_p$ anche prendendo le singole componenti:

x: $\frac{1}{2}m v_{ix}^2 = \frac{1}{2}m v_{ix}^2$

y: $\frac{1}{2}m v_{iy}^2 = mg(h_{max} - h_0)$ ($\Delta\ell$)

b) $\frac{1}{2}m v_{iy}^2 = mg\Delta h \rightarrow \Delta h = \frac{1}{2g}(v_i \sin\vartheta)^2 = 0.0242\ m = \boxed{2.4 \times 10^{-2}\ m}$

Lancio da piano inclinato

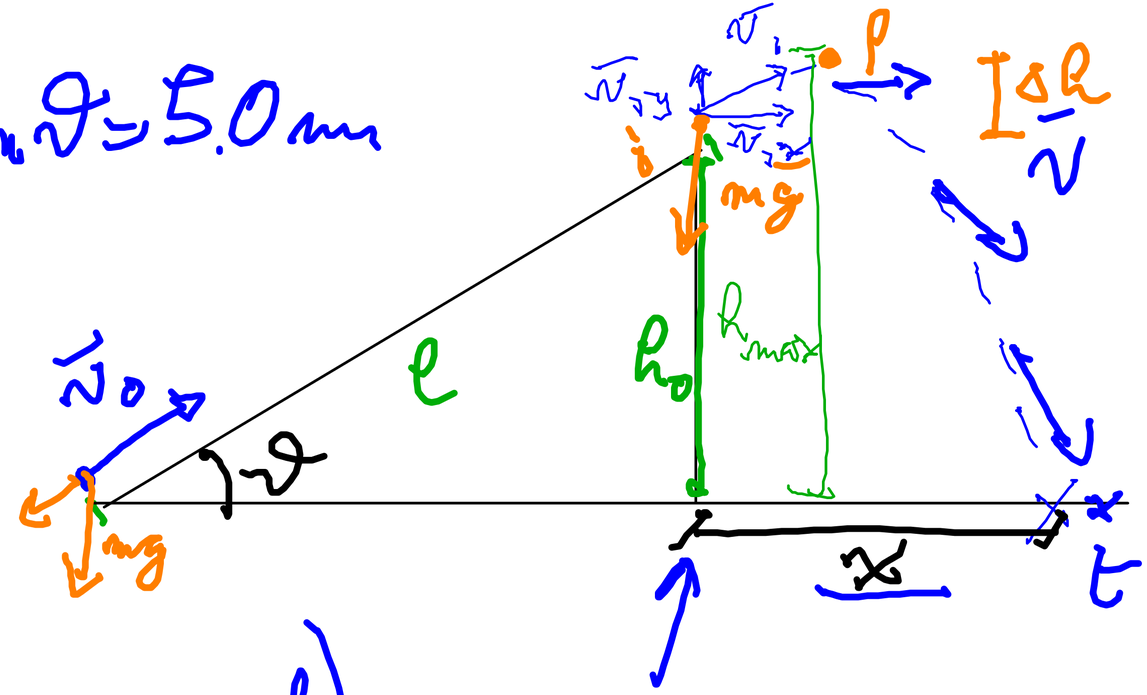
$v_0 = 10\ m/s$, $\vartheta = 30^\circ$

$\ell = 10\ m$

a) $v_1 = ?$ b) $h_{max} = ?$

c) t di caduta $= ?$ d) gittata $= ?$

$h_0 = \ell \sin\vartheta = 5.0\ m$



c) $y(t) - 0 = h_0 + v_{1y} t - \frac{1}{2} g t^2$

$g t^2 - 2 v_{1y} t - 2 h_0 = 0$

$t_2 = \frac{v_{1y} \pm \sqrt{v_{1y}^2 + 2 g h_0}}{g} > v_{1y}$ $t_2 > 0$

$t_1 = \frac{v_{1y} + \sqrt{v_{1y}^2 + 2 g h_0}}{g} \simeq 1.082\ s \simeq \boxed{1.1\ s}$ $t_1 < 0$

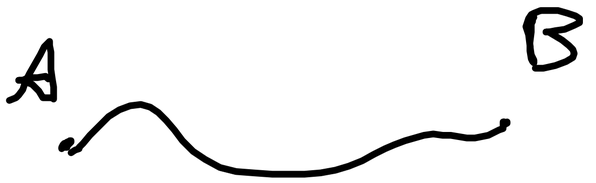
d) $x(t) = 0 + v_{1x} t$

$= v_{1x} t$

$= v_1 \cos\vartheta\ t$

$= 1.29\ m \simeq \boxed{1.3\ m}$

Bilancio energetico con forze NON conservative



$$K_p - K_i = W_{AB}$$

valida SEMPRE

LAVORO GENERALE $=$

$$W_{AB}^{CON} + W_{AB}^{NONC.}$$

$$W_{AB}^{CON} = -(U_p - U_i) = U_i - U_p$$

di solito è negativo

$$K_p - K_i = W_{AB}^{CON} + W_{AB}^{NONC} = U_i - U_p + W_{AB}^{NONC}$$

$$K_p + U_p = K_i + U_i + W_{AB}^{NONC}$$

$$E_p = E_i + W_{i \to p}^{NONC}$$

Moto con attrito

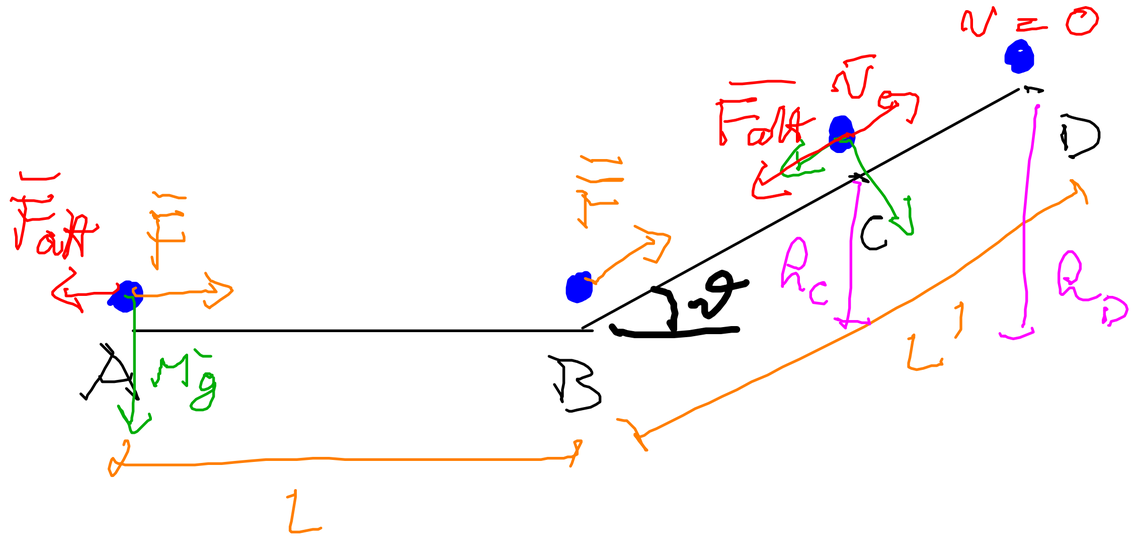
$F = 20\,N$ costante da A a C

$L = 1.0\,m$, $v_A = 0$, $\vartheta = 30°$

$M = 1.0\,kg$, $h_D = 0.50\,m$

$\mu = 1.2$ dinamico

a) $v_B = ?$, b) $W^{att}_{BD} = ?$, c) $h_c = ?$ d) $v_c = ?$



a) $W_{AB} = \sum \vec{F} \cdot \vec{L} = (\vec{F} + \vec{F}_{att}) \cdot \vec{L} = FL - F_{att} L = FL - \mu Mg L \simeq 8.23\,J \simeq \boxed{8.2\,J}$

$= K_f - K_i = \frac{1}{2} M v_f^2 \rightarrow v_f = \sqrt{\frac{2(F - \mu Mg) L}{M}} = 4.057\,m/s \simeq \boxed{4.1\,m/s}$

b) $W^{att}_{BD} = (\vec{F}_{att} \cdot \vec{L}')_{BD} = -\mu (Mg \cos\vartheta) \frac{h_D}{\sin\vartheta} = -10.15\,J \simeq \boxed{-10\,J}$

Moto con attrito

$F = 20\,N$ costante da A a C

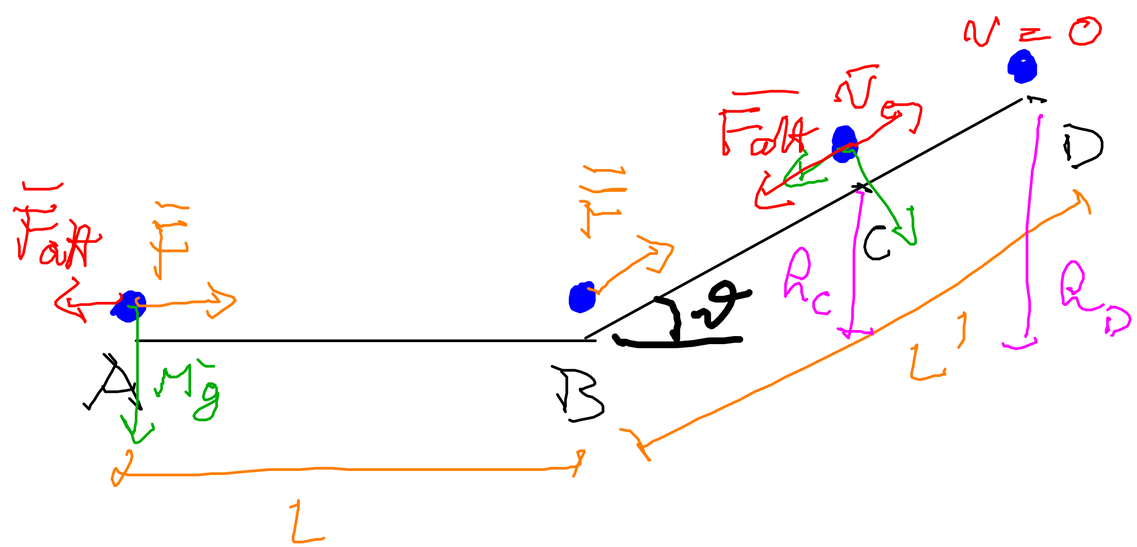
$L = 1.0\,m$, $v_A = 0$, $\vartheta = 30°$

$M = 1.0\,kg$, $h_D = 0.50\,m$

$\mu = 1.2$ dinamico

a) $v_B = ?$, b) $W_{BD}^{Att} = ?$, c) $h_c = ?$ d) $v_C = ?$

quota 0



c) su C la forza F si spegne

$$E_D = E_B + W_{BD}^{NON\,C}$$

Lavoro da forza F B→C
+
Lavoro attrito B→D

$$U_D = K_B + W_{BC}^{F} + W_{BD}^{Att}$$

$$Mgh_D - W_{AB} - W_{BD}^{Att} = F\frac{h_c}{\sin\vartheta}$$

$h_c = 0.172\,m \approx \boxed{0.17\,m}$

Moto con attrito

$F = 20\,N$ costante da A a C

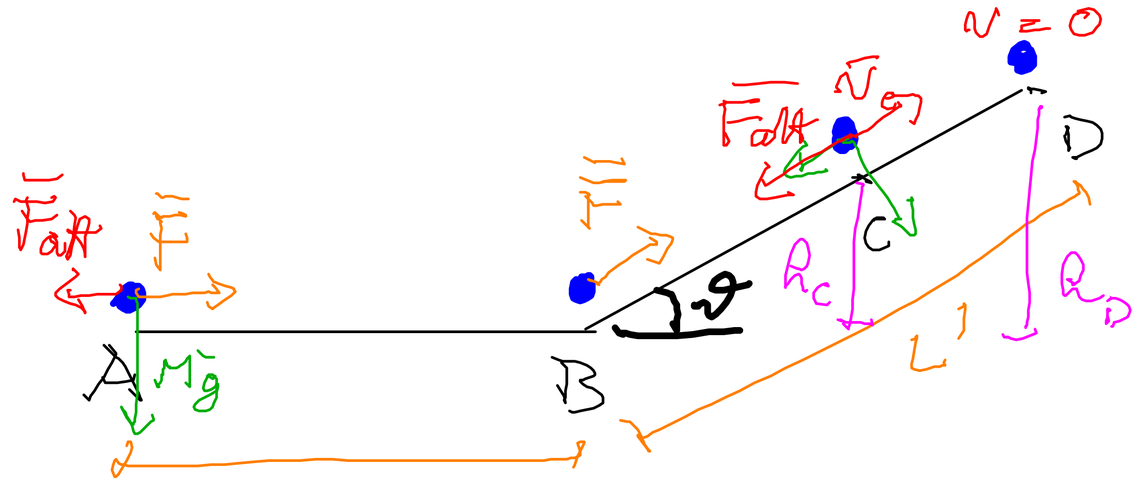
$L = 1.0\,m$, $v_A = 0$, $\vartheta = 30°$

$M = 1.0\,kg$, $h_D = 0.50\,m$

$\mu = 1.2$ dinamico

a) $v_B = ?$, b) $W_{BD}^{Att} = ?$, c) $h_c = ?$ d) $v_c = ?$

quota 0



d) $E_C = E_B + W_{BC}^{NONC}$

$K_C + U_C = K_B + W_{BC}^{P} + W_{BC}^{Att}$

$\frac{1}{2} M v_c^2 + Mg h_c = \frac{1}{2} M v_B^2 + F \frac{h_c}{\sin\vartheta} - \mu (Mg\cos\vartheta) \frac{h_c}{\sin\vartheta}$

$$v_c = \sqrt{2\left(\frac{v_B^2}{2} - g h_c + \frac{F h_c}{M \sin\vartheta} - \mu g \frac{h_c}{\tan\vartheta}\right)}$$

$= 4.45\,m/s \simeq \boxed{4.4\,m/s}$

Bungee jumping

$M = 75\ kg$

$k = 50\ N/m$

a) $l_1 = ?$

b) $a(l_1) = ?$

c) $v_{max} = ?$

a) massima elongazione

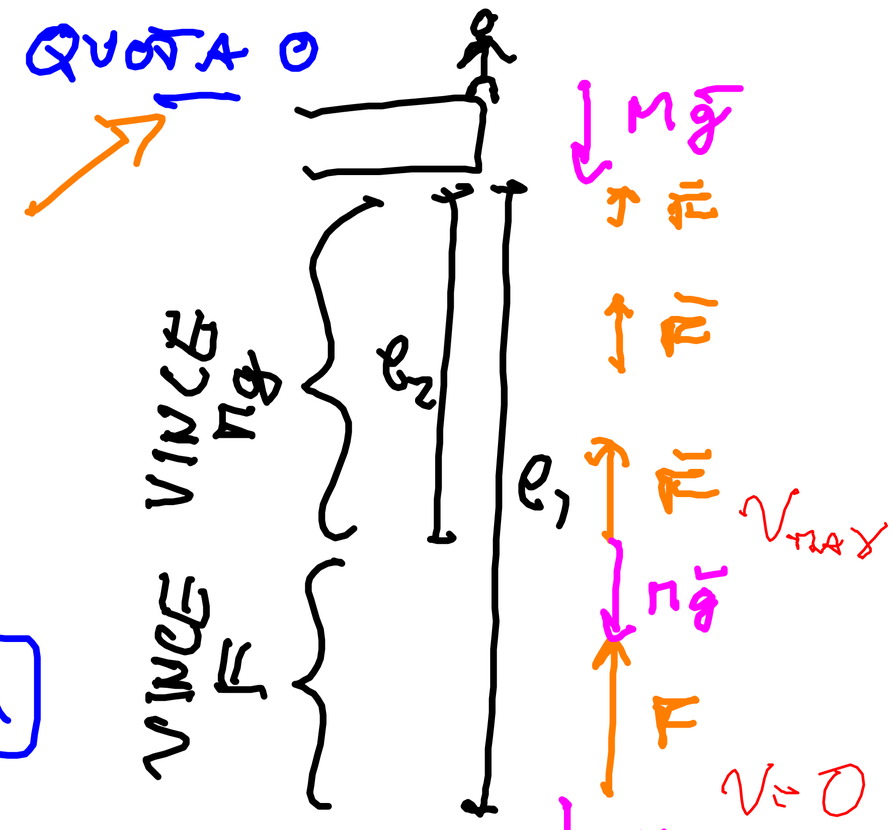
$E_p = E_i$

$K_p + U_p^{grav} + U_p^{molla} = K_i + U_i$

($K_p = 0$, $U_i = 0$)

$-Mgl_1 + \frac{1}{2}kl_1^2 = 0$

$l_1 = \frac{2Mg}{k} = 29.4\ m = \boxed{29\ m}$



b) $a = \frac{|\sum \tilde{F}|}{m} = \frac{kl_1}{m} - \frac{Mg}{m} = \frac{k}{m}\frac{2Mg}{k} - g = 2g - g = g = \boxed{9.8\ m/s^2}$

c) v_{max} quando forze si equivalgono

$-Mg + kl_2 = 0$

$l_2 = \frac{Mg}{k} = 14.7\ m$

$E_p = E_i = 0$

$\frac{1}{2}mv^2 - mgl_2 + \frac{1}{2}kl_2^2 = 0$

$\frac{1}{2}mv^2 - \frac{m^2g^2}{k} + \frac{1}{2}k\frac{m^2g^2}{k^2} = 0$

$v = \sqrt{\frac{Mg^2}{k}} = \boxed{12\ m/s}$