Es n 1

È errato affermare che $E_{pot} > E_{cin}$ in qualsiasi punto.

Es. n 2

$$E_{potenziale} = mgh$$

$$E^{A}_{pot} = m_A g h_A = 8\,kg \cdot 9.81\,m/s^2 \cdot 5\,m = 392\,J$$

$$E^{B}_{pot} = m_B g h_B = 5\,kg \cdot 9.81\,m/s^2 \cdot 7\,m = 343\,J$$

$$E^{C}_{pot} = m_C g h_C = 12\,kg \cdot 9.81\,m/s^2 \cdot 4\,m = 471\,J$$

La sfera B ha energia potenziale minima. Le sfere A e B devono essere porta ad altezze:

$$h_A = \frac{E_{pot}^{C}}{m_A g} = \frac{m_C \cancel{g} h_C}{m_A \cancel{g}} = \frac{12\,\cancel{kg} \cdot 4\,m}{8\,\cancel{kg}} = 6\,m$$

$$h_B = \frac{E_{pot}^{C}}{m_B g} = \frac{m_C \cancel{g} h_C}{m_B \cancel{g}} = \frac{12\,kg \cdot 4\,m}{5\,kg} = 9.6\,m$$

Es n. 3

Il corpo si muove in verso contrario alla forza applicata

Es. n. 4

$$L = K_f - K_i = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 = \frac{1}{2} \cdot 2\,kg \cdot (25\,m^2/s^2 - 4\,m^2/s^2) = 21\,J$$

Es. n. 5

$$|L| = |K_f - K_i| = -\frac{1}{2} m v_f^2 + \frac{1}{2} m v_i^2$$

$$v_i = 54\,km/h = \frac{54}{3.6}\,m/s = 15\,m/s$$

$$v_f = 45\,km/h = 12.5\,m/s$$

$$\Rightarrow |L| = \frac{1}{2} \cdot 700\,kg \cdot (15^2\,m^2/s^2 - 12.5^2\,m^2/s^2) = 24063\,J$$

Es. n. 6

$$K = \frac{1}{2} m v^2 \Rightarrow v = \sqrt{\frac{2K}{m}} = \sqrt{\frac{2 \cdot 186\,J}{2.200\,kg}} = 13\,m/s$$

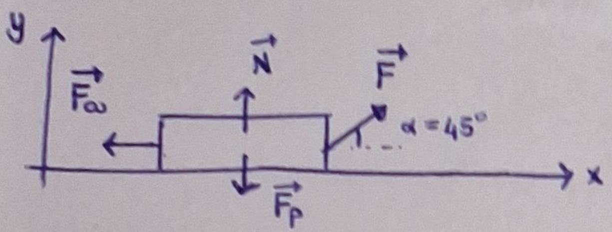
Es. n. 7

$$L_{tot} = (\vec{F_1} + \vec{F_2}) \cdot \vec{\Delta s} = F_1 \Delta s \cos 30^\circ + F_2 \Delta s \cos 45^\circ = \Delta s (F_1 \cos 30^\circ + F_2 \cos 45^\circ)$$

$$\Rightarrow \Delta s = \frac{L_{tot}}{F_1 \cos 30^\circ + F_2 \cos 45^\circ} = \frac{1994\,J}{215\,N \cdot \cos 30^\circ + 285\,N \cdot \cos 45^\circ} = 5.14\,m$$

~~Es n 8~~

Es. n. 8



$m = 10\ kg$ $\quad \Delta s = 10\ m$

$v = cost$

$\mu_d = 0.20$ $\quad L_F = ?$

$\vec{F_a} + \vec{N} + \vec{F_p} + \vec{F} = 0$ perché $v = cost$

x: $F\cos\alpha - F_a = 0 \Rightarrow F\cos\alpha = F_a = \mu_d N$

y: $N - F_p + F\,sen\,\alpha = 0 \Rightarrow N = mg - F\,sen\,\alpha$

$\cancel{\Rightarrow F = \frac{\mu_d N}{\cos\alpha} = \mu_d mg}$

$F\cos\alpha = \mu_d(mg - F\,sen\,\alpha) \Rightarrow F(\cos\alpha + \mu_d\,sen\,\alpha) = \mu_d mg$

$$\Rightarrow F = \frac{\mu_d mg}{\cos\alpha + \mu_d\,sen\,\alpha}$$

$$L_F = \vec{F}\cdot\vec{\Delta s} = F\cdot\Delta s\cdot\cos\alpha = \frac{\mu_d mg}{\cos\alpha + \mu_d\,sen\,\alpha}\cos\alpha\cdot\Delta s$$

$$= \frac{0.20\cdot 10kg\cdot 9.81\ m/s^2}{\cos 45° + 0.20\cdot sen\,45°}\cdot\cos 45°\cdot 10\ m = 163\ J$$

Es. n 9

$E_{el} = \frac{1}{2}k\cdot(\Delta x)^2$

a) $E_{el} = \frac{1}{2}\cdot 60\ N/m\cdot(4\cdot 10^{-2}\ m)^2 = 0.048\ J$

~~b)~~ $E_{el} = \frac{1}{2}\cdot 10\ N/m\cdot(0.16\ m)^2 = 0.128\ J$

c) $E_{el} = \frac{1}{2}\ 15\ N/m\cdot(0.08\ m)^2 = 0.048\ J$

d) $E_{el} = \frac{1}{2}\cdot 30\ N/m\cdot(8\cdot 10^{-2}\ m)^2 = 0.096\ J$

Es. n. 10

$E_i = E_f \Rightarrow E^i_{pot.\ grav.} = E^f_{el} \Rightarrow mgh = \frac{1}{2}k(\Delta x)^2$

$$\Rightarrow \Delta x = \sqrt{\frac{2mgh}{k}} = \sqrt{\frac{2\cdot 2kg\cdot 9.81\ m/s^2\cdot 2\ m}{200\ N/m}} = 0.63\ m$$

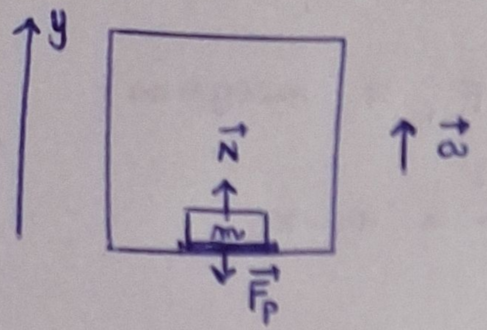
Es. n. 11

Energia elastica ed energia potenziale gravitazionale perché è in equilibrio

Es. n. 12

$$T = F_{centripeta} = m\frac{v^2}{R} \Rightarrow v = \sqrt{\frac{TR}{m}} = \sqrt{\frac{6.0N\cdot 0.30\ m}{0.200\ kg}} = 3.0\ m/s$$

Es.m. 13



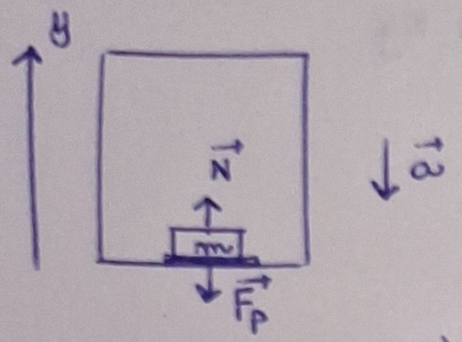
L'ascensore sale / scende con una accelerazione:

$$a = \frac{\Delta v}{\Delta t} = \frac{6.0\ m/s}{2.5\ s} = 2.4\ m/s^2$$

Caso in salita: nel sistema di riferimento inerziale

$$y: \quad N - mg = ma \Rightarrow N = m(a+g)$$

$$\Rightarrow m_{bilancia} = \frac{m(a+g)}{g} = \frac{80\ kg\ (9.81+2.4)\ m/s^2}{9.81\ m/s^2} \sim 100\ kg$$



Caso in discesa:

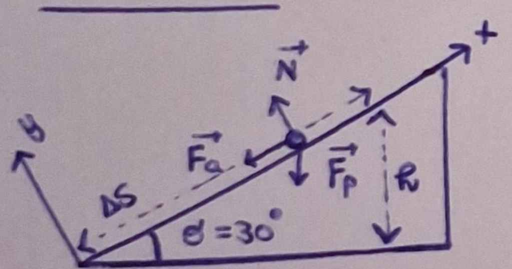
$$y: \quad N - mg = -ma \Rightarrow N = m(g-a)$$

$$\Rightarrow m_{bilancia} = \frac{m(g-a)}{g} = \frac{80\ kg\ (9.81\ m/s^2 - 2.4\ m/s^2)}{9.81\ m/s^2} \sim 60\ kg$$

Es.m.14

$$P = \frac{L}{\Delta t} \Rightarrow L = P \cdot \Delta t = 650\ W \cdot 90\ s = 58\,500\ J$$

Es.m. 15



Teorema dell'energia cinetica:

$$L_{tot} = K_f - K_i \Rightarrow L_{forza peso} + L_{attrito} = -\frac{1}{2} m v_0^2$$

perché alla fine si ferma

$$L_{forza\ peso} = -mgh \qquad L_{attrito} = \vec{F_a} \cdot \vec{\Delta s} = -\mu_d N \Delta s = -\mu_d N \cdot \frac{h}{\sin\theta}$$

$$y: \quad N - F_{py} = 0 \Rightarrow N = mg\cos\theta$$

$$\Rightarrow L_{Fp} + L_{att.} = -mgh - \mu_d mg \cos\theta \frac{h}{\sin\theta} = -\frac{1}{2} m v_0^2$$

$$\Rightarrow gh + \mu_d g h \frac{1}{\tan\theta} = \frac{1}{2} v_0^2 \Rightarrow gh\left(1 + \frac{\mu_d}{\tan\theta}\right) = \frac{1}{2} v_0^2$$

$$\Rightarrow h = \frac{v_0^2}{g\left(1+\frac{\mu_d}{\tan\theta}\right)} = \frac{9.00\ m^2/s^2}{2 \cdot 9.81\ m/s^2 \left(1 + \frac{0.300}{\tan 30°}\right)} = 0.302\ m = 30.2\ cm$$