(1) DATI

$P = 2 \times 10^4\ W$

$h = 20\ m$

$m_s = 85\ kg$

$N = 40$

RICHIESTA

$\Delta t = ?$

SOLUZIONE

$$\Delta t \cdot P = \frac{\Delta E}{\Delta t} \cdot \Delta t \quad \triangleright \quad \frac{P \cdot \Delta t}{P} = \frac{\Delta E}{P} \quad \triangleright \quad \Delta t = \frac{\Delta E}{P}$$

$$\Delta E_p = E_{p,f} - E_{p,i} = mgh \quad \triangleright \quad \Delta E_p = N \cdot m_s \cdot g \cdot h = 40 \cdot (85\,kg) \cdot \left(9.81 \frac{N}{kg}\right)(20\,m)$$

$(m = N \cdot m_s)$ $\qquad \Delta E_p = 67 \times 10^4\ J$

$$\Delta t = \frac{67 \times 10^4\ J}{2 \times 10^4\ J/s} = 33\ s$$

(2) DATI

$m = 230\,kg$

$h = 12\,m$

$v_i = 0\,m/s$

$d = 4\,m$

$v_f = 0\,m/s$

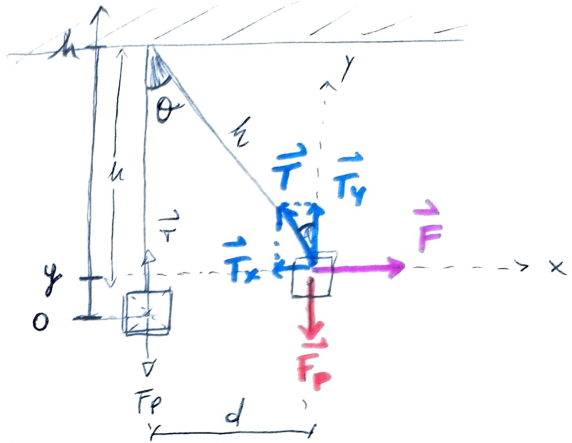
RICHIESTE

$|\vec{F}| = ?$

$\mathcal{L}_{TOT} = ?$

$\mathcal{L}_{F_P} = ?$

$\mathcal{L}_T = ?$



SOLUZIONE

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

asse x: $\vec{T}_x + \vec{F} = 0 \;\triangleright\; -T_x + F = 0 \;\triangleright\; T \sin\theta = F$

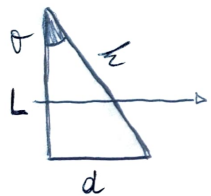
asse y: $\vec{T}_y + \vec{F}_P = 0 \;\triangleright\; +T_y - F_P = 0 \;\triangleright\; T\cos\theta = F_P$

$\begin{cases} T = F_P/\cos\theta \\ \frac{F_P}{\cos\theta}\cdot \sin\theta = F \end{cases}$

$\triangleright\; F = F_P \tan\theta$

$= m \cdot g \cdot \tan\theta$

$\simeq 799\,N$



$L = h\cos\theta = 11.3\,m$

$\sin\theta = \frac{d}{h} \Rightarrow \theta = \sin^{-1}\left(\frac{d}{h}\right) = \sin^{-1}\left(\frac{4\,m}{12\,m}\right) = 19.5°$

$$\mathcal{L}_{TOT} = \Delta E_K = E_{K,f} - E_{K,i} = 0\ J$$

$$\mathcal{L}_{F_P} = -\Delta E_P = -(E_{P,f} - E_{P,i}) = -E_{P,f} + E_{P,i} = -mgy + mgy_0$$

$$(y = h - L = 12\ m - 11.3\ m = 0.69\ m)$$

$$\mathcal{L}_{F_P} = -1557\ J$$

$$\mathcal{L}_T = -\mathcal{L}_{F_P} = +1557\ J$$

(3) **DATI**

$m = 2g = 2 \times 10^{-3}\ kg$

$v_i = 0\ m/s$

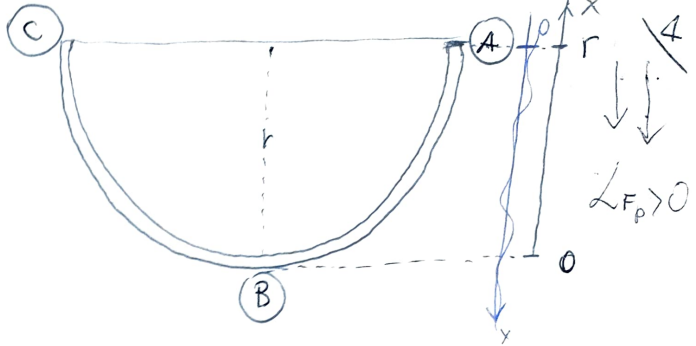
$r = 22\ cm = 22 \times 10^{-2}\ m$

RICHIESTE

$\mathcal{L}_{F_p}^{A-B} = ?$

$\mathcal{L}_{F_p}^{A-C} = ?$

$v_B = ?$



SOLUZIONE

$$\mathcal{L}_{F_p}^{A-B} = -\Delta E_p = -\left(E_{p,f}^{(B)} - E_{p,i}^{(A)}\right) = +E_{p,i} = m \cdot g \cdot r = (2\times10^{-3}\,kg)\left(9.81\,\frac{N}{kg}\right)(22\times10^{-2}\,m)$$

$$\mathcal{L}_{F_p} = 4.32 \times 10^{-5}\ J$$

~~$\mathcal{L}_{F_p} = -\Delta E_p = -(E_{p,f} - E_{p,i})$~~

$$\mathcal{L}_{F_p}^{A-C} = -\left(E_{p,f}^{(C)} - E_{p,i}^{(A)}\right) = -(mgr - mgr) = 0\ J$$

$E = E_p + E_K \quad \triangleright \quad E_A = E_p^{(A)} + E_k^{(A)}$

$\triangleright \quad E_B = E_p^{(B)} + E_k^{(B)}$

$E_A = E_B \triangleright E_p^{(A)} = E_k^{(B)}$

$2 \cdot mgr = \frac{1}{2} m v_B^2 \cdot 2$

$$v_B = \sqrt{2 \cdot g \cdot r} = 2.08\ m/s$$

④

DATI

$m = 1\,kg$

$v_i = 0\ m/s$

$k = 400\ N/m$

$v_f = 0\ m/s$

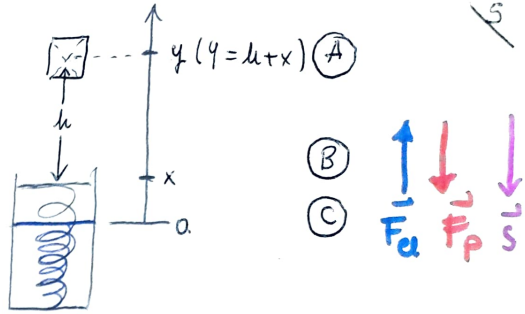
$x = 19\,cm = 19 \times 10^{-2}\,m$

RICHIESTE

$\mathcal{L}_{Massa\text{-}Molla} = ?$

$\mathcal{L}_{Molla\text{-}Massa} = ?$

$h = ?$



SOLUZIONE

(A) $E_A = \cancel{E_K^{(A)}} + E_P^{(A)} = m \cdot g\, y$

(B) $E_B = E_K^{(B)} + E_P^{(B)} = \frac{1}{2} m v_B^2 + mgx$

(C) $E_C = \cancel{E_K^{(C)}} + E_P^{(C)} = \frac{1}{2} k x^2$

$\mathcal{L}_{F_P} = -\Delta E_P^{(F_P)} = -(\cancel{E_P^{(C)}} - E_P^{(B)})$

$= + E_P^{(B)} = m \cdot g \cdot x$

$= (1\,\cancel{kg})\left(9.81\,\frac{N}{\cancel{kg}}\right)(19 \times 10^{-2}\,m)$

$= 1.9\ J$ CONTI DA CONTROLLARE !

$\mathcal{L}_{F_{el}} = -\Delta E_P^{(F_{el})} = -(E_{P,el}^{(C)} - \cancel{E_{P,el}^{(B)}}) = -\frac{1}{2} k x^2 = -\frac{1}{2}\left(400\,\frac{N}{m}\right)(19 \times 10^{-2}\,m)^2 = -7.2\ J$

$E_A = E_C \triangleright\ mgy = \frac{1}{2} k x^2 \triangleright\ mg(h+x) = \frac{1}{2} k x^2 \triangleright\ mgh + mgx = \frac{1}{2} k x^2$

$mgh = \frac{1}{2} k x^2 - mgx \triangleright\ h = \frac{1}{2}\frac{kx^2}{mg} - x = \frac{1}{2}\frac{(400\,N/m)(19 \times 10^{-2}\,m)^2}{(1\,kg)(9.81\,N/kg)} - 19 \times 10^{-2}\,m$

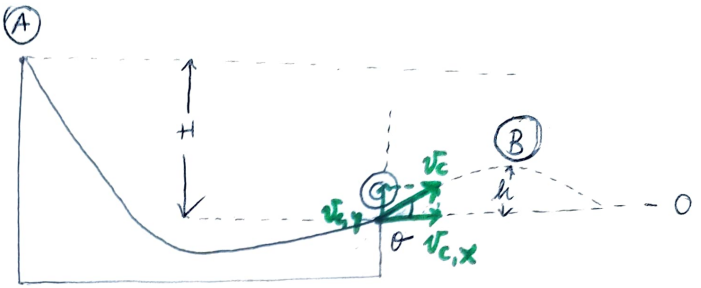
$= 0.54\ m$

⑤ **DATI**

$m = 60\,kg$
$v_i = 0\,m/s$
$H = 20\,m$
$\theta = 28°$

RICHIESTE

$h = ?$



SOLUZIONE

Ⓐ $E_A = E_K^{(A)} + E_P^{(A)} = mgH$

Ⓑ $E_B = E_K^{(B)} + E_P^{(B)} = \frac{1}{2} m v_B^2 + mgh$

Ⓒ $E_C = E_K^{(C)} + E_P^{(C)} = \frac{1}{2} m v_C^2$

$E_A = E_C \quad \triangleright \quad 2 mgH = \frac{1}{2} m v_C^2 \cdot 2$

$v_C = \sqrt{2gH} = \sqrt{2 \times (9.81\,N/kg)(20\,m)} = 19.8\,\frac{m}{s}$

$v_{C,x} = v_C \cos\theta = (19.8\,\frac{m}{s}) \cos(28°) = 17.49\,\frac{m}{s}$

$v_{C,x} = v_B \quad \triangleright$ lungo l'asse x, il moto è rettilineo uniforme ($v = cost.$)

$E_A = E_B \quad \triangleright \quad mgH = \frac{1}{2} m v_B^2 + mgh \quad \triangleright \quad gh = gH - \frac{1}{2} v_B^2$

$\triangleright \quad h = H - \frac{1}{2} \frac{v_B^2}{g} = (20\,m) - \frac{1}{2} \frac{(17.49\,m/s)^2}{9.81\,m/s^2} = 4.4\,m$