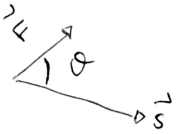
RECAP

- $\mathcal{L}$ [J] → [N·m]

$$\mathcal{L} = \vec{F} \cdot \Delta\vec{s}$$

$$\mathcal{L} = F_x s_x + F_y s_y + F_z s_z$$

$$\mathcal{L} = |\vec{F}|\,|\Delta\vec{s}| \cos\theta$$



- $E_K = \frac{1}{2} m v^2$ [J]

- $\mathcal{L} = \Delta E_K = E_{K,f} - E_{K,i}$

- $P = \frac{\Delta E}{\Delta t}$ $\frac{[J]}{[s]}$ → [W]

- ~~$U = mgh + y$~~

- ~~$\Delta U = -\mathcal{L}$~~

- $E_p = mgy$

- $\mathcal{L} = -\Delta E_p$

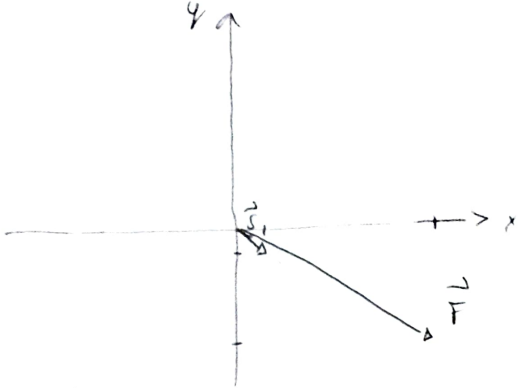
(1) DATI

$\vec{S} = (15\hat{i} - 12\hat{j})\ m$

$\vec{F} = (210\hat{i} - 150\hat{j})\ N$

RICHIESTA

$\mathcal{L} = ?$



SOLUZIONE $\quad \mathcal{L} = \vec{F} \cdot \vec{S}$

$$\mathcal{L} = F_x S_x + F_y S_y = (210\,N)(15\,m) + (-150\,N)(-12\,m) = 4950\,J$$

(2) DATI

$|\vec{F}| = 2N$

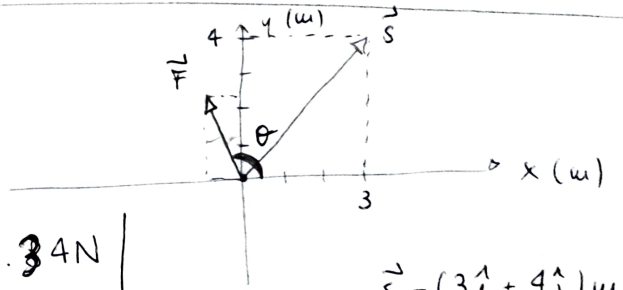
$\theta = 100°$

$x_f = 3m$

$y_f = 4m$

RICHIESTA

$\mathcal{L} = ?$



SOLUZIONE $\quad \vec{F} = F_x\hat{i} + F_y\hat{j}$

$F_x = F\cos\theta = -0.34N$

$F_y = F\sin\theta = 1.96N$

$\vec{S} = (3\hat{i} + 4\hat{j})\ m$

$\mathcal{L} = \vec{F}\cdot\vec{S} = F_x S_x + F_y S_y = 6.8\,J$

③ DATI

$m = 15 \times 10^3\ kg$

$v_i = 50\ km/h = 14\ m/s$

$v_f = 65\ km/h = 18\ m/s$

$\Delta t = 1\ min = 60\ s$

RICHIESTE

$L = ?$

$P = ?$

Soluzione

$L = \Delta E_K \rightarrow \quad L = E_{K,f} - E_{K,i} = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 = \frac{1}{2} m (v_f^2 - v_i^2)$

$L = \frac{1}{2} (15 \times 10^3\ kg) [(18\ m/s)^2 - (14\ m/s)^2] = 96 \times 10^4\ J$

CONTI DA RIVEDERE!

$P = \frac{\Delta E}{\Delta t} = \frac{96 \times 10^4\ J}{60\ s} = 16 \times 10^3\ W$

4 DATI

$|\vec{F}| = 20\,N$

$m = 3\,kg$

$\theta = 30°$

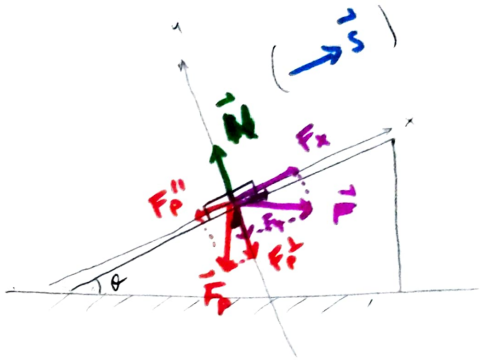
$S = 0.5\,m$

$v_i = 0\,m/s$

RICHIESTE

$\mathcal{L}_F = ?$

$v_f = ?$



SOLUZIONE

$$\vec{F}_{TOT,x} = \vec{F}_P'' + \vec{F}_x = -F_P'' + F_x = -mg\sin\theta + F\cos\theta =$$

$$\overset{!}{=} -(3kg)\left(9.81\,\frac{N}{kg}\right)\sin(30°) + (20N)\cos(30°) = 2.6\,N$$

$$\mathcal{L} = \vec{F}_{TOT,x} \cdot \vec{S} = F_{TOT,x} \cdot S = (2.6N)(0.5m) = 1.3\,J$$

$$\mathcal{L} = \Delta K = K_f \qquad \mathcal{L} = \Delta E_K = E_{K,f} - E_{K,i} \;\triangleright\; \frac{2\mathcal{L}}{m} = \frac{1}{2} m v_f^2 \cdot 2 \;\triangleright\; v_f = \sqrt{\frac{2\mathcal{L}}{m}} = 0.93\,\frac{m}{S}$$

⑤

DATI

$m = 5\,kg$

$v_i = 3.5\,m/s$

$|\vec{s}| = 2.3\,m$

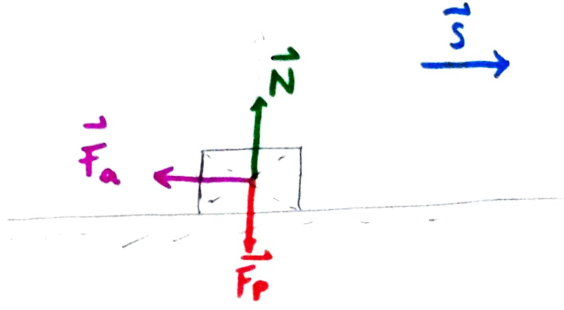
$v_f = 0\,m/s$

RICHIESTE

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

$|\vec{F}_a| = ?$

$\mu_d = ?$



SOLUZIONE

$$\mathcal{L} = \Delta E_k = E_{k,f} - E_{k,i} = -\frac{1}{2} m v_i^2 = -\frac{1}{2}(5\,kg)(3.5\,m/s)^2 = -30.6\,J$$

$$\mathcal{L} = \vec{F}_a \cdot \vec{s} = |\vec{F}_a||\vec{s}|\cos\theta = -|\vec{F}_a||\vec{s}| \quad \triangleright \quad -\frac{\mathcal{L}}{|\vec{s}|} = +\frac{|\vec{F}_a||\vec{s}|}{+|\vec{s}|}$$

$$\triangleright \quad |\vec{F}_a| = -\frac{\mathcal{L}}{|\vec{s}|} = +\frac{(+30.6\,J)}{2.3\,m} = 13.3\,N$$

$$F_a = \mu_d m g \quad \triangleright \quad \mu_d = \frac{F_a}{mg} = \frac{13.3\,N}{(5\,kg)\left(9.81\,\frac{N}{kg}\right)} = 0.27$$

(6) DATI

$y_f = 5\,m$

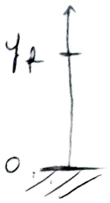
$m_s = 25\,kg$

$\mathcal{L}_0 = 4.9\,kJ = 4.9 \times 10^3\,J$

RICHIESTA

$m_0 = ?$

$(E_p = mgy)$



SOLUZIONE

$\Delta E_p = -\mathcal{L} \quad \triangleright \quad E_{p,f} - E_{p,i} = -\mathcal{L}$

$mgy_f = -\mathcal{L}_{pg} \qquad (m = m_s + m_0)$

$mgy_f = -(-\mathcal{L}_0) \quad \triangleright \quad \frac{mgy_f}{gy_f} = \frac{\mathcal{L}_0}{gy_f}$

$m = \frac{\mathcal{L}_0}{gy_f} \quad \triangleright \quad m_s + m_0 = \frac{\mathcal{L}_0}{g \cdot y_f} \quad \triangleright \quad m_0 = \frac{\mathcal{L}_0}{gy_f} - m_s$

$m_0 = \frac{4.9 \times 10^3\,J}{\left(9.81\,\frac{N}{kg}\right)(5\,m)} - 25\,kg = 75\,kg$

7) DATI

$y_f = 1.6\,m$

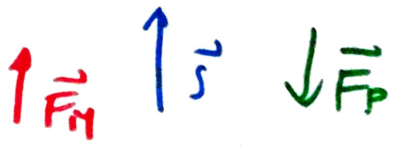
$m = 20\,kg$

$N = 10$

RICHIESTE

~~ΔU~~ $\Delta E_P = ?$

$\mathcal{L}_{FM} = ?$ ← FORZA MUSCOLARE!



$\mathcal{L}_{FM} > 0$

$\mathcal{L}_{F_P} < 0$

SOLUZIONE

$$\Delta E_P = E_{P,f} - E_{P,i} = mgy_f - \cancel{mgy_i} = (20\,kg)\left|9.81\,\tfrac{N}{kg}\right|(1.6\,m) = 314\,J$$

$(\mathcal{L}_{F_P} = -\mathcal{L}_{FM})$

$$\Delta E_P = -\mathcal{L}_{F_P} \rightarrow \Delta E_P^{(1)} = +\mathcal{L}_{FM}^{(1)} \qquad \mathcal{L}_{FM} = N\Delta E_P^{(1)} = 10\,(314\,J) = 3140\,J$$

(8) DATI

$m = 50\,kg$

$y_i = 2000\,m$

RICHIESTE

$v_f = ?$

$\Delta E_k = ?$

$$\begin{cases} v_f = v_0 - g\,t \end{cases}$$

Soluzione

$\Delta E_p = -\mathcal{L} \rightarrow [\mathcal{L} = \Delta E_k] \rightarrow \Delta E_p = -\Delta E_k \triangleright E_{p,f} - E_{p,i} = -(E_{k,f} - E_{k,i})$

$+E_{p,i} = +E_{k,f} \triangleright 2 \cancel{m} g y_i = \frac{1}{\cancel{2}} m v_f^2 \cdot \cancel{2} \triangleright v_f = \sqrt{2 g y_i} = \sqrt{2 \times 9{,}81\,N/kg \times 2000\,m}$

$v_f = 198\,m/s$

$\Delta E_k = E_{k,f} - \cancel{E_{k,i}} = \frac{1}{2} m v_f^2 = 98 \times 10^4\,J$