Es. 1

Lo spostamento cercato è la gittata, quindi:

$$R = \frac{v_0^2}{g} \sin(2\vartheta_0)$$

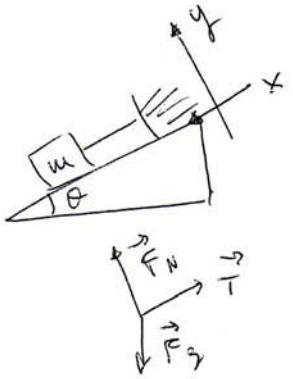
$$2\vartheta_0 = \arcsin \frac{gR}{v_0^2} = \arcsin \frac{(9.8\ m/s^2)(560\ m)}{(82\ m/s)^2} =$$

$$= \arcsin 0.816 \Rightarrow \vartheta_0 \approx 27° \quad \text{2 soluzioni}$$
$$\vartheta_0 \approx 63°$$

Es. 2

$$\vec{T} + \vec{F}_N + \vec{F}_g = m\vec{a} = 0$$

$$\begin{cases} x: & T - mg\sin\vartheta = 0 \\ y: & F_N - mg\cos\vartheta = 0 \end{cases}$$



$$T = mg\sin\vartheta = 67N$$

$$F_N = mg\cos\vartheta = 131N$$

Es. 3

$$p_0 + \frac{1}{2}\rho v_0^2 + \rho g y = p_1 + \frac{1}{2}\rho v_1^2 + \rho g y$$

$$A_0 v_0 = A_1 v_1 \Rightarrow v_1 = v_0 \frac{A_0}{A_1}$$

$$p_1 = p_0 - \frac{1}{2}\rho v_0^2 \left(\frac{A_0^2}{A_1^2} - 1\right) =$$

$$= p_0 - 59.8\ Pa = (1.013 \cdot 10^5 - 59.8)\ Pa$$

$$\rho = \rho_{aria} = 1.21\ kg/m^3$$

ES 4

(a) L'energia cinetica si trasforma in E_{int} del proiettile e dell'albero.

(b) Dal 1° princ. Termodinamica $(\Delta U + \Delta K + \Delta E_{int} = Q - W)$

siccome $Q = W = 0 \Rightarrow$

$$\Rightarrow \Delta E_{int} + \Delta K = 0$$

$$\Delta E_{int} = -\Delta K = \frac{1}{2}\left(m v_i^2 - m v_f^2\right) =$$

$$= \frac{1}{2}\left(3.0 \cdot 10^{-3}\ kg\right)\left[(400\ m/s)^2 - (200\ m/s)^2\right] =$$

$$= 180\ J$$

ES 5

$$E = k\frac{Q_1}{r_1^2} + k\frac{Q_2}{r_2^2} = 9.0 \cdot 10^9\ N \cdot m^2/C^2 \cdot \left(\frac{25 \cdot 10^{-6}\ C}{(2.0 \cdot 10^{-2}\ m)^2} + \right.$$

$$\left. + \frac{50 \cdot 10^{-6}\ C}{(8.0 \cdot 10^{-2}\ m)^2}\right) = 6.3 \cdot 10^8\ N/C$$