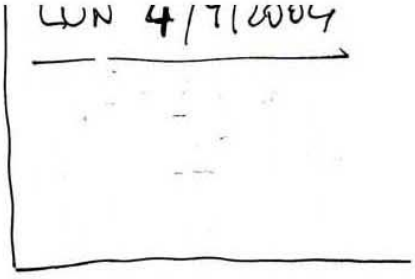
SOLUZIONI 04/09/2006

Es. 1

2) $\begin{cases} x = t^2/2 \\ y = 1 - t^2 \end{cases}$ $\quad y = -2x + 1$



b) $\begin{cases} v_x = t \\ v_y = -2t \end{cases}$ $\quad \begin{cases} a_x = 1 \\ a_y = -2 \end{cases}$

c) $v = \sqrt{v_x^2 + v_y^2} = \sqrt{(0.5)^2 + (-1)^2} = 1.12 \text{ m/s} \quad (t = 0.5)$

$a = \sqrt{a_x^2 + a_y^2} = \sqrt{1^2 + (-2)^2} = 2.24 \text{ m/s}^2$

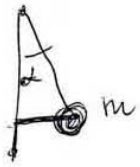
Es. 2

a) $L = mgh = mgl(1 - \cos\alpha)$ (fra t iniz. e passaggio in equilibrio)

$T = \frac{1}{2} m v^2 = mgl(1 - \cos\alpha) =$

$= 0.08 \times 9.8 \times 1 \times (1 - 0.5) = 0.392 \text{ J}$

$v = \sqrt{\frac{2T}{m}} = \sqrt{\frac{2 \cdot 0.392}{0.08}} = 3.13 \text{ m/s}$



b) $m\vec{a} = \vec{T} + \vec{P}$ (1) generica

$0 = \vec{T}' + \vec{P}$ (2) a riposo

All'equilibrio la (1) è ($v = v_{max}$):

$\vec{T} + \vec{P} = 0 \quad \vec{T} = -\vec{P}$

$|\vec{a}| = \frac{mv^2}{l}$

$\frac{mv^2}{l} = T - mg \Rightarrow T = \frac{mv^2}{l} + mg = 1.568 \text{ N}$

A riposo (si vede (2)): $\vec{T}' = -\vec{P} \Rightarrow |\vec{T}'| = mg$

$\frac{T}{T'} = \frac{v^2}{gl} + 1 = 2$

.3

$p_0 = p_{atm} + \frac{mg}{S} = 1.5 \cdot 10^5 N/m^2$

$V_0 = \frac{nRT_0}{p_0} = 1.66$ litri

$W_{PP} = mgh = mg\, V_0/2S = 41$ J (peso pistone)

$W = W_{PP} + W_{Patm} = -(300\text{ J} + 41\text{ J}) = -341$ J

$T_f = \frac{p_f V_f}{nR} = \frac{3p_0 \cdot V_0/2}{nR} = \frac{3}{2} T_0 = 450°K$

$\Delta U = n C_v (T_f - T_0) = 187$ J

$Q = \Delta U + W = -37$ cal $= (187 - 341)$ J $=$

$= -154$ J

Es. 4

Da $Q = vS$: $v_2 = \frac{Q}{S} = \frac{0.5 \cdot 10^3\ cm^3/s}{10\ cm^2} =$

$= 0.5 \cdot 10^2 = 50$ cm/s

$\frac{v_1^2}{2g} + h_1 + \frac{p_1}{\rho g} = \frac{v_2^2}{2g} + h_2 + \frac{p_2}{\rho g}$

$v_1 = \frac{0.5 \cdot 10^3}{5} = 100$ cm/s

$g = 980\ cm/s^2$

$\rho = 1\ g/cm^3$

$$p_1 - p_2 = (h_2 - h_1)\rho g + \frac{(v_2^2 - v_1^2)}{2} \cdot \rho$$

$$= 200 \cdot 980 \cdot 1 - \frac{7500}{2} \cdot 1 =$$

$= 188500$ ~~[illegible]~~ barie $\simeq$

$\simeq 0.2$ ~~Atm~~

ES. 5

~~Alto~~

$C_1 = 0.1 + 0.5 + 0.5 = 1.1\ \mu F$

~~Basso~~

$C_2 = 2 + 2 = 4\ \mu F$

~~Cassa alta~~

$$C_3 = \frac{0.2 \cdot 1.1}{0.2 + 1.1} = 0.17\ \mu F$$

~~Cassa bassa~~

$$C_4 = \frac{1 \cdot 4}{1 + 4} = 0.8\ \mu F$$

$\Rightarrow C_3 + C_4 = C_{tot} = 0.97\ \mu F$