Soluzioni dell'appello del 7/09/2015

1. Meccanica

1. $|\vec{l}| = mvl = 0.5 \text{ kg} \cdot \text{m}^2/\text{s}$

2. $I_{tot} = \frac{Ml^2}{3} + ml^2$

$mvl = I\omega_0 \qquad \omega_0 = \frac{mvl}{I}$

$\omega_0 = 5.9 \text{ rad/s}$

3. $\mathcal{L} = \int_0^\theta \tau_p \, d\theta$

$= \int_0^\theta + Mg\frac{l}{2}\sin\theta \, d\theta = Mg\frac{l}{2}(\cos\theta - 1)$

4. $E_{cf} - E_{ci} = \mathcal{L}$

$-\frac{1}{2}\left(I + ml^2\right)\omega_0^2 = Mg\frac{l}{2}(\cos\theta_{max} - 1)$

$\cos\theta_{max} = 1 - \frac{\left(I + ml^2\right)\omega_0^2}{Mgl}$

$\theta_{max} = 66.5°$

2. Onde acustiche

1. $\beta = \log_{10}\frac{I}{I_0}$ (in bel), $\quad I \propto \frac{1}{r^2}$

in bel: $\beta_1 - \beta_2 = 15 - 12$

$\log\frac{I_1}{I_0} - \log\frac{I_2}{I_0} = 3$

$\log\left(\frac{I_1}{I_2}\right) = \log\left(\frac{l_2^2}{100^2}\right) = 3$

$l = 10^{3.5} = 3162 \text{ m}.$

2. $f = \frac{v_s}{2L} = 833\ Hz$

$\lambda = \frac{v_s}{f} = 0.418\ m$

3. Termodinamica.

1. Calore ceduto dal piombo $Q_{Pb} = m_{Pb} \cdot c_{Pb} (100-300)$

(il piombo passa da 300 a 100 °C) $= -51200\ J$

calore ricevuto dall'acqua:

$$Q_{ac} = m_{H_2O} \cdot c_{H_2O} (100 - 95) + m_{H_2O\ vap.} \cdot \lambda$$

$Q_{ac} = -Q_{Pb}$ $\longrightarrow$

$$m_{H_2O,vap} = \frac{1}{\lambda} \left(-Q_{Pb} - m_{H_2O} c_{H_2O} (100-95) \right)$$

$$= 0.018\ kg.$$

2. 1. $\Delta U = 0$, $\Delta S = 0$

isoterme: $Q = T\Delta S$

adiabatiche: $Q = 0$, $\Delta S = 0$

. $\Delta U = 0 = W + Q$

$$W = -Q_1 - Q_2 = -T_1 \Delta S_1 - T_2 \Delta S_2$$

. $\Delta S = \Delta S_1 + \Delta S_2 \rightarrow \Delta S_1 = -\Delta S_2$

$$W = -T_1 \Delta S_1 + (T_1 + 200) \Delta S_1$$

$$= 200\, \Delta S_1$$

$$W = 1.67\ 10^4\ J.$$