Secondo esonero del 24/06/2016

Soluzioni

1. Onde

1 - 

$$L = \frac{\lambda}{4}$$

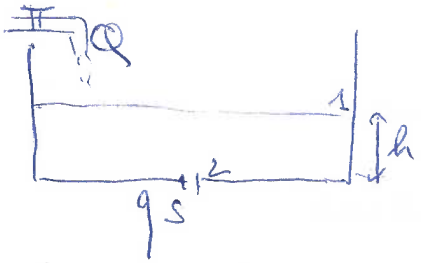
$$v = \lambda f \qquad f = \frac{v}{4L} = 500\ Hz$$

2. $v = at = 10\ m/s$

$$f' = f \cdot \frac{v}{v + v_s} \qquad f' = 485.7\ Hz$$

3 battimento $\qquad f_b = f' - f = 14.3\ Hz$

2. Fluidi



regime stazionario

$$Q = q = v_2 S = 3$$

a) Bernoulli fra 1 e 2:

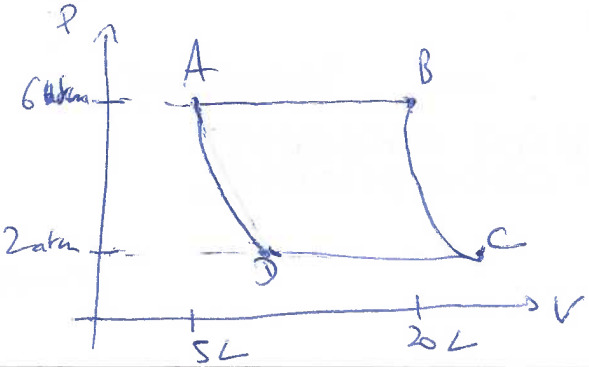
$$\frac{1}{2}\rho v_1^2 + \rho g h + p_0 = \frac{1}{2}\rho v_2^2 + p_0$$

$$h = \frac{Q^2}{2g S^2} \qquad h = 0.56\ m$$

b) $\quad v_2 = \frac{Q}{S} = 3.3\ m/s$

3. Termodinamica

1)



2. $T_A = \frac{P_A V_A}{nR} = 180\,K$

$T_B = \frac{P_A V_B}{nR} = 722\,K$

$P_B^{1-\gamma} T_B^{\gamma} = P_C^{1-\gamma} T_C^{\gamma} \quad T_C = T_B \cdot \left(\frac{P_A}{P_B}\right)^{\frac{1-\gamma}{\gamma}} = 465\,K$

$T_D = T_A = 180\,K$

3 $A \to B$

$W_{AB} = -P_A (V_B - V_A) = -9000\,J$

$W_{BC} = \Delta U_{BC} = n C_v (T_C - T_B) = 2 \times \frac{3}{2} R (T_C - T_B) = -6631.4\,J$

$W_{CD} = -P_D (V_D - V_C) = -nR T_D + nR T_C = 4736.7\,J$

$W_{DA} = nR T_D \ln \frac{V_D}{V_A} = nR T_D \ln \frac{P_A}{P_D} = 3286\,J$

$W_{TOT} = -7608\,J \qquad (0 : \Delta U = 0 = W + Q \quad W = -Q_{tot})$

4. $\rho = \frac{|W|}{Q_{assorbito}}$

$Q_{AB} = nC_p (T_B - T_A) = 22520\,J$

$Q_{BC} = 0$

$Q_{CD} = nC_p (T_D - T_C) = -11841$

$Q_{DA} = -W_{DA} = -3286\,J$

$\rho = \frac{7608}{22520} = 0.33$

5 $\rho_{carnot} = 1 - \frac{T_{min}}{T_{max}} = 0.75$