Phy 2 2014/11

Q1.

For a floating object:

$$F_b = P \rightarrow \rho_{water} g V_{sub} = mg \rightarrow \rho_{water} g \left(\frac{1}{3} V\right) = \rho_{wood} V g$$

$$\rightarrow \rho_{wood} = \frac{1}{3} \rho_{water} = 333.33\ (\mathrm{kg/m^3})$$

Q2.

Denote that: (1) at the top of cylinder, (2) at the hole, p_0: atmospheric pressure.
Bernoulli's equation:

$$p_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = p_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$$

$$\leftrightarrow (1000 + p_0) + 0 + 1000 \times 9.8 \times 0.7 = p_0 + \frac{1}{2} \times 1000 \times v_2^2 + 0$$

$$\rightarrow v_2 = 3.96\ (\mathrm{m/s})$$

Q3.

We have:

$$\Delta V = V_0 \beta \Delta T \rightarrow 9 \times 10^{-5} = 2 \times 10^{-2} \times (3\alpha) \times 80 \rightarrow \alpha = 1.88 \times 10^{-5}\ (\mathrm{^\circ C^{-1}})$$

Q4.

$$P_{cond} = A \frac{T_H - T_L}{\sum L/K} = 3 \frac{25 - (-10)}{\left(\frac{2.5}{1} + \frac{2.5}{0.026} + \frac{2.5}{1}\right) \times 10^{-3}} = 1038\ (\mathrm{W})$$

Q5.

$$W_{AB} = \frac{1}{2}(p_A + p_B)(V_B - V_A) = \frac{1}{2}(2+1)(6-5) = 1.5\ (\mathrm{kJ})$$

We have: $Q_{AB} = -4.5\ (\mathrm{kJ}) \rightarrow \Delta E_{AIB} = \Delta E_{AB} = Q_{AB} - W_{AB} = -4.5 - 1.5 = -6\ (\mathrm{kJ})$
And,

$$W_{AIB} = W_{AI} + W_{IB} = 0 + 1(6-5) = 1\ (\mathrm{kJ})$$

$$\rightarrow Q_{AIB} = \Delta E_{AIB} + W_{AIB} = -6 + 1 = -5\ (\mathrm{kJ})$$