Phy 2 2016/11

Q1.

$$F_{net} = F_{in} - F_{out} = p_{in}A - p_{out}A = (p_{in} - p_{out})A$$
$$= (1 - 0.22) \times 1.01 \times 10^5 \times 0.86 \times 1.83 = 1.24 \times 10^5 \text{ (Pa)}$$

Q2.

Bernoulli's equation:

$$p_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = p_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$$
$$\leftrightarrow 2 \times 10^5 + \frac{1}{2} \times 1000 \times 2^2 + 0 = 1.1 \times 10^5 + \frac{1}{2} \times 1000 \times v_2^2 + 1000 \times 9.8 \times 4$$
$$\rightarrow v_2 = 10.28 \text{ (m/s)}$$

Q3.

We have:

$$\Delta V = V_0 \beta \Delta T \rightarrow 20.4 \times 10^{-5} = 6.8 \times 10^{-2} \times (3\alpha) \times 100 \rightarrow \alpha = 10^{-5} \text{ (°C}^{-1}\text{)}$$

Q4.

We have:

$$P_{cond(1)} = P_{cond(2)} \rightarrow k_1 A \frac{T_1 - T_2}{L_1} = k_2 A \frac{T_2 - T_3}{L_2}$$
$$\rightarrow T_3 = T_2 - \frac{k_1}{k_2}\frac{L_2}{L_1}(T_1 - T_2) = 32 - \frac{1}{0.8}0.4(37 - 32) = 29.5 \text{ (°C)}$$

Similarly,

$$T_x = T_3 - \frac{k_1}{k_3}\frac{L_3}{L_1}(T_1 - T_2) = 29.5 - \frac{1}{0.8}0.4(37 - 32) = 27 \text{ (°C)}$$

Q5.

a)

Given that: $\Delta E_{BC} = -5$ (J)

For adiabatic process BC: $W_{BC} = 0 \rightarrow Q_{BC} = \Delta E_{BC} = -5$ (J)

b)

The problem gives us: $E_A = E_B \rightarrow \Delta E_{AB} = 0$ (J) and $Q_{ABC} = -20$ (J)

$$\rightarrow Q_{AB} = Q_{ABC} - Q_{BC} = -20 - (-5) = -15 \text{ (J)}$$
$$\rightarrow W_{AB} = Q_{AB} = -15 \text{ (J)}$$