Phy 2 2013/10

Q1.

$$F_{net} = F_{in} - F_{out} = p_{in}A - p_{out}A = (p_{in} - p_{out})A$$
$$= (1 - 0.25) \times 1.01 \times 10^5 \times 2 = 1.515 \times 10^5 \text{ (Pa)}$$

Q2.

$$P - F_b = ma \leftrightarrow mg - \rho_w gV = ma$$
$$\leftrightarrow \rho_{al} Vg - \rho_w gV = \rho_{al} Va$$
$$\rightarrow a = \frac{\rho_{al} g - \rho_w g}{\rho_{al}} = \frac{2.7 \times 9.8 - 1 \times 9.8}{2.7} = 6.17 \text{ (m/s}^2\text{)}$$

Q3.

Equation of continuity:

$$A_1 v_1 + A_2 v_2 = A_3 v_3$$
$$\rightarrow 8 \times 4 \times 2 + 7 \times 3 \times 4 = 10 \times h \times 4$$
$$\rightarrow h = 3.7 \text{ (m/s)}$$

Q4.

$$P_{cond} = kA \frac{T_H - T_L}{L} = 401 \times 6.5 \times 10^{-4} \frac{100 - 0}{1.5} = 17.38 \text{ (W)}$$

For an hour, the heat transfer to the ice is:

$$P_{cond} = \frac{Q}{t} \rightarrow Q = P_{cond} t = 17.38 \times 3600 = 62.56 \text{ (kJ)}$$

Therefore,

$$m = \frac{Q}{L_f} = \frac{62.56}{333} = 0.19 \text{ (kg)}$$

Q5.

For a closed cycle: $\Delta E_{int} = Q - W = 0 \rightarrow Q_{net} = W_{net}$

The cycle is clockwise:

$$W_{net} = DA.AB = (p_A - p_D)(V_B - V_A) = (2 - 1)(5 - 3) = 2 \text{ (kJ)}$$

Thus, $Q_{net} = W_{net} = 2$ (kJ)