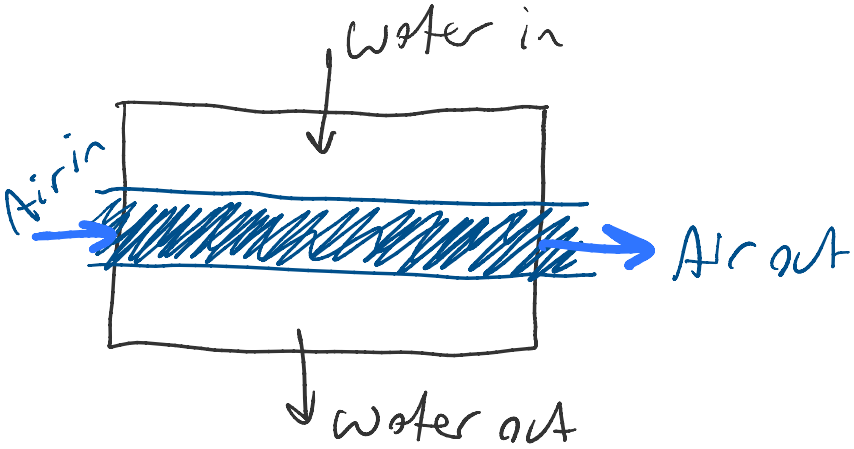
PBC3

October 30, 2022 10:17 PM



Water

State 1	State 2
T_{1w} 5°C	T_{2w} = 20°C
P_{1w} = 200 kPa	$P_{2w} = P_{1w}$

$\dot{m}_w = 0.5$ kg/s

Air

State 1	State 2
T_{1A} = 23°C	T_{2A} = ?
P_{1A} = 100 kPa	$P_{2A} = P_{1A}$

$\dot{m}_A = 2.5$ kg/s

a) $h_{1w} = 21.02$ kJ/kg (from table)
$h_{2w} = 83.915$ kJ/kg

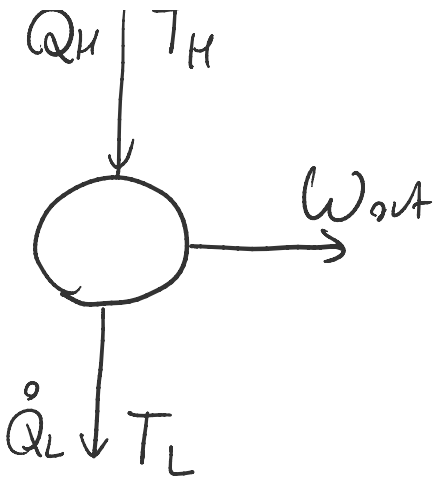
$$\dot{Q} = \dot{m}_w \Delta h_w$$
$$= (0.5)(83.915 - 21.02)$$
$$= 31.4475$$

$$\dot{Q} = \dot{m}_A C_p \Delta T_A$$

$$T_{2A} = T_{1A} - \dot{Q} / \dot{m}_A C_p$$
$$= 23 - 31.4475/(2.5 \cdot 1.005)$$

$$\boxed{T_{2A} = 10.484\ ^\circ C}$$

b) $\dot{Q}_H \mid T_H$ $\qquad \eta = 1 - T_L / T_H$

b) 

$$\eta = 1 - T_L/T_H$$
$$= 1 - 283.484/1273$$
$$= 0.7773$$
$$\boxed{= 77.73\%}$$

c) $$\dot{q}_H/\dot{q}_L = T_H/T_L$$

$$\dot{q}_H = \left(\frac{1273}{283.484}\right)(1000)$$
$$\dot{q}_H = 4490.55 \text{ kW/kg}$$

$$\dot{q}_H = \underline{\dot{w}}_{out} + \dot{q}_L = 4490.55 - 1000$$
$$\boxed{\underline{\dot{w}}_{out} = 3490.55 \text{ kW/kg}}$$