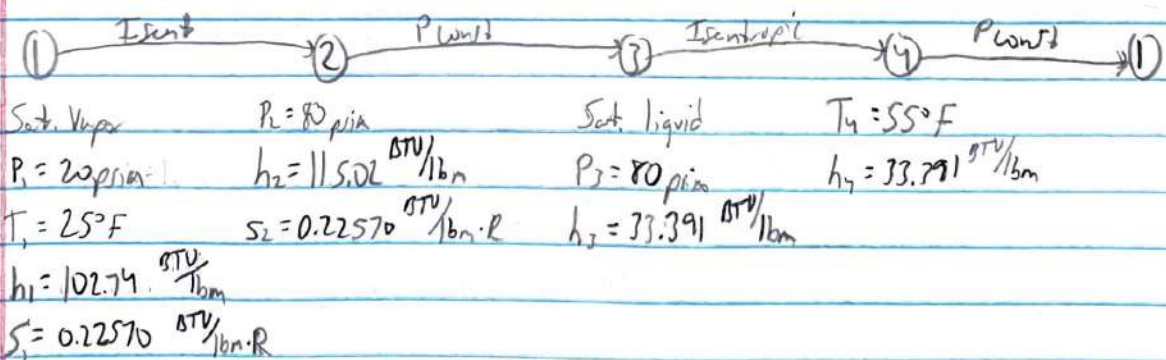
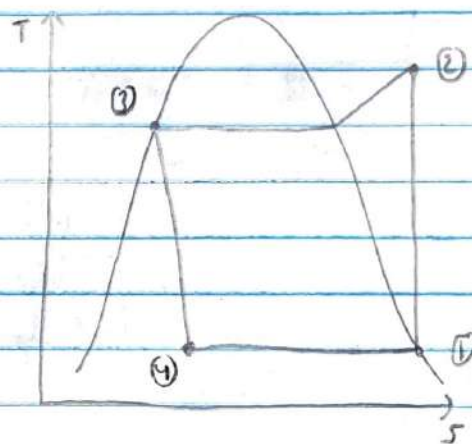
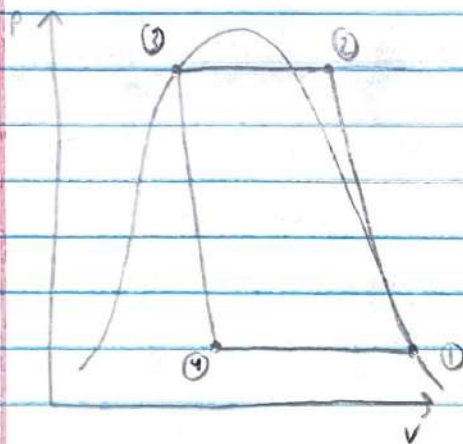
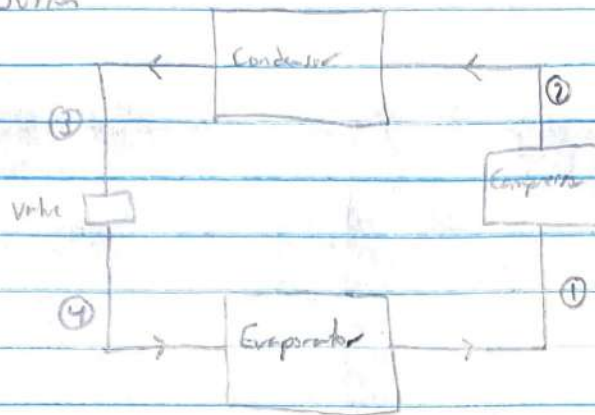


Carson Sutter

HW 3.1

11.11.)



$$\dot{m}_{\text{ice}} = 15 \text{ lbm/h}$$

$$Q_c = h_1 - h_4 = 69.35 \text{ BTU/lbm}$$

$$W = h_2 - h_1 = 12.28 \text{ BTU/lbm}$$

$$Q_c = \dot{m}_{\text{ice}} (169 \text{ BTU/lbm})$$

$$\dot{Q}_c = \frac{15 \text{ lbm/h}}{3600 \text{ s/h}} (169 \text{ BTU/lbm})$$

$$\dot{Q}_c = 0.704 \text{ BTU/s}$$

$$\dot{m}_r = \frac{\dot{Q}_c}{(h_1 - h_4)}$$

$$\dot{m}_r = \frac{0.704}{69.35}$$

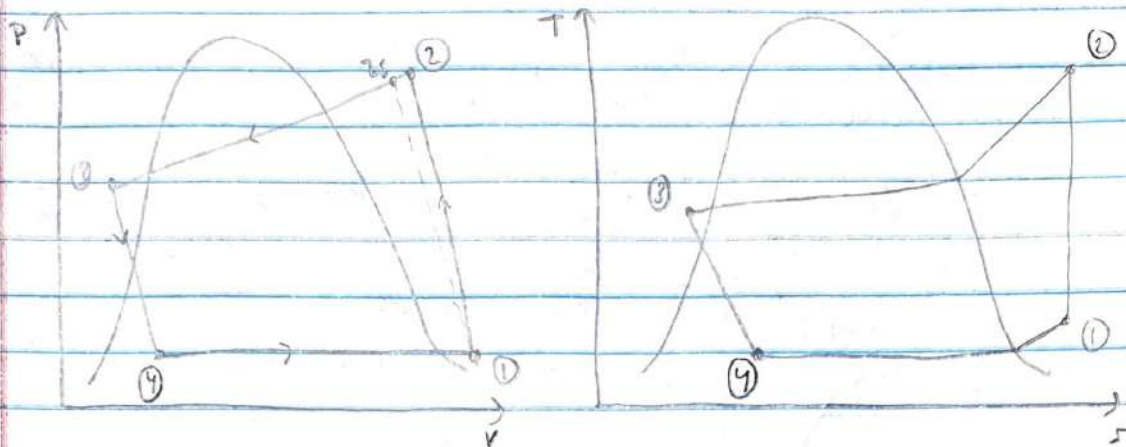
$$\dot{m}_r = 0.0102 \text{ lbm/s}$$

$$\dot{W}_{\text{in}} = \dot{m}_r (h_2 - h_1)$$

$$= 0.0102 (12.28)$$

$$\dot{W}_{\text{in}} = 0.1253 \text{ BTU/s}$$

11-17.)



$$P_1 = 0.2 \text{ MPa} \quad P_2 = 1.2 \text{ MPa} \quad P_3 = 1.15 \text{ MPa} \quad P_4 = 0.2 \text{ MPa}$$

$$T_1 = -5^\circ\text{C} \quad T_2 = 70^\circ\text{C} \quad T_3 = 44^\circ\text{C} \quad h_4 = h_3 = 114.28 \text{ kJ/kg}$$

$$\text{SH Table} \quad \text{SH Table} \quad h_3 = 114.28 \text{ kJ/kg}$$

$$h_1 = 248.795 \text{ kJ/kg} \quad h_2 = 300.61 \text{ kJ/kg}$$

$$s_1 = 0.9539 \text{ kJ/kg}\cdot\text{K} \quad s_2 = 0.9938 \text{ kJ/kg}\cdot\text{K}$$

$$h_{2s} = 287.183 \text{ kJ/kg}$$

$$\text{Given: } \dot{m} = 0.07 \text{ kg/s}$$

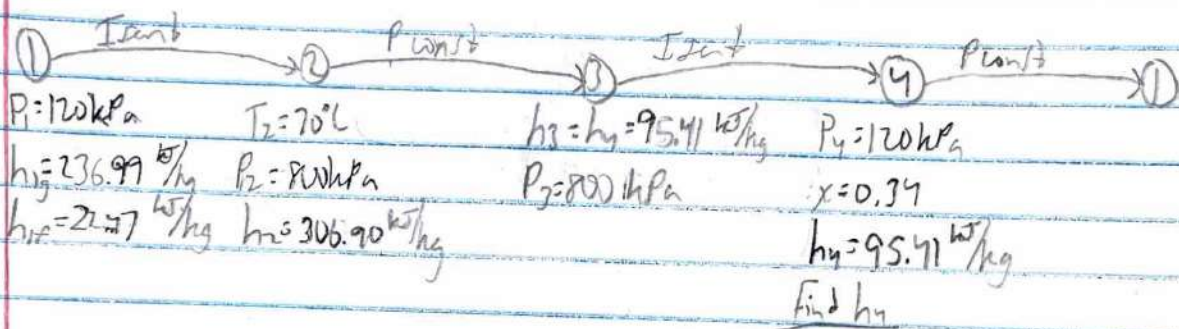
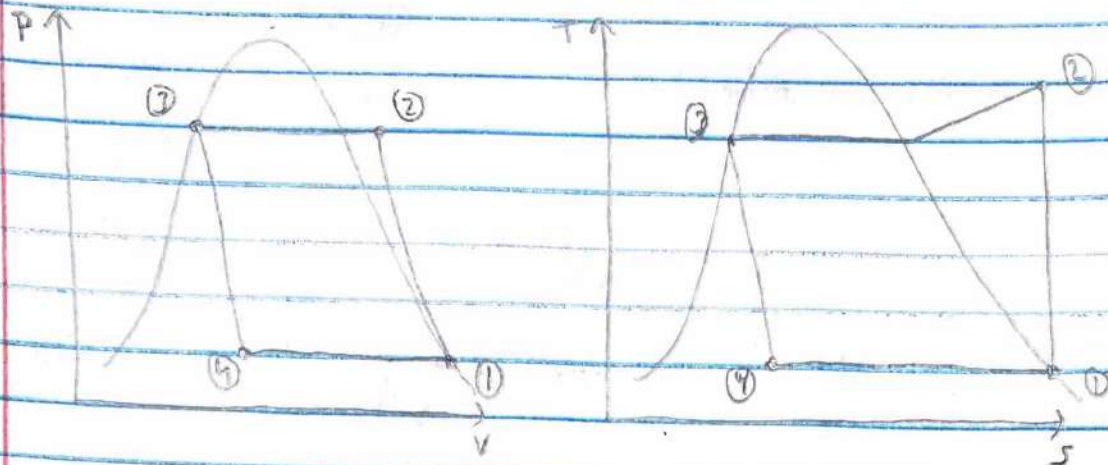
$$\begin{aligned} \text{a.) } \dot{Q}_L &= \dot{m} q_L = 0.07 (h_1 - h_4) \\ &= 0.07 (137.52) \\ &= 9.72 \text{ kW} \end{aligned}$$

$$\begin{aligned} \dot{W}_{in} &= \dot{m} w_{in} = 0.07 (h_2 - h_1) \\ &= 0.07 (51.82) \\ &= 3.63 \text{ kW} \end{aligned}$$

$$\text{b.) } \eta_c = \frac{\dot{W}_{in,s}}{\dot{W}_{in}} = \frac{(h_{2s} - h_1)}{(h_2 - h_1)} = \frac{(287.18 - 248.795)}{(300.61 - 248.795)} = \boxed{74 = 74\%}$$

$$\text{c.) } \text{COP} = \frac{\dot{Q}_L}{\dot{W}_{in}} = \frac{9.72}{3.63} = \boxed{2.60}$$

11-21)



$\dot{W}_{in} = 450 \text{ W}$

$$h_f = h_c + x(h_g - h_c)$$

$$h_f = 22.47 + 0.34(236.99 - 22.47)$$

$$h_f = 95.41 \text{ kJ/kg}$$

a.) $\dot{W}_{in} = \dot{m}(h_2 - h_1)$

$$450 = \dot{m}(306.90 - 236.99)$$

$$\dot{m} = \frac{6.44}{10^3} = \boxed{0.0064 \text{ kg/s}}$$

b.) $P_2 = 800 \text{ kPa}$

c.) $\text{COP} = \frac{h_1 - h_f}{h_2 - h_1} = \frac{236.99 - 95.41}{306.90 - 236.99} = \boxed{2.03}$