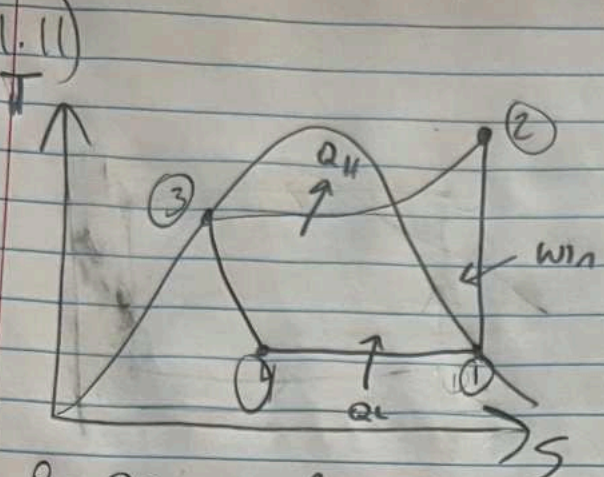
HW 3.1

Josh Ware
Justin Bass



$P_e = 20 psia$ $P_c = 80 psia$

$h_1 = 102.74 \frac{Btu}{lb}$ $h_2 = 114.99 \ Btu/lb$ $h_3 = 33.391 \ Btu/lb$

$s_1 = 0.2257 \frac{Btu}{lbR}$

$$RC = \left(15 \frac{lbm}{h}\right)\left(164 \frac{Btu}{lbm}\right)$$

$$RC = 2535 \frac{Btu}{h}$$

$$RC = \dot{m}_r (h_1 - h_3)$$

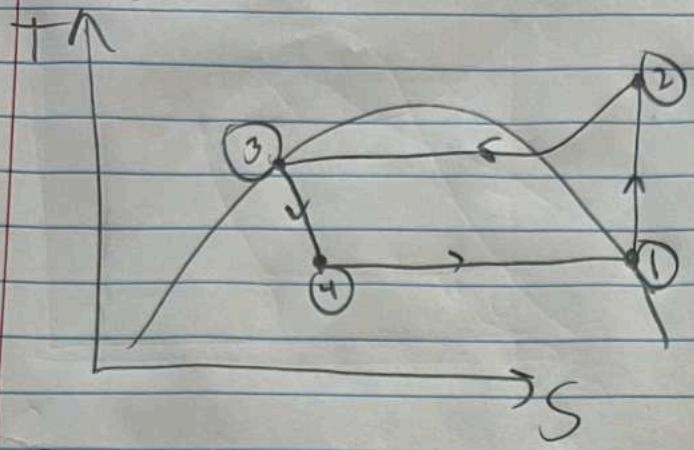
$$2535 \frac{Btu}{h} = \dot{m}_r (102.74 - 33.391)$$

$$\dot{m}_r = 36.554 \frac{lb}{h}$$

$$P = \dot{m}_r (h_2 - h_1)$$
$$= 36.554 (114.99 - 102.74)$$
$$= 448.08 \ Btu/h$$
$$= 0.176 \ hp$$

$$\boxed{P = 0.1761 \ hp}$$

11.17)



$Q_L = 9.42$ kW $W_{in} = 3.63$ kW $\eta_{is} = 74.1\%$ COP = 2.60

① → ② → ③ → ④

①	②	③	④
$P_1 = 0.2$ MPA	$P_2 = 1.2$ MPA	$P_3 = 1.15$ MPa	$P_4 = 0.21$ MPa
$T_1 = -5°C$	$T_2 = 70°C$	$T_3 = 44°C$	$h_4 = 115.16$ kJ/kg
$h_1 = 249.75$	$h_2 = 300.61$	$h_3 = 115.16$	
$s_1 = 0.9525$ kJ/kg·k			

$Q_L = \dot{m}(h_1 - h_4)$

$= 0.07(249.75 - 115.16)$

$\boxed{Q_L = 9.42 \text{ kW}}$

$W_{in} = \dot{m}(h_2 - h_1)$

$= 0.07(300.61 - 249.75)$

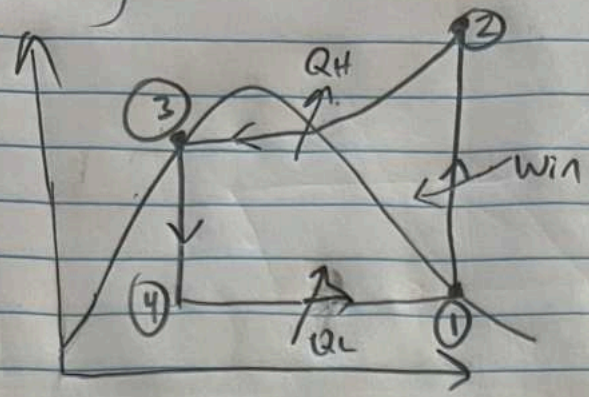
$\boxed{W_{in} = 3.56 \text{ kW}}$

$\eta_{is} = \dfrac{h_{2s} - h_1}{h_2 - h_1} = \dfrac{287.44 - 249.75}{300.61 - 249.75}$

$= \boxed{74.1\%}$

$COP = \dfrac{Q_L}{W_{in}} = \dfrac{9.42}{3.63} = \boxed{2.60}$

11-19)



(1) → (2) → (3) → (4)

$P_1 = 120 kPa$ | $P_2 = P_3$ | $h_3 = h_4$ | $P_{h4} = 120 kPa$

$h_1 = 236.97$ kJ/kg | $T_2 = 70°C$ | $h_3 = 95.4$ kJ/kg | $h_4 = 22.49 + 0.34(214.48)$

$S_1 = 0.9477$ kJ/kg·k | $h_2 = 306.9$ kJ/kg | $P_3 = 798.9 kPa$ | $h_4 = 95.4$ kJ/kg

A) $W_c = \dot{m}(h_2 - h_1)$

$\dot{m} = \frac{W_c}{h_2 - h_1}$

$\dot{m} = \frac{450 \times 10^{-3}}{306.9 - 236.97}$

$\dot{m} = 0.00643$ kg/s

B) $P_3 = P_{sat} = 798.9 kPa$

C) $Q_L = \dot{m}(h_1 - h_4)$

$= 0.006435(236.97 - 95.4)$

$= 0.911$ kW

$COP = \frac{Q_L}{W_c}$

$= \frac{0.911}{0.45}$

$COP = 2.02$