$T_2 = T_1 + \text{Compressor discharge temp rise}$

$T_2 = T_1 + \text{assume } 100°F (55.56°C)$

$T_2 = 40°F + 100°F = 140°F (60°C)$

$\gamma_2 = 1.13$

$\Delta T_{1s} = 40°F \left(\frac{P_{cond}}{P_1}\right)^{\left(\frac{\gamma-1}{\gamma}\right)} = 40°F \left(\frac{220\ psia}{34.14 psia}\right)^{\left(\frac{1.13-1}{1.13}\right)} = 121.5°F$ (66.4°C)

$T_{2s} = T_1 + \Delta T_{1s} = 40°F + 121.5°F = 161.5°F$

$\eta_C = \frac{(T_{2s} - T_1)}{T_2 - T_1} = \frac{161.5°F - 40°F}{140°F - 40°F} = 151.5°F$

$h_4 = 24.864 + 0.8 \cdot 83.397 = 92.01$

$\dot{m} = \frac{\dot{Q}_{in}}{h_1 - h_4} = \frac{941.055}{99.5 - 92} = 125.47\ lb_m/s$

Problem 1

C) It is assumed that the refrigerant enters the evaporator as a saturated vapor (100% quality) and exits the condenser as a saturated liquid (100% quality).

$COP = \frac{Q_{out}}{W_{in}} = \frac{452.53}{3262.22} = 0.138$

D)

$Q_{out} = 452.53\ Btu/s$

$W_{in} = \dot{m}(h_2 - h_1) = 125.4716 lb_m/s \cdot (125.5 - 99.5)\ Btu/lb_m = 3262.22\ Btu/s$

Problem 1