{Question 4E}

P_1=4*convert(bar, kPa)
x_1=1
P_3=9*convert(bar, kPa)
x_3=0
n_isentropic=0.70
mdot=3[kg/min]
n_isentropic=(h_2s-h_1)/(h_2-h_1)

{Part a}
h_1=enthalpy(*R134a*,P=P_1,*x*=x_1)
s_1=entropy(*R134a*,P=P_1,*x*=x_1)

P_2=P_3
s_2s=s_1
h_2s=enthalpy(*R134a*,P=P_2,*s*=s_2s)

W=mdot*(h_2-h_1)/convert(min,sec) {Power of the Compressor: W = 1.2 kW}

{Part b}
h_3=enthalpy(*R134a*,P=P_3,*x*=x_3)
capacity=mdot*(h_1-h_3)/convert(min,sec)*convert(kW,tons) {Refrigerating Capacity: capacity = 0.343 tons}

{Part c}
COP=mdot*(h_1-h_3)/convert(min,sec)/W {Coefficient of Preformance: COP = 6.412}

{Part d}
T_1=temperature(*R134a*,P=P_1,*x*=x_1)
s_3=entropy(*R134a*,P=P_3,*x*=x_3)
T_4=T_1
s_4=s_3
P_4=P_1
T_2=temperature(*R134a*,P=P_2,*h*=h_2)
T_3=temperature(*R134a*,P=P_3,*s*=s_3)
s_2=entropy(*R134a*,P=P_2,*h*=h_2)
h_4=enthalpy(*R134a*,*T*=T_4,*s*=s_4)

SOLUTION
Unit Settings: SI C kPa kJ mass deg

capacity = 2.189 [tons]	COP = 6.412	h_1 = 255.6 [kJ/kg]
h_2 = 279.6 [kJ/kg]	h_{2s} = 272.4 [kJ/kg]	h_3 = 101.6 [kJ/kg]
h_4 = 99.52 [kJ/kg]	mdot = 3 [kg/min]	$n_{isentropic}$ = 0.7
P_1 = 400 [kPa]	P_2 = 900 [kPa]	P_3 = 900 [kPa]
P_4 = 400 [kPa]	s_1 = 0.9269 [kJ/kg-K]	s_2 = 0.9498 [kJ/kg-K]
s_{2s} = 0.9269 [kJ/kg-K]	s_3 = 0.3738 [kJ/kg-K]	s_4 = 0.3738 [kJ/kg-K]
T_1 = 8.91 [C]	T_2 = 45.05 [C]	T_3 = 35.51 [C]
T_4 = 8.91 [C]	W = 1.2 [kW]	x_1 = 1
x_3 = 0		

No unit problems were detected.
EES suggested units (shown in purple) for h_4 P_4 s_2 s_3 s_4 T_1 .

Lookup Table: Lookup 1

	Temperature	Pressure	Enthalpy	Entropy
	[C]	[kPa]	[kJ/kg]	[KJ/kg-K]
Row 1	8.91	400	255.6	0.9269
Row 2	45.05	900	279.6	0.9498
Row 3	35.51	900	101.6	0.3738
Row 4	8.91	400	99.52	0.3738
Row 5	8.91	400	255.6	0.9269