PSet # 5

3.42 R-134a, 200 kPa, 100 kg ~~[illegible]~~

12.322 m^3

$$v_1 = \frac{V}{m} = \frac{12.322}{100} = 0.12322 \ m^3/kg$$

From table A-12, the gas is superheated.

$T_{sat} = -10.09 \rightarrow$ ~~$v_f < v_1 < v_g$~~

$v_1 > v_g$

$0.123 > 0.099 \ (m^3/kg)$

Table A-13, P = 0.2 MPa

T = 40°C, $u = 263.08$ kJ/kg

$v_2 = V_2/2 = 0.06161 \ m^3/kg$

T_2 is $-10.09°C$ sat.

as $v_f < v_2 < v_g$ @ $P_{sat} = 200$ kPa

$$x_2 = \frac{v_2 - v_f}{v_{fg}} = \underline{\underline{.6140}}$$

$$u_2 = u_f + x_2 u_{fg} = 152.61 \ \frac{kJ}{kg}$$

$$\Delta u = u_2 - u_1 = \underline{\underline{-110.47}} \ kJ/kg$$

3.48 $\dot{Q} = \dot{m}_{cond} \cdot h_{fg}$

$= (45 \ kg/h)(2429.8 \ kJ/kg) = 109,341$ kJ/h

$= 30.4$ kW

h_{fg} @ $T_{sat} = 30°C$ from table ~~A~~-4/A-3

Pset # 5

3.52 R-134a, Rigid Vessel $\Delta V = 0$

$\left\{ \begin{array}{l} P = 800\,kPa \\ T = 120^\circ C \end{array} \right.$ Table A-13 (sh)

$u = 327.8$ kJ/kg

$v = 0.0376\ m^3/kg$

Total Volume $= mv = 0.0753\ m^3$

Total $U = mu = 655.7$ kJ

3.58 $v_1 = v_2 = v_{cr} = 0.003106\ m^3/kg$

Table A-4.

$$m = \frac{V}{v} = \frac{0.3}{.003106} = 96.6\ kg$$

At $150^\circ c$

$v_f = .001091\ m^3/kg$ (A-4)

$v_g = 0.39248\ m^3/kg$

$$x_1 = \frac{v_1 - v_f}{v_{fg}} = \underline{.005149}$$

$m_f = (1-x_1)(m_T) = (1 - .005149)\,96.6$

$= 96.10$ kg

$V_f = m_f v_f = \underline{\underline{.105\ m^3}}$

3.63

$V_1 = m v_1 = (1.4)(.001157) = 0.001619$

$V = 4V_1$ (given) $\underline{.006476\ m^3}$

$$v_2 = \frac{V}{m} = \frac{.006476}{1.4} = .004626\ m^3/kg$$

Pset # 5

3.63 Contd. $v_2 = .004626\ m^3/kg$

Table A-5 Interpolate between $P = 21{,}000$, $22{,}000$ kPa

$T_2 = 371.3^\circ C$

$P_2 = 21{,}367\ kPa$

$u_2 = 2201.5\ kJ/kg$

$\Delta U = m(u_2 - u_1)$

$= 1892\ kJ$

3.64 Discussed in class (A-5) @ 3.5 MPa $T_{sat} = 242.6^\circ C$

$T_1 = 242.6 + 5^\circ C \doteq 247^\circ C$

$h_1 = 2821.\ kJ/kg$ (A-6)

$P_2 = P_1$ (3.5 MPa)

$x_2 = 0$ liquid

$h_2 = 1049.7\ kJ/kg$

$v_2 = 0.001235\ m^3/kg$

$\Delta h = 1049.7 - 2821.1 = -1771\ kJ/kg$

Final state $v_3 = v_2$ $(\Delta V = 0)$

$= .001235\ m^3/kg$; $T_3 = 200^\circ C$

~~Interpolate~~ from table A-4 for P & $T = 200^\circ C$

1555 kPa

$x = .0006$

3.68 60 kPa $-20^\circ C$ R-134a

straight forward Problem. SH states.

3.79 Assume Volume Const

Then $\frac{P_1}{T_1} = P_2/T_2 \Rightarrow P_2$ is calculated

$\Delta P = 26 \text{ kPa}$

$$m_1 = \frac{P_1 V}{RT_1} \qquad m_2 = \frac{P_2 V}{RT_2}$$

$$\Delta m = \underline{m_2 - m_1} = .007 \text{ kg}$$

<u>3.80</u> Discussed in r problem in class

$$V_B = \left(\frac{m_1 RT_1}{P_1}\right)_B$$

$$m_A = \left(\frac{P_1 V}{RT_1}\right)_A \qquad m_A + m_B = 10.846 \text{ kg}$$

$$V_A + V_B = 3.21 \text{ m}^3$$

$$P_2 = \frac{mRT_2}{V} = 284.1 \text{ kPa}$$

<u>3.82</u> $R_{O_2} = 0.2598 \text{ kJ/kg.k}$

$$V_1 = \frac{mRT_1}{P_1} = .04845 \text{ m}^3$$

$$V_2 = \frac{mRT_2}{P_2} = .03546 \text{ m}^3$$

$$\Delta V = V_2 - V_1$$

<u>3.120</u> $P_2 = P_{sat}$ @ $200°c$ 1555 kPa

Force balance $\Rightarrow P_1 = P_2 \left(\frac{A_2}{A_1}\right)$

$$= P_2 \left(D_2/D_1\right)^2$$

$$= 248.8 \text{ kPa}$$

$$V_1 = \frac{mRT}{P_1} = 3.95 \text{ m}^3 \qquad R_{He} = 2.0769 \frac{\text{kJ}}{\text{kg K}}$$

<u>3.127</u> Discussed in r problem

$R_{H_2} = 4.124$ Repeated Application Ideal gas law