4-30E *Complete the following table for Refrigerant-134a*:

T, °F	P, psia	*h*, Btu / lbm	*x*	Phase description
65.89	80	78	***0.566***	***Saturated mixture***
15	***29.759***	***69.92***	0.6	***Saturated mixture***
10	70	***15.35***	**- - -**	***Compressed liquid***
160	180	129.46	**- - -**	***Superheated vapor***
110	***161.16***	***117.23***	1.0	***Saturated vapor***

4-31 A piston-cylinder device contains R-134a at a specified state. Heat is transferred to R-134a. The final pressure, the volume change of the cylinder, and the enthalpy change are to be determined.

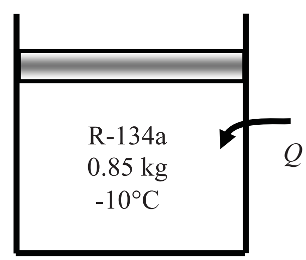
Analysis (a) The final pressure is equal to the initial pressure, which is determined from

$$P_2 = P_1 = P_{\text{atm}} + \frac{m_p g}{\pi D^2/4} = 88\text{ kPa} + \frac{(12\text{ kg})(9.81\text{ m/s}^2)}{\pi(0.25\text{ m})^2/4}\left(\frac{1\text{ kN}}{1000\text{ kg.m/s}^2}\right) = \mathbf{90.4\ kPa}$$

(b) The specific volume and enthalpy of R-134a at the initial state of 90.4 kPa and -10°C and at the final state of 90.4 kPa and 15°C are (from EES)

$v_1 = 0.2302\text{ m}^3/\text{kg}$ $\qquad h_1 = 247.76\text{ kJ/kg}$

$v_2 = 0.2544\text{ m}^3/\text{kg}$ $\qquad h_2 = 268.16\text{ kJ/kg}$



The initial and the final volumes and the volume change are

$$V_1 = mv_1 = (0.85\text{ kg})(0.2302\text{ m}^3/\text{kg}) = 0.1957\text{ m}^3$$

$$V_2 = mv_2 = (0.85\text{ kg})(0.2544\text{ m}^3/\text{kg}) = 0.2162\text{ m}^3$$

$$\Delta V = 0.2162 - 0.1957 = \mathbf{0.0205\ m^3}$$

(c) The total enthalpy change is determined from

$$\Delta H = m(h_2 - h_1) = (0.85\text{ kg})(268.16 - 247.76)\text{ kJ/kg} = \mathbf{17.4\ kJ/kg}$$