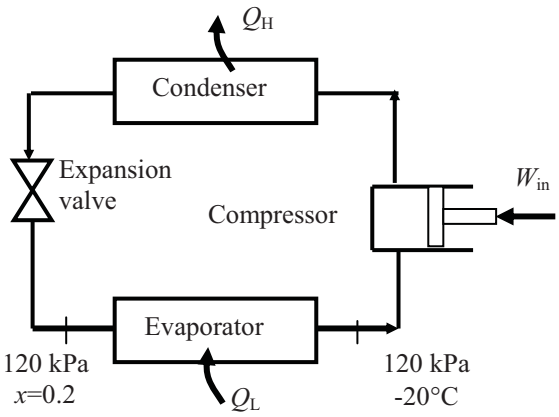
7-58 A commercial refrigerator with R-134a as the working fluid is considered. The evaporator inlet and exit states are specified. The mass flow rate of the refrigerant and the rate of heat rejected are to be determined.

Assumptions **1** The refrigerator operates steadily. **2** The kinetic and potential energy changes are zero.

Properties The properties of R-134a at the evaporator inlet and exit states are (Tables A-11 through A-13)

$$\left.\begin{matrix} P_1 = 120\ \text{kPa} \\ x_1 = 0.2 \end{matrix}\right\} h_1 = 65.38\ \text{kJ/kg}$$

$$\left.\begin{matrix} P_2 = 120\ \text{kPa} \\ T_2 = -20°\text{C} \end{matrix}\right\} h_2 = 238.84\ \text{kJ/kg}$$



Analysis (*a*) The refrigeration load is

$$\dot{Q}_L = (\text{COP})\dot{W}_{\text{in}} = (1.2)(0.45\ \text{kW}) = 0.54\ \text{kW}$$

The mass flow rate of the refrigerant is determined from

$$\dot{m}_R = \frac{\dot{Q}_L}{h_2 - h_1} = \frac{0.54\ \text{kW}}{(238.84 - 65.38)\ \text{kJ/kg}} = \mathbf{0.0031\ kg/s}$$

(*b*) The rate of heat rejected from the refrigerator is

$$\dot{Q}_H = \dot{Q}_L + \dot{W}_{\text{in}} = 0.54 + 0.45 = \mathbf{0.99\ kW}$$