39.7 In a refrigeration cycle, R-134a leaves the evaporator at $20psia$ with $20°F$ of superheat. What is the entropy of the refrigerant entering the compressor?

A. $0.03\frac{Btu}{lb°F}$

B. $0.22\frac{Btu}{lb°F}$

C. $0.24\frac{Btu}{lb°F}$

D. $106\frac{Btu}{lb°F}$

In the Reference Handbook, search for Properties of Refrigerants and use the phrase: Pressure Versus Enthalpy. Find the chart for Refrigerant 134a.

Following a horizontal line at a pressure of $20psia$ to the rightmost edge of the saturation curve, corresponding to a saturated vapor condition. Continue horizontally to the right to account for the additional $20°F$ of superheat. Note that to the right of the saturation curve, lines of constant temperature are curved downward (nearly vertical). This is the compressor entering condition, typically noted as State 1 of the refrigeration cycle.

Once the state point has been identified, read off the entropy from the chart. Note that lines of constant entropy run roughly southwest/northeast on the diagram.

$$s \approx 0.235\frac{Btu}{lb°F}$$

Answer C

39.8 A chiller plant producing a low chilled water supply temperature of $40°F$ uses a glycol/water mixture of 30% glycol by volume. At $40°F$, glycol has a specific heat capacity of $0.56\frac{Btu}{lb_m°F}$ and a specific gravity of 1.15. What is the specific heat capacity of the mixture?

A. $0.86\frac{Btu}{lb_m°F}$

B. $0.87\frac{Btu}{lb_m°F}$

C. $0.88\frac{Btu}{lb_m°F}$

D. $0.89\frac{Btu}{lb_m°F}$

The glycol/water mixture is defined as being 30% glycol by volume, but the specific heat capacity of the mixture will be a function of the relative *mass* of glycol and water, not the volume.

Assume an arbitrary volume of $100ft^3$ of the mixture, comprised of $30ft^3$ of glycol and $70ft^3$ of water.

Find the mass of water:

$$m_{water} = \rho_{water}V_{water} = \left(62.4\frac{lb_m}{ft^3}\right)\left(70ft^3\right) = 4368lb_m$$

Find the mass of glycol, by first determining the density of glycol using the specific gravity.