37.17 A refrigeration cycle using R-123 operates between $30psia$ and $125psia$ with no subcooling and isenthalpic expansion. What is the quality of the mixture entering the evaporator?

A. 0.20

B. 0.26

C. 0.32

D. 0.38

Look up the R-123 properties table and Pressure Versus Enthalpy Curves for Refrigerant 123. Consider the high pressure side of the refrigeration cycle after the refrigerant passes through the condenser, it is expected to be a saturated liquid at $125psia$. Let this be considered State 3. Use either the table or the chart to determine the enthalpy of saturated liquid, h_f. The table lends itself to slightly higher precision but may take a bit more time. Formal interpolation is not necessary. Beware of the logarithmic scale on the vertical axis if using the P-H chart. Since the expansion process in a typical refrigeration cycle is isenthalpic, the enthalpy after expansion is the same as the enthalpy prior to expansion. Let the low pressure condition after expansion be considered State 4.

$$h_4 = h_3 = h_{f@125psia} \approx 64.3 \frac{Btu}{lb}$$

Use the table to obtain h_f and h_g at the low pressure condition of $30psia$.

$$h_{f@30psia} \approx 38.14 \frac{Btu}{lb}$$

$$h_{g@30psia} \approx 107.4 \frac{Btu}{lb}$$

Calculate the enthalpy at State 4.

$$\chi_4 = \frac{h_4 - h_f}{h_g - h_f} = \frac{64.3 \frac{Btu}{lb} - 38.14 \frac{Btu}{lb}}{107.4 \frac{Btu}{lb} - 38.14 \frac{Btu}{lb}} = 0.378$$

Answer D