

**31.1 What is the enthalpy of  $1\text{ lb} \cdot \text{mole}$  of  $300^\circ\text{F}$  steam with a quality of 60%?**

- A.  $630\text{Btu}$
- B.  $820\text{Btu}$
- C.  $11,400\text{Btu}$
- D.  $14,700\text{Btu}$

$1\text{ lb} \cdot \text{mol}$  of  $\text{H}_2\text{O}$  weighs:  $2(1) + 16 = 18\text{lbs}$

From the **Properties of Saturated Water and Steam** Table @ $300^\circ\text{F}$ :

$$h_f = 269.7 \frac{\text{Btu}}{\text{lb}}$$

$$h_{fg} = 910.2 \frac{\text{Btu}}{\text{lb}}$$

Find the specific enthalpy at 60% quality:

$$h = h_f + \chi h_{fg} = 269.7 \frac{\text{Btu}}{\text{lb}} + (.6) \left( 910.2 \frac{\text{Btu}}{\text{lb}} \right) = 815.8 \frac{\text{Btu}}{\text{lb}}$$

**Specific Enthalpy** is the total enthalpy per unit mass, expressed as:  $h = \frac{H}{m}$  which can be rearranged to  $H = mh$  where mass and specific enthalpy are both known.

Substitute and solve:

$$H = mh = (18\text{lbs}) \left( 815.8 \frac{\text{Btu}}{\text{lb}} \right) = 14,684\text{Btu}$$

**Answer D**