

46.17 A refrigeration cycle using R-134a has a refrigeration effect of $8000 \frac{Btu}{hr}$ and a coefficient of performance of 11. What is the power required to run the compressor?

- A. 210W
- B. 730W
- C. 28KW
- D. 90KW

Use the definition of **Coefficient of Performance for Refrigerators and Air Conditioners**. Solve for the work of the compressor. Convert units to Watts.

$$COP = \frac{Q_L}{W}$$

$$W = \frac{Q_L}{COP} = \frac{8000 \frac{Btu}{hr}}{11} \left(\frac{1W}{3.412 \frac{Btu}{hr}} \right) = 213W$$

Answer A

46.18 100,000 $\frac{lbm}{hr}$ of steam at 5psig with quality $\chi = 0.9$ flows through a pipe with an inside diameter of 20in. What is the velocity?

- A. $230 \frac{ft}{s}$
- B. $255 \frac{ft}{s}$
- C. $850 \frac{ft}{s}$
- D. $940 \frac{ft}{s}$

Since the steam is a saturated mixture, use the quality to determine the specific volume at 5psig. Use the steam table by searching **Properties of Saturated Water and Steam** by pressure. 5psig \approx 20psia. Collect the values for specific volume of a liquid, v_f , and specific volume change during phase change, v_{fg} .

$$v_f = 0.0168 \frac{ft^3}{lb}$$

$$v_{fg} = 20.09 \frac{ft^3}{lb}$$

Use the equation for **specific volume of a two-phase system**.

$$v = v_f + \chi v_{fg} = 0.0168 \frac{ft^3}{lb} + (0.9) \left(20.09 \frac{ft^3}{lb} \right) = 18.1 \frac{ft^3}{lb}$$

Next find the area of a pipe with an inside diameter of 20in in ft^2 .