39.16 A refrigerator draws $800W$ of power and absorbs $4000\frac{Btu}{hr}$ from the internal volume. What is the coefficient of performance?

A. 0.7

B. 1.5

C. 1.7

D. 5.0

Look up Coefficient of Performance for a Refrigerator in the reference handbook and use the formula:

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

where Q_L is the refrigeration effect i.e. the heat removed from the cold space and W is the work done by the compressor to drive the refrigeration process. Note that the units must cancel completely as the COP should be unitless. Substitute and solve.

$$COP_R = \frac{Q_L}{W} = \frac{4000\frac{Btu}{hr}}{800W\left(3.412\frac{Btu}{hr \cdot W}\right)} = 1.5$$

Answer B

39.17 The cold and hot reservoirs of a reversed Carnot refrigeration cycle are $-20°F$ and $80°F$, respectively. $3000\frac{Btu}{hr}$ are absorbed from the cold reservoir. What is the work input?

A. $160W$

B. $200W$

C. $700W$

D. $1100W$

Find the coefficient of performance for a Carnot Refrigerator in the reference handbook as having the formula:

$$COP_{R,carnot} = \frac{T_L}{T_H - T_L}$$

where T_L and T_H are the low and high reservoir temperatures, respectively, in absolute degrees i.e. Rankine. Therefore the COP can be determined as such:

$$COP_{R,carnot} = \frac{T_L}{T_H - T_L} = \frac{-20°F + 460}{[(80°F + 460) - (-20°F + 460)]} = \frac{440°R}{100°R} = 4.4$$

Having been given the rate of heat removal from the cold reservoir and calculated the COP for the cycle, the compressor work to drive the refrigeration process can be calculated: