A "540W" electric heater is designed to operate from 120V lines.

(a) What is resistance?

\[ P = \frac{V_{ab}^2}{R} \Rightarrow R = \frac{V_{ab}^2}{P} = \left(\frac{120V}{540W}\right)^2 \]

\[ R = \frac{1.44 \times 10^4}{540} \quad \Rightarrow \quad \frac{V^2}{(5/5)} \]

\[ = \frac{V^2}{(5/5)} \]

\[ = \frac{V}{A} \]

\[ = \frac{4.5}{A} \]

\[ R = 26.7 \Omega \]

(b) What current does it draw?

\[ V = \frac{I}{R} \Rightarrow I = \frac{V}{R} = \frac{120V}{26.7\Omega} = 4.5A \]

(c) If line voltage drops to 110V, what power does heater take? (Assume \( R \) is constant)

As in (b) \[ I = \frac{V}{R} = \frac{110V}{26.7\Omega} = 4.12A \]

\[ \text{eq. 2.17?} \] and \[ P = VI = (110V)(4.12A) = 453 \text{ W} \]

\[ \text{eq. 2.17?} \]

(d) Resistance is a function of Temp as shown by eqn. 25-12, p. 952.

\[ R(T) = R_0 \left[ 1 + \alpha (T - T_0) \right] \]

If the heater coils are metallic (see Table 25-2, p. 948) you can see that \( \alpha \) metals \( \geq 0 \). Since \( T - T_0 \) is smaller than before the \( R \) is lower. If \( R \) is lower than the current \[ I = \frac{110V}{26.7\Omega} = \]

\[ < 26.7\Omega \]

Correction is upward from what we calculated in part (c).