17. ***REASONING*** Assuming that the resistance is R at a temperature T and R_0 at a temperature T_0, we can write the percentage change p in resistance as

$$p = \frac{R - R_0}{R_0} \times 100$$

Equation 20.5, on the other hand, gives the resistance as a function of temperature as follows:

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

where α is the temperature coefficient of resistivity. Substituting this expression into the expression for the percentage change in resistance gives

$$p = \frac{R - R_0}{R_0} \times 100 = \frac{R_0 + R_0\alpha\left(T - T_0\right) - R_0}{R_0} \times 100 = \alpha\left(T - T_0\right)100 \qquad (1)$$

The change in temperature is unknown, but it is the same for both wires. Therefore, we will apply Equation (1) to each wire and divide the two expressions to eliminate the unknown change in temperature. From the result we will be able to calculate the percentage change in the resistance of the tungsten wire.

SOLUTION Applying Equation (1) to both wires gives

$$p_{\text{Tungsten}} = \alpha_{\text{Tungsten}}\left(T - T_0\right)100 \quad \text{and} \quad p_{\text{Gold}} = \alpha_{\text{Gold}}\left(T - T_0\right)100$$

Dividing these two expressions, eliminating $(T - T_0)$ algebraically, and solving for p_{Tungsten} give

$$\frac{p_{\text{Tungsten}}}{p_{\text{Gold}}} = \frac{\alpha_{\text{Tungsten}}\left(T - T_0\right)100}{\alpha_{\text{Gold}}\left(T - T_0\right)100} = \frac{\alpha_{\text{Tungsten}}}{\alpha_{\text{Gold}}}$$

$$p_{\text{Tungsten}} = p_{\text{Gold}}\left(\frac{\alpha_{\text{Tungsten}}}{\alpha_{\text{Gold}}}\right) = (7.0\%)\frac{0.0045\,(\text{C}^\circ)^{-1}}{0.0034\,(\text{C}^\circ)^{-1}} = \boxed{9.3\%}$$