How much would you have to raised the temperature of a copper wire (originally at $T_{ref} =$ 20 °C) to increased its resistance by 20 %?

Solution.

A temperature coefficient of resistance α is given by:

$$\alpha = \frac{1}{R}\frac{dR}{dT},$$

where R is the conductor resistance at reference temperature, dR is the increment of resistance, dT is the temperature increment.

The temperature coefficient of resistance of copper is $\alpha = 4 \cdot 10^{-3}\, 1/^{\circ}\mathrm{C}$. So we have:

$$dT = \frac{dR}{R\alpha} = \frac{20\%}{4 \cdot 10^{-3}\, 1/^{\circ}\mathrm{C}} = 50\ ^{\circ}\mathrm{C}.$$

The final temperature is $T = T_{ref} + dT = 20^{\circ}\mathrm{C} + 50^{\circ}\mathrm{C} = 70^{\circ}\mathrm{C}$.

Answer: $dT = 50\ ^{\circ}\mathrm{C}$; $T = 70\ ^{\circ}\mathrm{C}$.