

Answer on Question #58259-Engineering-Mechanical Engineering

The temperature at which the tungsten filament of a 12V and 36W lamp operates is 1730°C. If the temperature coefficient of resistance of tungsten is $6 \times 10^{-3} / \text{K}$, find the resistance of the lamp at a room temperature of 20 °C.

10.00Ω

0.45Ω

0.39Ω

4.00Ω

Solution

$$P = \frac{U^2}{R} \rightarrow R = \frac{U^2}{P}$$

The dependence resistance on the temperature is given by the formula

$$R = R_0(1 + \alpha\Delta T)$$

In our case:

$$R = R_0(1 + \alpha\Delta T) \rightarrow \frac{U^2}{P} = R_0(1 + \alpha\Delta T) = \frac{12^2}{36} (1 + 6 \cdot 10^{-3} \cdot (20 - 1730)) =$$

$$R_0 = \frac{U^2}{P(1 + \alpha\Delta T)} = \frac{12^2}{36(1 + 6 \cdot 10^{-3} \cdot (1730 - 20))} = 0.36\Omega$$

Answer: 0.36Ω.