Answer on Question #41572, Physics, Other

Question:

The temperature at which the tungsten filament of a 12V and 36W lamp operates is 1730oC. If the temperature coefficient of resistance of tungsten is 6×10−3 /K, find the resistance of the lamp at a room temperature of 20oC

1) 10,00 Ω
2) 0,45 Ω
3) 0,39 Ω
4) 4,00 Ω

Answer:

Power of tungsten filament equals:

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

Therefore, resistance equals:

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

In other hand resistance equals:

$$R(T) = R(T_0)(1 + \alpha\Delta T)$$

T is the temperature at which the resistance is measured, T_0 is the reference temperature, and ΔT is the difference between T and T_0. Finally, α is the temperature coefficient.

So, the resistance of the lamp at a room temperature equals:

$$R_r = \frac{\dfrac{12^2}{36}}{1 + 6 \cdot 10^{-3}(1730 - 20)} = 0.36 \ \Omega$$

Answer: 0.36 Ω