

Question #32493

The temperature at which the tungsten filament of a 12V and 36W lamp operates is 1730 Degrees Celsius. If the temperature coefficient of resistance of tungsten is $610^{-3}/K$, find the resistance of the lamp at a room temperature of 20 Degrees Celsius.

Solution:

The resistance in the connection with temperature is

$$R = R_0(1 - \alpha(T - T_0))$$

Where

R_0 is the resistance at the previous temperature T_0

α is the temperature coefficient of resistance

Such as

$$P = IU = \frac{U^2}{R_0}$$

$$R_0 = \frac{U^2}{P}$$

where:

U is the voltage (volt)

P is the power (watt)

$$R = \frac{U^2}{P}(1 - \alpha(T - T_0))$$

$$R = \frac{12^2}{36}(1 - 6 * 10^{-3}(20 - 1730)) = 45.04 \text{ ohms}$$

Answer: at a room temperature (20°C) resistance is 45 ohms.