

### Question#8520

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  $6 \times 10^{-3}/K$ , find the resistance of the lamp at a room temperature of 20 Degrees Celsius.

- (A) 10.00 ohms
- (B) 0.45 ohms
- (C) 0.39 ohms
- (D) 4.00 ohms

**Solution:**

**Let:**

$$U = 12V, P = 36W, T_1 = 1730^\circ C, T_2 = 20^\circ C, \alpha = 6 * 10^{-3} K^{-1}$$

$$R_2 = ?$$

**Find resistance of a lamp at 1730°C**

$$P = IU, I = \frac{U}{R}$$

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

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

$$R_1 = \frac{12^2}{36} = 4 \text{ ohms}$$

**Dependence of resistance on temperature is:**

$$R_1 = R_2(1 + \alpha\Delta T) \Rightarrow$$

$$R_2 = \frac{R_1}{1 + \alpha\Delta T}$$

$$\Delta T = T_1 - T_2 = 1710^\circ C$$

$$R_2 = \frac{4}{1 + 6 \times 10^{-3} \times 1710} = 0.36 \text{ ohms}$$

**Answer: "C" (nearest value) Resistance is: 0.36 ohms**