

Q. 01

At room temperature (27.0 °C) the resistance of a heating element is 100 Ω. What is the temperature of the element if the resistance is found to be 117 Ω, given that the temperature coefficient of the material of the resistor is $1.70 \times 10^{-4} \text{ } ^\circ\text{C}^{-1}$

Answer

Room temperature, $T = 27^\circ\text{C}$

Resistance of the heating element at T , $R = 100 \text{ } \Omega$

Let T_1 is the increased temperature of the filament.

Resistance of the heating element at T_1 , $R_1 = 117 \text{ } \Omega$

Temperature co-efficient of the material of the filament,

$$\alpha = 1.70 \times 10^{-4} \text{ } ^\circ\text{C}^{-1}$$

α is given by the relation,

$$\alpha = \frac{R_1 - R}{R(T_1 - T)}$$

$$T_1 - T = \frac{R_1 - R}{R\alpha}$$

$$T_1 - 27 = \frac{117 - 100}{100(1.7 \times 10^{-4})}$$

$$T_1 - 27 = 1000$$

$$T_1 = 1027^\circ\text{C}$$

Therefore, at 1027°C, the resistance of the element is 117Ω.