Ch—03 Current Electricity

Daily Practice Problem 03

Q1. It is desired to make 20 Ω coil of wire, which has a thermal coefficient of resistance. To do this, a carbon resistor of resistance R_1 is placed in series with an iron resistor of resistance R_2. The proportions of iron and carbon are to chosen that $R_1 + R_2 = 20\Omega$ for all temperatures near 20°C. Find the values of R_1 and R_2? $\alpha_{carbon} = -0.5 \times 10^{-3°}C^{-1}$, $\alpha_{iron} = 5 \times 10^{-3°}C^{-1}$

Q2. A resistance thermometer measures temperature with the increase in resistance of a wire of high temperature. If the wire is platinum and has a resistance of 10 Ω at 20°C and a resistance of 35 Ω in a hot furnace, what is the temperature of the furnace? ($\alpha_{platinum} = 0.0036°C^{-1}$)

Q3. A conductive wire has resistance of 10 ohm at 0°C and α is 1/273°C, then determine its resistance at 273°C. 12.

Q4. (a) At what temperature would the resistance of a copper conductor be double of its value of 0°C? **(b)** Does this same temperature hold for all copper conductors, regardless of shape and size? ($\alpha_C = 4.0 \times 10^{-3°}C^{-1}$)

Q5. A potential difference is applied across the filament of a bulb at t= 0, and it is maintained at a constant value while the filament gets heated to its equilibrium temperature. We find that the final current in the filament is one-sixth of the current drawn at t = 0. If the temperature of the filament at t = 0 is 20°C and the temperature coefficient of resistivity at 20°C is 0.0043 $°C^{-1}$, find the final temperature of the filament.

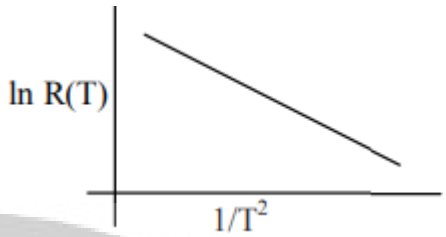
Q6. A copper coil has a resistance of 20.0 Ω at 0°C and a resistance of 26.4Ω at 80°C. Find the temperature coefficient of resistance of copper.

Q7. A metallic wire has a resistance of 120 Ω at 20°C. Find the temperature at which the resistance of same metallic wire rises to 240 Ω where the temperature coefficient of the wire is $2 \times 10^{-40}C^{-1}$.

Q8. The resistance of the platinum wire of a platinum resistance thermometer at the ice point is 5 Ω and at steam point is 5.23 Ω. When the thermometer is inserted in a hot bath, the resistance of the platinum wire is 5.795 Ω. Calculate the temperature of the bath.

Q9. The temperature coefficient of resistivity of copper is $0.004°C^{-1}$. Find the resistance of a 5 m long copper wire of diameter 0.2 mm at 100°C, if the resistivity of copper at 0°C is 1.7×10^{-8} Ωm.

Q10. In an experiment, the resistance of a material is plotted as a function of temperature (in some range). As shown in the figure, it is a straight line.



One may conclude that

(a) $R(T) = R_0 e^{-T^2/T_0^2}$
(b) $R(T) = R_0\, e^{T^2/T_0^2}$
(c) $R(T) = R_0 e^{(-T_0^2/T^2)}$
(d) $R(T) = \frac{R_0}{T^2}$

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ANSWERS

1. $R_1 = 18.18\ \Omega$, $R_2 = 1.82\ \Omega$

2. $714°C$

3. 10e

4. (a) $250°C$ **(b)**Yes

5. $1182.8°C$

6. $\alpha = 4 \times 10^{-3} C^{-1}$

7. $T = 5020°C$

8. $345.65°C$

9. $3.8\ \Omega$

10. c