A platinum resistance thermometer has resistance of 52.5 ohms and 9.75 ohms at 0 degree Celsius and 100 degree Celsius respectively.when the resistance is 8.25 ohms, find the temperature?

Solution

The electrical resistivity of most materials changes with temperature. If the temperature T does not vary too much, a linear approximation is typically used:

$$\rho(T) = \rho_0\big(1 + \alpha * (T - T_0)\big)$$

where α is called the temperature coefficient of resistivity, T_0 is a fixed reference temperature (usually room temperature or $0°C$), and is the resistivity at temperature . The parameterα is an empirical parameter fitted from measurement data.
(http://en.wikipedia.org/wiki/Electrical_resistivity_and_conductivity#Temperature_dependence)

Thus:

$$\rho(100) = \rho(0)\big(1 + \alpha * (100 - 0)\big)$$

We are given:

$$\rho(100) = 9.75\ \Omega$$

$$\rho(0) = 52.5\ \Omega$$

So:

$$9.75 = 52.5 * \big(1 + \alpha * (100 - 0)\big)$$

$$1 + 100 * \alpha = \frac{9.75}{52.5}$$

$$\alpha \approx -0.00814\,\frac{\Omega}{K}$$

So, for platinum:

$$\rho(T) = 52.5 * (1 - 0.00814 * T)$$

Where T in Celsius ;

We are given $\rho(T_x) = 8.25\ \Omega$

$$8.25\ = 52.5 * (1 - 0.00814 * T_x)$$

$$T_x \approx 103.55\ °C$$

Answer: **103.55** degree Celsius