Question #55653, Physics / Electric Circuits |

A copper wire has a resistance of 2.0 ohm at 0C and 2.26 ohm at 30C. What is the resistance at 50C?

Answer:

The resistance of the copper wire is defined by the equation:

$R_1 = R_0(1+\alpha[T_1 - T_0])$, where R_1, T_1 – the final resistance and temperature, R_0, T_0 – the initial resistance and temperature and α – the temperature coefficient for copper.

Using data for the resistances at 0 C^0 and 30 C^0, the temperature coefficient of resistance for copper can be found:

2.26 ohm = 2.0 ohm(1+ α[30 C^0 - 0 C^0])

2.26 ohm = 2.0 ohm + 30α

$\alpha = 0.26/(30\ C^0) = 8.7 \times 10^{-3}\ (C^0)^{-1}$

Thus, the resistance at 50 C^0 is:

(The initial temperature and resistance are 30 C^0 and 2.26 ohm, respectively.)

$R_1 = 2.26$ ohm $\times(1+ 8.7\times10^{-3}\ (C^0)^{-1}[50\ C^0 - 30\ C^0]) = 2.65$ omh