6. When 5V potential difference is applied across a wire of length 0.1 m, the drift speed of electrons is 2.5×10^{-4} ms^{-1}. If the electron density in the wire is 8×10^{28} m^{-3}, the resistivity of the material is close to :

(1) 1.6×10^{-6} Ωm

(2) 1.6×10^{-5} Ωm ← Correct

(3) 1.6×10^{-8} Ωm

(4) 1.6×10^{-7} Ωm

$J = nev_d$ — (1)

$J = \frac{V}{RA} = \frac{V}{\rho\frac{L}{A}\times A} = \frac{V}{\rho L}$ — (2)

From (1) & (2),

$nev_d = \frac{V}{\rho L}$

$\Rightarrow \rho = \frac{V}{nev_d L}$

$V = 5$ V, $L = 0.1$ m, $v_d = 2.5\times10^{-4}$,

$n = 8\times10^{28}$ m^{-3}, $e = 1.6\times10^{-19}$ C

$\Rightarrow \rho = \frac{5}{8\times10^{28}\times1.6\times10^{-19}\times2.5\times10^{4}\times0.1}$ Ωm

$\Rightarrow \rho = \frac{1}{4\times1.6\times10^{4}} \simeq 1.56\times10^{-5}$ Ωm

Option (2) is correct