



班级: 计01

姓名: 谷逸超

编号: 2020010869

科目: 物理

第 1 页

4. 已知: $S = 20\text{mm} \times 80\text{mm} = 1.6 \times 10^{-3} \text{m}^2$, $l = 2\text{m}$, $\rho = 1.75 \times 10^{-8} \Omega \cdot \text{m}$, $n = 8.5 \times 10^{28} \text{m}^{-3}$, $U = 50\text{mV} = 5 \times 10^{-2} \text{V}$

求: (1) R (2) I (3) J (4) E (5) P (6) v

解: (1) $R = \rho \frac{l}{S} = 1.75 \times 10^{-8} \times \frac{2}{1.6 \times 10^{-3}} = 2.19 \times 10^{-5} \Omega$

(2) $I = \frac{U}{R} = \frac{5 \times 10^{-2}}{2.19 \times 10^{-5}} = 2.29 \times 10^3 \text{A}$

(3) $J = \frac{I}{S} = \frac{2.29 \times 10^3}{1.6 \times 10^{-3}} = 1.43 \times 10^6 \text{A/m}^2$

(4) $E = \rho J = 1.75 \times 10^{-8} \times 1.43 \times 10^6 = 2.5 \times 10^{-2} \text{V/m}$

(5) $P = UI = 5 \times 10^{-2} \times 2.29 \times 10^3 = 115 \text{W}$

(6) $v = \frac{J}{ne} = \frac{1.43 \times 10^6}{8.5 \times 10^{28} \times 1.6 \times 10^{-19}} = 1.05 \times 10^{-4} \text{m/s}$

8. 已知: $r_1 = 0.5\text{cm} = 5 \times 10^{-3} \text{m}$, $r_2 = 2\text{cm} = 2 \times 10^{-2} \text{m}$, $\rho = 1 \times 10^{12} \Omega \cdot \text{m}$, $L = 1000\text{m}$, $U = 100\text{V}$

求: (1) R (2) I

解: (1) $R = \frac{\rho}{2\pi L} \ln \frac{r_2^2}{r_1^2} = \frac{1 \times 10^{12}}{2\pi \times 1000} \ln \frac{(2 \times 10^{-2})^2}{(5 \times 10^{-3})^2} = 2.2 \times 10^8 \Omega$

(2) $I = \frac{U}{R} = \frac{100}{2.2 \times 10^8} = 4.54 \times 10^{-7} \text{A}$

18 已知: 导体均匀, 恒定电流

求: 均匀导体内不存在净电荷.

解: 导体内取高斯面, 有 $q_{in} = \epsilon_0 \oint E \cdot d\mathbf{s} = \epsilon_0 \oint \rho J \cdot d\mathbf{s}$

由于导体均匀, 电阻率处处相等, 故 $q_{in} = \epsilon_0 \rho \oint J \cdot d\mathbf{s}$

由恒定电流 $\oint J \cdot d\mathbf{s} = 0$, 故 q_{in} 为 0, 导体内不存在净电荷.