Leen Sabri

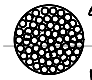
Q2 $L = 8m$, diameter $= 6mm \Rightarrow r = 3mm = 3\times10^{-3} m$, $R = 30 m\Omega = 30\times10^{-3}\Omega$, $V = 23 V$

a) $V = RI \Rightarrow I = \frac{V}{R} = \frac{23}{30\times10^{-3}} \approx 766.67\ A$

b) $J = \frac{I}{A} = \frac{766.67}{r^2\pi} = \frac{766.67}{(3\times10^{-3})^2\pi} = 27129039.99$

c) $\rho = \frac{RA}{L} = \frac{(30\times10^{-3})((3\times10^{-3})^2(3.14))}{8} = 1.05975\times10^{-7}$

Q3

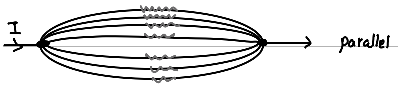


63 Strand

كيبل يحتوي على 63 شعيرة (Strands) * يعني الشعيرات أسلاك موصولة على التوازي

for each fine wire $\longrightarrow R = 2.65\ \mu\Omega = 2.65\times10^{-6}\Omega$

$I_{total} = 0.75 A$



a) $\rightarrow$ بما إنهم نفس الأسلاك ومشبوكين على التوازي ∴ التيار بتوزع بالتساوي بينهم

$I_s = \frac{0.75}{63} \approx 0.0119\ A$

b) الجهد في التوازي متساوي عند جميع الفاتحات (مقاومة الأسلاك)

$V = V_s \Rightarrow V_s = I_s R_s = 0.0119 \times 2.65\times10^{-6} \approx 3.155\times10^{-8}\ v$

c) $R_{eq} = \frac{V}{I_{tot}} = \frac{3.155\times10^{-3}}{0.75} \approx 4.206\times10^{-3}\Omega$ // or $\frac{1}{R_{eq}} = \frac{1}{2.65\times10^{-6}} + \frac{1}{2.65\times10^{-6}} + \underset{\text{لحد ما نوصل 63}}{\cdots\cdots} \Rightarrow R_{eq} = \frac{2.65\times10^{-6}}{63}$

Q11 $V = 230$, $L = 14.1 ms$, $r = 0.3\times10^{-3} m$, $J = 1.98\times10^{8} A/m^2$

$J = \frac{I}{A} \Rightarrow I = J.A = J(r^2\pi) = (1.98\times10^{8})(0.3\times10^{-3})^2(3.14) = 55.9548\ A$

$V = RI \Rightarrow 230 = R(55.9548) \Rightarrow R \approx 4.11046\ \Omega$

$R = \frac{\rho L}{A} \Rightarrow 4.11046 = \frac{\rho(14.1)}{(0.3\times10^{-3})^2(3.14)} \Rightarrow \rho = 8.234\times10^{-8}$

Q13 $\sigma = 2\times10^{6} (\Omega.m)^{-1} \Rightarrow \rho = \frac{1}{\sigma} = 5\times10^{-7} (\Omega.m)$, $A = 2.3\ mm^2 = 2.3\times10^{-6} m^2$, $I = 5.5A$, $V = 1.4$, $L = ??$

$mm \times10^{-3} = m$
$mm^2 \times10^{-6} = m^2$

$R = \frac{V}{I} = \frac{1.4}{5.5} = 0.2545\ \Omega$

713 $R = \frac{\rho L}{A} \Rightarrow L = \frac{RA}{\rho} = \frac{(0.2545)(2.3\times10^{-6})}{5\times10^{-7}} = 1.1709\ m$

Q14 $P = 90W \rightarrow I = 3A$, $R = ??$

$P = I^2 R \Rightarrow R = \frac{P}{I^2} = \frac{90}{(3)^2} = \frac{90}{9} = 10\ \Omega$

Q15 $\rho = 5\times10^{-7}\ \Omega m$, $L = 5.85 m$, $V = 112v$, $P = 4000W$

a) $R = \frac{\rho L}{A}$ to find $R \Rightarrow P = \frac{V^2}{R} \Rightarrow 4000 = \frac{(112)^2}{R} \Rightarrow R = 3.136\Omega$

$3.136 = \frac{(5\times10^{-7})(5.85)}{A} \Rightarrow A = 9.327\times10^{-7}$

b) $V = 100 \Rightarrow P = 4000 \Rightarrow L = ??$

$P = \frac{V^2}{R} \Rightarrow 4000 = \frac{(100)^2}{R} \Rightarrow R = 2.5\Omega$

$R = \frac{\rho L}{A} \Rightarrow 2.5 = \frac{(5\times10^{-7})L}{(9.327\times10^{-7})} \Rightarrow L = 4.6635\ m$

ما تغير المقطع العرضي ← A

Q17 $V = 3v$, $P = 0.707W \Rightarrow R = ??$

نفس القادحة $\Rightarrow V = 12V \Rightarrow P = ??$

$P = \frac{V^2}{R} \Rightarrow R = \frac{V^2}{P} = \frac{(3)^2}{0.707} = 12.72984\ \Omega$

when $V = 12 \Rightarrow P = \frac{V^2}{R} = \frac{(12)^2}{12.72984} = 11.312\ W$

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Q20 $V_s = 12\,\mu V = 12\times10^{-6}\,V$, $V_{(x=0)} = 0$, $\underset{(L)}{X_s} = 3m$, $r = 2.2mm = 2.2\times10^{-3}m$, $I = ??$

$A = \pi r^2 = (3.14)(2.2\times10^{-3})^2 = 1.51976\times10^{-5}$

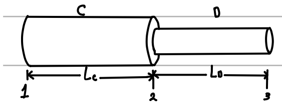
ρ_{cooper} from the Table $= 1.69\times10^{-8}\,\Omega.m$

$R = \frac{\rho L}{A} = \frac{(1.69\times10^{-8})(3)}{(1.51976\times10^{-5})} = 3.3361\times10^{-3}$

$I = \frac{V}{R} = \frac{12\times10^{-6}}{3.3361\times10^{-3}} = 3.5971\times10^{-3}\,A$

Q25 $L_c = L_D = 1\,m$, $\rho_c = 2\times10^{-6}\,(\Omega\,S)$, $r_c = 1mm = 1\times10^{-3}\,m$, $\rho_D = 1\times10^{-6}\,(\Omega.m)$, $r_D = 0.5mm = 0.5\times10^{-3}m$, $I = 2A$

Find ΔV_c , ΔV_D , P_c , P_D



$R_c = \frac{\rho_c L_c}{A_c} = \frac{(2\times10^{-6})(1)}{\pi(1\times10^{-3})^2} = 0.64\,\Omega$

$\Delta V_c = V_2 - V_1 = IR_c = 2(0.64) = 1.27V$

$P_c = P_{12} = I^2R_c = (2)^2(0.64) = 2.56$ watt

$R_D = \frac{\rho_D L_D}{A_D} = \frac{(1\times10^{-6})(1)}{\pi(0.5\times10^{-3})^2} = 1.27\,\Omega$

$\Delta V_D = V_3 - V_2 = IR_D = 2(1.27) = 2.55V$

$P_D = P_{23} = I^2R_D = (2)^2[1.27] = 5.08$ watt

Q32 $J = (2.75\times10^{10}\,A/m^4)r^2$, $R = 3mm = 3\times10^{-3}m$, $V = 80\,V$ 714

$I = \int J.dA$, $A = \pi r^2 \Rightarrow dA = 2\pi r$

$= \int_0^R (2.75\times10^{10})r^2.2\pi r = (2.75\times10^{10})2\pi\int_0^R r^3\,dr = 1.727\times10^{11}\frac{r^4}{4}\Big|_0^R = 4.3175\times10^{10}R^4 = 4.3175\times10^{10}(3\times10^{-3})^4 = 3.5\,A$

$P = VI = 80(3.5) = 280$

Electric Energy $= P.t = (280)(3600) = 1008000\,J$

Q45 $R = 2.67mm = 2.67\times10^{-3}\,m$

a) $J_a = \frac{J_0 r}{R}$ b) $J_b = J_0(1 - \frac{r}{R})$, $J_0 = 5.5\times10^4\,A/m^2$, $I = ?$

a) $I = \int J_a\,dA = \int_0^R \frac{J_0 r}{R}2\pi r\,dr = \frac{J_0}{R}2\pi\int_0^R r^2dr = \frac{J_0 2\pi}{R}\frac{R^3}{3} = \frac{2J_0\pi}{3}R^2 = \frac{2}{3}(5.5\times10^4)(3.14)(2.67\times10^{-3})^2 = 0.821\,A$

b) $I = \int J_b\,dA = \int_0^R J_0(1-\frac{r}{R})2\pi r\,dr = 2\pi J_0\int_0^R(r - \frac{r^2}{R})dr = 2\pi J_0\left[\frac{r^2}{2} - \frac{r^3}{3R}\right]_0^R = 2\pi J_0\left[\frac{R^2}{2} - \frac{R^3}{3R}\right] = 2\pi J_0\left[\frac{R^2}{2} - \frac{R^2}{3}\right] = 2\pi J_0 R^2\left[\frac{1}{6}\right] = \frac{\pi J_0 R^2}{3} = 0.411A$

c) Near the surface at $r = R$ $J_a > J_b$

Q53 $4.5\times10^8 \Rightarrow$ doubly charged negative ions تحتوي الحزمة على 4.5×10^8 أيونات سالبة مضاعفة الشحنة بالمحيط وكلها تتحرك شمالاً بسرعة 300m/s

$V_d = 300\,m/s$

a) $J = n_e q V_d$

The particle concentration (تركيز) is $n_e = 4.5\times10^8/cm^3 = \frac{4.5\times10^8}{1\,cm^3} = \frac{4.5\times10^8}{1\times10^{-6}\,m^3} = 4.5\times10^{14}\,m^{-3}$, the charged negative ions

$q = 2e = 2(1.6\times10^{-19}C) = 3.2\times10^{-19}\,C$ → doubly ions لانه حاكي
الايون له ضعف الالكترون

$J = n_e q V_d = (4.5\times10^{14})(3.2\times10^{-19})(300) = 0.0432\,A/m^2$

b) since the particles are negativly charged and moving towards north, So, the direction of the current density will be in south direction.

c) $J = \frac{I}{A} \Rightarrow I = JA = 0.0432\times(2.5\times10^{-6}) = 1.08\times10^{-7}\,A$