

Chapter 27 (Benson)

E01 (a) $N = I\Delta t/e = 1.19 \times 10^{16}$; (b) $J = I/A = 2.42 \times 10^3 \text{ A/m}^2$.

E05 (a) $J = I/A = 2.83 \times 10^6 \text{ A/m}^2$; (b) $\rho = 1.7 \times 10^{-8} \Omega \cdot \text{m}$: $E = \rho J = 4.81 \times 10^{-2} \text{ V/m}$.

E09 $L = 10 \text{ m}$, $d = 1.5 \text{ mm}$, $I = 12 \text{ A}$ & $\rho = 2.8 \times 10^{-8} \Omega \cdot \text{m}$: (a) $J = I/A = 6.79 \times 10^6 \text{ A/m}^2$; (b) $v = J/ne = 4.24 \times 10^{-4} \text{ m/s}$; (c) $E = \rho J = 0.19 \text{ V/m}$.

E13 $R = \rho L/A = \rho l/\pi(b^2 - a^2)$.

E24 $R_1 = V/I_1 = 3 \Omega$, $R_2 = V/I_2 = 3.53 \Omega$. $\alpha = (R_2 - R_1)/R_1 \Delta T = 2.21 \times 10^{-3} \text{ C}^{-1}$.

E26 $L = 20 \text{ m}$ & $d = 1.024 \text{ mm}$: (a) $R = \rho L/A = 0.413 \Omega$; (b) $P_w/(P_w + P_s) = 0.413/(4 + 0.413) = 9.36\%$.

E29 (a) $(80)(3600) = 2.88 \times 10^5 \text{ C}$; (b) $U = QV = 3.46 \times 10^6 \text{ J}$, $\Delta t = U/P = 1.38 \times 10^5 \text{ s} = 38.4 \text{ h}$.

E47 $m = 21 \text{ g}$, $R = 0.065 \Omega$, $\rho_m = 8900 \text{ kg/m}^3$ & $\rho = 1.7 \times 10^{-8} \Omega \cdot \text{m}$: Using $m/\rho_m = AL$ & $R = \rho L/A$ gives $L = 3.00 \text{ m}$ & $A = 7.856 \times 10^{-7} \text{ m}^2$.

E52 $J = nev_d = I/A = I/\pi r^2$, $r^2 = I/\pi nev_d = 5.71 \times 10^{-7}$, $r = 0.756 \text{ mm}$.

P03 (a) $R = \int dR = \int \rho dr/(2\pi rL) = \rho \ln(b/a)/2\pi L$; (b) $R = 37.4 \Omega$.

P04 $R = \int dR = \int \rho dr/(4\pi r^2) = \rho(1/a - 1/b)/4\pi$. (Teacher: Jyh-Shinn Yang, 90.05.17)

P09 (a) $R = (\rho_1 + \rho_2)L/A$, $I = V/R = 10 \text{ A}/(\rho_1 + \rho_2)L = 1.883 \text{ A}$; $P_1 = I^2 R_1 = (1.883^2)(0.2165) = 0.77 \text{ (W)}$, $P_2 = (1.883^2)(5.093) = 18.1 \text{ (W)}$; (b) $E_1 = IR_1/L = 0.0102 \text{ V/m}$, $E_2 = IR_2/L = 0.240 \text{ V/m}$.