Unidad 5, Corriente y Resistencia, Capitulo 25. pag. 841-846.

[3 / 25.1] #1

a) $I = 5.00\ A$

$\varnothing = 2.05\ mm$

$n = 8.5 \times 10^{28}\ e/m^3$

$Q = It = (5)(1) = 5.00\ C$

$n = \frac{Q}{e} = \frac{5}{1.6 \times 10^{-19}} = 3.125 \times 10^{19}$

$e = 3.12 \times 10^{19}$ //

b) $J = \frac{I}{A} = \frac{5}{\pi \left(\frac{2.05 \times 10^{-3}}{2}\right)^2} = 1514859.6$

$J = 1.51 \times 10^6\ A/m^2$

c) $J = nq\vec{v}_d \Rightarrow \vec{v}_d = \frac{I}{nq} = \frac{1.5 \times 10^6}{(8.5 \times 10^{28})(1.6 \times 10^{-19})} = 1.11 \times 10^{-4}$

$\vec{v}_d = 1.11 \times 10^{-4}\ m/s$ //

d) La densidad de corriente y la velocidad cambian, pero debido al tiempo el numero de electrones no cambia.

$I = 55\ A - (0.65\ A/s^2)t^2$ [7 / 25.1] #2

a) $t = 0\ s$; $t = 8.0\ s$ $\quad I = \frac{dQ}{dt} \Rightarrow dQ = I\,dt$

$Q = \int I\,dt = \int_0^8 (55 - 0.65t^2)\,dt$

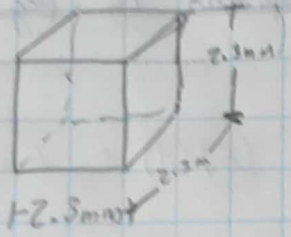
$Q = \left[55t - \frac{0.65}{3}t^3\right]\Big|_0^8 = \left[55(8) - \frac{0.65}{3}(8)^3\right] - 0 = 329.0$

$Q = 329\ C$ //

b) $I = \frac{Q}{t} \Rightarrow I = \frac{329}{8} = 41.12\ A$

$I = 41.1\ A.$ //

12/25.3 #3



$\ell = 4.0\,m$
$I = 3.6\,A$
$n = 8.5 \times 10^{28}/m^3$
$\rho = 1.72 \times 10^{-8}\ \Omega \cdot m$

a)
$$J = \frac{I}{A} = \frac{3.6\,A}{(2.3\times10^{-3})} = 6.81\times10^{5}\ A/m^2$$

$J = 6.81 \times 10^5\ A/m^2$ 4

b) $E = \rho J$

$E = (1.72\times10^{-8})(6.81\times10^{5}) = 0.012\ V/m.$

$E = 0.012\ V/m$ 4

c) $I = n q A \bar{v}$

$$t = \frac{\ell}{v_d} = \frac{\ell n q A}{I} = \frac{(4)(8.5\times10^{28})(1.6\times10^{-19})(2.3\times10^{-3})^2}{3.6} = 8\times10^{4}\ s.$$

$t = 8.0 \times 10^4\ s.$ 4

$\ell = 15.0\ cm$ $I = 12.5\ A$ 15/25.3 #4
$\varnothing = 1.0\ mm.$
$T_0 = 20°C.$
$T = 120°C.$

a) $\rho = \frac{E}{J} \rightarrow E = \rho J$

$\rho_{(T)} = \rho_0 [1 + \alpha (T - T_0)]$

$$E = \rho_{20°}\left[1 + 0.0045(120-20)\right]\left[\frac{12.5}{\pi(0.0005)^2}\right]$$

$E = (5.25\times10^{-8})[1 + 0.45](15.91\times10^{6}) = 1.21\ V/m.$

$E = 1.21\ V/m.$ 4

b) $$R = \frac{\rho \ell}{A} = \frac{(7.61\times10^{-8})(0.150)}{\pi(0.0005)^2} = 0.0145$$

$R = 0.0145\ \Omega$ 4

c) $V = EL = (1.21)(0.15) = 0.182\ V.$

$\therefore V = 0.182\ V$ 4

$l = 2.50\ m$

$r_{int} = 2.75\ cm$

$r_{ext} = 4.60\ cm$

$\rho = 2.75 \times 10^{-8}\ \Omega \cdot m$

22/25.3 — #5

a) $R = \frac{\rho l}{A}$ $\quad A = \pi (r_{ext}^2 - r_{int}^2)$

$$R = \frac{(2.75 * 10^{-8})(2.50)}{\pi[(0.0460)^2 - (0.0275)^2]} = 1.61 * 10^{-5}\ \Omega.$$

$R = 1.61 * 10^{-5}\ \Omega$ #

b) $dR = \frac{\rho dr}{2\pi r l} \Rightarrow R = \int_{r_{int}}^{r_{ext}} \frac{\rho dr}{2\pi r l}$

$$R = \frac{\rho}{2\pi l} \int_{r_{int}}^{r_{ext}} \frac{dr}{r} = \frac{\rho}{2\pi l} \ln\left(\frac{r_{ext}}{r_{int}}\right)$$

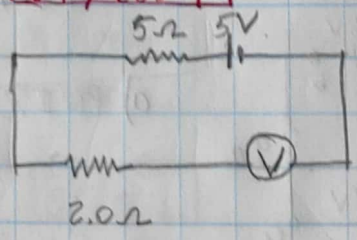
$$R = \frac{2.75 * 10^{-8}}{2\pi (2.50)} \ln\left(\frac{0.0460}{0.0275}\right) = 9.01 * 10^{-10}\ \Omega$$

$R = 9.01 * 10^{-10}\ \Omega$ #

27/25.4 — #6

$R = 2.0\ \Omega$

$\varepsilon_{em} = 5.0\ V$ y R_{int}:



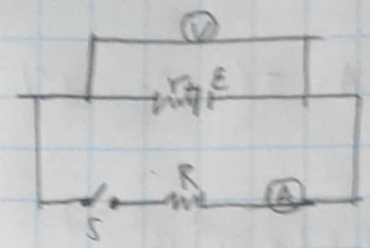
a) No hay corriente ya que es un voltímetro ideal por su resistencia infinita.

b) Sin corriente no se pierde voltaje $\Rightarrow V_{ab} = 5.0\ V$.

$V_{ab} = 5.0\ V$ #

c) El voltaje se mantiene en 5.0V ya que no hay caída de voltaje debido a la falta de corriente.

29/25.4 #7



V = 3.08V abierto

V = 2.97V cerrado

A = 1.65A

$V_{ab} = \varepsilon = 3.08V$ → abierta

Cerrado: $V_{ab} = \varepsilon - Ir = 2.97V$

$$r = \frac{\varepsilon - 2.97V}{I} = \frac{3.08 - 2.97}{1.65} = 0.067\,\Omega$$

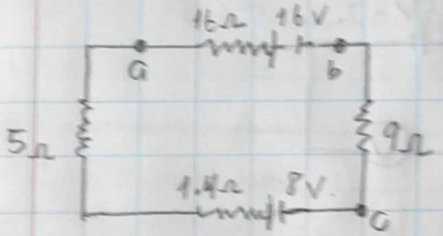
$r = 0.067\,\Omega$

$V_{ab} = IR$

$$R = \frac{V_{ab}}{I} = \frac{2.97}{1.65} = 1.80\,\Omega$$

$R = 1.80\,\Omega$

39/25.5 #8



a) $P = I^2 R \Rightarrow I = \frac{8}{17} = 0.47\,A$

$P_{5\Omega} = (0.47)^2(5) = 1.1\,W$

$P_{9\Omega} = (0.47)^2(9) = 2.0\,W$ $\quad P_T = 1.1 + 2 + 3.1\,W$

$P = 3.1\,W$

b) $P = I\varepsilon - I^2 r \Rightarrow P_{16V} = (0.47)(16) - (0.47)^2(1.6) = 7.2\,W$

$P_{16V} = 7.2\,W$

c) $P = I\varepsilon + I_1^2 = (0.47)(8) + (0.47)^2(1.4) = 4.1$ $\quad P_{8V} = 4.1\,W$

43 / 25.5 #9

a) 12 V y 60 A·h

$P = VI \rightarrow P = (12)(60) = 720\ W$

$U = Pt = (720)(5600) = 2.6 \times 10^6\ J$

$U = 2.6 \times 10^6\ J$ 4

b) $\rho_g = 900\ kg/m^3$; $L_c = 46 \times 10^6\ J/kg$

$m = \frac{2.6 \times 10^6}{46 \times 10^6} = 0.0565\ kg$

$V = \frac{m}{\rho} = \frac{0.0565}{900} = 6.3 \times 10^{-5}\ m^3$

$V = 0.063\ L$ 4

$V = 6.3 \times 10^{-5}\ m^3 \left(\frac{1000\ L}{1\ m^3}\right) = 0.063\ L$

$t = 5800\ s$ 4

c) $U = Pt \rightarrow t = \frac{U}{P} = \frac{2.6 \times 10^6}{450} = 5800\ s.$

51 / 25.6 #10

$\varnothing = 2.50\ mm$

$l = 14\ m$

$R = 0.104\ \Omega$

a) $R = \frac{\rho l}{A}$

$\rho = \frac{RA}{l} = \frac{0.104 (1.25 \times 10^{-3})^2 \pi}{14}$

$\rho = 3.65 \times 10^{-8}\ \Omega \cdot m$

$\rho = 3.65 \times 10^{-8}\ \Omega \cdot m$ 4

b) $E = 1.28\ V/m$ $V = EL$ y $I = \frac{V}{R}$

$V = (1.28)(14)$

$V = 17.9\ V$

$I = \frac{17.9}{0.104} = 172\ A$ $I = 172\ A$ 4

c) $n = 8.5 \times 10^{28}\ e^-/m^3$ $J = \frac{I}{A}$ $J = n q \vec{v}_d$

$J = \frac{E}{\rho} = \frac{1.28}{3.65 \times 10^{-8}} = 3.51 \times 10^7$

$v_d = \frac{I}{n e} = \frac{3.51 \times 10^7}{(8.5 \times 10^{28})(1.602 \times 10^{-19})} = 2.58 \times 10^{-3}\ m/s.$

$\vec{v}_d = 2.58 \times 10^{-3}\ m/s$ 4

#17

60 / 25.6

a) $R = \frac{\rho}{4\pi}\left(\frac{1}{a} - \frac{1}{b}\right)$

$dR = \frac{\rho\, dr}{4\pi r^2} \Rightarrow R = \frac{\rho}{4\pi}\int_a^b \frac{dr}{r^2} = -\frac{\rho}{4\pi r}\Big|_a^b = \frac{\rho}{4\pi}\left[\frac{1}{a} - \frac{1}{b}\right]$

$R = \frac{\rho}{4\pi}\left[\frac{1}{a} - \frac{1}{b}\right]$ 4

b) $I = \frac{V_{ab}}{R} = \frac{V_{ab}\, 4\pi ab}{\rho(b-a)}$

$J = \frac{I}{A} \Rightarrow J = \frac{V_{ab}\, 4\pi ab}{\rho(b-a)\, 4\pi r^2} = \frac{V_{ab}\, ab}{\rho(b-a) r^2}$

$J = \frac{V_{ab}\, ab}{\rho(b-a) r^2}$ 4

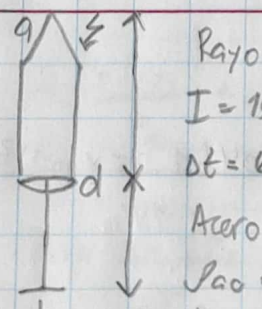
c) $L = b - a$

$R = \frac{\rho}{4\pi}\left(\frac{1}{a} - \frac{1}{b}\right) = \frac{\rho(b-a)}{4\pi ab} = \frac{\rho L}{4\pi a^2} = \frac{\rho L}{A}$

$R = \frac{\rho L}{A}$ 4

#12

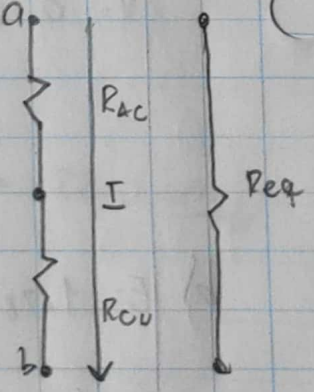
71 / 25.6



Rayo:
$I = 15{,}000\,A$
$\Delta t = 65\,\mu s$

Acero:
$\rho_{ac} = 20 \times 10^{-8}\ \Omega \cdot m$
$L_{ac} = 2.0\,m$
$\varnothing_{ac} = 1.8\,cm$

$\rho_{cu} = 1.72 \times 10^{-8}\ \Omega \cdot m$
$L_{cu} = 35\,m$
$\varnothing_{cu} = 8.00\,mm$



a) $Req_{ab} = R_{AC} + R_{Cu}$

$R = \frac{\rho L}{A}$

$R_{AC} = \frac{(20\times10^{-8})(2)}{(\pi/4)(0.018)^2} = 1.57 \times 10^{-3}\ \Omega$

$R_{Cu} = \frac{(1.72\times10^{-8})(35)}{(\pi/4)(0.008)^2} = 12.0 \times 10^{-3}\ \Omega$

$R_{eq} = (1.57 + 12)\times10^{-3}\ \Omega$

$R_{eq} = 13.57 \times 10^{-3}\ \Omega$

$V_{ab} = I_{TOT}\, R_{eq}$

$V_{ab} = (15{,}000)(13.57 \times 10^{-3})$

$V_{ab} = 204\ V$ 4

$V_{ab} = 204$ Volt 11

b) Potencia Promedio $= \frac{W}{\Delta t}$

$Pot_{prom} = \frac{Energía}{\Delta t} \Rightarrow Energía = P_{prom}\,\Delta t.$

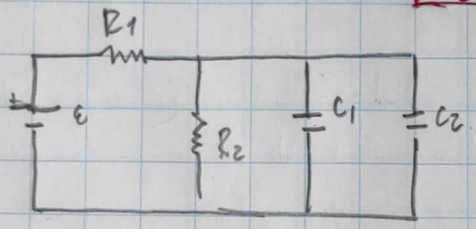
$P_{ot} = I_{TOT}\ V_{ab}$ $\qquad$ $Energía = (306 \times 10^{4})(65 \times 10^{-6}\,J)$

$P_{ot} = (15.000)(204)$

$P_{ot} = 306 \times 10^{4}\ J/s$ $\qquad$ $Energía = 199\,J.$

$E = 199\,J$ #4

72/ 26.6 #13



$\varepsilon = 72.0\,V$

$R_2 = 2\,\Omega$

$C_1 = 3\,\mu F$ $\qquad$ $Q_1 = 18\,\mu C$

$C_2 = 6\,\mu F$

a) $V_{c1} = \frac{Q_1}{C_1} = \frac{18\,\mu}{3\,\mu} = 6\,V.$ $\qquad$ $V_{c2} = V_{c1} = 6\,V.$

$Q_2 = C_2 V_2 = (6\,\mu)(6) = 36\,\mu C.$ $\qquad$ $Q_2 = 36\,\mu C$ c/u

b) $V_{R2} = V_{c1} = 6\,V.$

$I = \frac{V_{R2}}{R_2} = \frac{6}{2} = 3\,A.$

$R_1 = \frac{\varepsilon - IR_2}{I} = \frac{72 - 6}{3} = 22\,\Omega$ $\qquad$ $R_1 = 22.0\,\Omega$ c/u