



UNIVERSIDAD DE SAN CARLOS DE GUATEMALA  
FACULTAD DE INGENIERÍA  
ESCUELA DE CIENCIAS  
DEPARTAMENTO DE FÍSICA

Curso: F2 R	Nota:
2S2022	
AUX. CÉSAR FERNÁNDEZ	

TAREA  
HOJA DE TRABAJO  
EXAMEN CORTO



No.

5

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a)  $I = 5.00 \text{ A}$

$\phi = 2.05 \text{ mm}$

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

$Q = It = (5)(1) = 5.00 \text{ C}$

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

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

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

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

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

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

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

$I = 55 \text{ A} - (0.65 \text{ A/s}^2)t^2$  7 / 25.1

#2

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

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

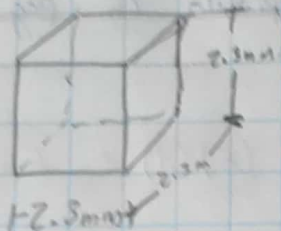
$Q = \left[ 55t - \frac{0.65}{3} t^3 \right] \Big|_0^8 = \left[ 55(8) - \frac{0.65}{3} (8)^3 \right] - 0 = 329.0 \text{ C}$

$Q = 329 \text{ C}$

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

$I = 41.1 \text{ A}$





12/25.3

#3

$$l = 4.0 \text{ m}$$

$$I = 3.6 \text{ A}$$

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

$$\rho = 1.72 \times 10^{-8} \Omega \cdot \text{m}$$

a)

$$J = \frac{I}{A} = \frac{3.6 \text{ A}}{(2.3 \times 10^{-3})^2} = 6.81 \times 10^5 \text{ A/m}^2$$

$$J = 6.81 \times 10^5 \text{ A/m}^2$$

b)  $E = \rho J$

$$E = (1.72 \times 10^{-8}) (6.81 \times 10^5) = 0.012 \text{ V/m}$$

$$E = 0.012 \text{ V/m}$$

c)  $I = n q A v$

$$t = \frac{l}{v} = \frac{l n q A}{I} = \frac{(4)(8.5 \times 10^{28})(1.6 \times 10^{-19})(2.3 \times 10^{-3})^2}{3.6} = 8 \times 10^4 \text{ s}$$

$$t = 8.0 \times 10^4 \text{ s}$$

$$l = 15.0 \text{ cm}$$

$$I = 12.5 \text{ A}$$

15/25.3

#4

$$\phi = 1.0 \text{ mm}$$

$$T_0 = 20^\circ \text{C}$$

$$T = 120^\circ \text{C}$$

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

$$\rho(T) = \rho_0 [1 + \alpha(T - T_0)]$$

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

$$E = (5.25 \times 10^{-8}) [1 + 0.45] (15.91 \times 10^6) = 1.21 \text{ V/m}$$

$$E = 1.21 \text{ V/m}$$

$$b) R = \frac{\rho l}{A} = \frac{(7.61 \times 10^{-8})(0.150)}{\pi (0.0005)^2} = 0.0145$$

$$R = 0.0145 \Omega$$

$$c) V = EL = (1.21)(0.15) = 0.182 \text{ V}$$

$$V = 0.182 \text{ V}$$

$$l = 2.50 \text{ m}$$

$$r_{\text{int}} = 2.75 \text{ cm}$$

$$r_{\text{ext}} = 4.60 \text{ cm}$$

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

22/25.3

#5

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

$$A = \pi (r_{\text{ext}}^2 - r_{\text{int}}^2)$$

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

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

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

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

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

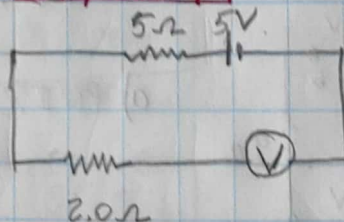
$$R = 9.01 \times 10^{-10} \Omega$$

$$R = 2.0 \Omega$$

$$V_{\text{em}} = 5.0 \text{ V} \text{ y } R_{\text{int}}$$

27/25.4

#6



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

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

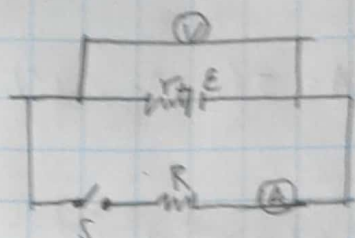
$$V_{ab} = 5.0 \text{ V}$$

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



29/05.4

#7



$$V = 3.08 \text{ V abierto}$$

$$V = 2.92 \text{ V cerrado}$$

$$A = 1.65 \text{ A}$$

$$V_{ab} = E = 3.08 \text{ V} \rightarrow \text{abierto}$$

$$\text{Cerrado: } V_{ab} = E - Ir = 2.92 \text{ V}$$

$$r = \frac{E - 2.92 \text{ V}}{I} = \frac{3.08 - 2.92}{1.65} = 0.067 \Omega$$

$$r = 0.067 \Omega$$

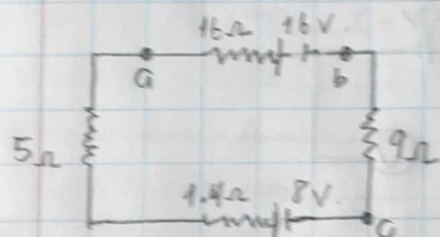
$$V_{ab} = IR$$

$$R = \frac{V_{ab}}{I} = \frac{2.92}{1.65} = 1.80 \Omega$$

$$R = 1.80 \Omega$$

39/25.5

#8



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

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

$$P_{9\Omega} = (0.47)^2 (9) = 2.0 \text{ W}$$

$$P_T = 1.1 + 2 = 3.1 \text{ W}$$

$$P = 3.1 \text{ W}$$

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

$$P_{8V} = 7.2 \text{ W}$$

$$c) P = IE + I^2 r = (0.47)(8) + (0.47)^2 (1.4) = 4.1$$

$$P_{8V} = 4.1 \text{ W}$$

43 / 25.5

#9

a) 12 V y 60 A·h

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

$$U = Pt = (720)(3600) = 2.6 \times 10^6 \text{ J}$$

$$U = 2.6 \times 10^6 \text{ J}$$

b)  $\rho_g = 900 \text{ kg/m}^3$  ;  $U = 46 \times 10^6 \text{ J/kg}$

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

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

$$V = 0.063 \text{ L}$$

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

$$t = 5800 \text{ s}$$

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

$$\phi = 2.50 \text{ mm}$$

$$L = 14 \text{ m}$$

$$R = 0.104 \Omega$$

51 / 25.6

#10

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

$$\rho = \frac{RA}{L} = \frac{0.104 (1.75 \times 10^{-3})^2 \pi}{14}$$

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

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

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

$$V = (1.28)(14)$$

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

$$I = 172 \text{ A}$$

$$V = 17.9 \text{ V}$$

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

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

$$\vec{v}_d = \frac{J}{nq} = \frac{3.51 \times 10^7}{(8.5 \times 10^{28})(1.602 \times 10^{-19})} = 2.58 \times 10^{-3} \text{ m/s}$$

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

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



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

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

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

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

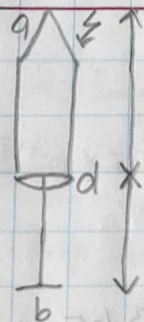
$$J = \frac{I}{A} \Rightarrow J = \frac{V_{ab} 4\pi ab}{\rho(b-a) 4\pi r^2} = \frac{V_{ab} ab}{\rho(b-a) r^2}$$

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

$$c) L = b-a$$

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

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



Rayo:

$$I = 15,000 \text{ A}$$

$$\Delta t = 65 \mu\text{s}$$

Acero:

$$\rho_{\text{ac}} = 20 \times 10^{-8} \Omega \cdot \text{m}$$

$$L_{\text{ac}} = 7.0 \text{ m}$$

$$\phi_{\text{ac}} = 1.8 \text{ cm}$$

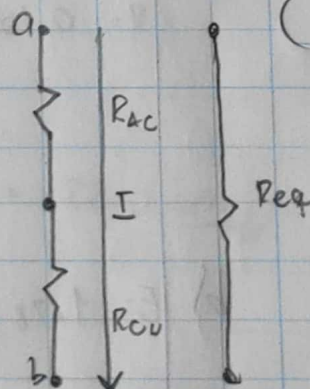
$$77 / 25.6$$

$$\rho_{\text{cu}} = 1.72 \times 10^{-8} \Omega \cdot \text{m}$$

$$L_{\text{cu}} = 35 \text{ m}$$

$$\phi_{\text{cu}} = 8.00 \text{ mm}$$

#12



$$a) R_{\text{eq}, ab} = R_{\text{ac}} + R_{\text{cu}}$$

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

$$R_{\text{ac}} = \frac{(20 \times 10^{-8}) (7)}{(\pi/4) (0.018)^2} = 1.57 \times 10^{-3} \Omega$$

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

$$R_{\text{eq}} = (1.57 + 12) \times 10^{-3} \Omega$$

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

$$V_{ab} = I_{\text{tot}} R_{\text{eq}}$$

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

$$V_{ab} = 204 \text{ V}$$

$$V_{ab} = 204 \text{ volt}$$

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

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

$$Pot = I_{TOT} V_{ab}$$

$$Pot = (15.000)(204)$$

$$Pot = 306 \times 10^4 \text{ J/s}$$

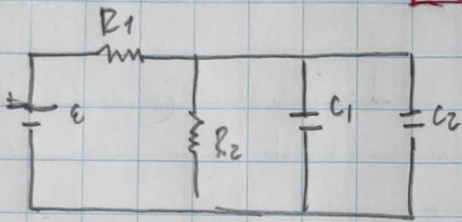
$$\text{Energía} = (306 \times 10^4)(65 \times 10^{-6})$$

$$\text{Energía} = 1995$$

$$E = 1995 \text{ J}$$

72/25.6

A13



$$E = 72.0 \text{ V}$$

$$R_2 = 2 \Omega$$

$$C_1 = 3 \mu\text{F}$$

$$C_2 = 6 \mu\text{F}$$

$$Q_1 = 18 \mu\text{C}$$

$$a) V_{C1} = \frac{Q_1}{C_1} = \frac{18 \mu\text{C}}{3 \mu\text{F}} = 6 \text{ V}$$

$$V_{C2} = V_{C1} = 6 \text{ V}$$

$$Q_2 = C_2 V_2 = (6 \mu\text{F})(6) = 36 \mu\text{C}$$

$$Q_2 = 36 \mu\text{C}$$

$$b) V_{R2} = V_{C1} = 6 \text{ V}$$

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

$$R_1 = \frac{E - I R_2}{I} = \frac{72 - 6}{3} = 22 \Omega$$

$$R_1 = 22.0 \Omega$$