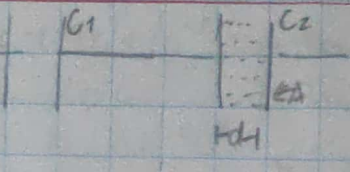
	UNIVERSIDAD DE SAN CARLOS DE GUATEMALA	FÍSICA 2 C	NOTA:
	FACULTAD DE INGENIERÍA		
	ESCUELA DE CIENCIAS	1S2023	
	DEPARTAMENTO DE FÍSICA		
	INGA. CLAUDIA CECILIA CONTRERAS FOLGAR DE ALFARO	AUX. ANGEL QUIM	

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Tarea 5
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T5

P1

a)   $C_2 \rightarrow A = 0.100 \text{ m}^2$   $C_{eq} = 2.75 \text{ nF}$   
 $d = 1 \times 10^{-3} \text{ m}$   
 $K = 5.40$

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} \Rightarrow C_2 = \frac{K \epsilon_0 A}{d} = \frac{\epsilon_0 (5.40) (0.100)}{1 \times 10^{-3}} =$$

$$\frac{1}{C_1} = \frac{1}{C_{eq}} - \frac{1}{C_2} \quad C_2 = 4.78 \times 10^{-9} \text{ F}$$

$$\frac{1}{C_1} = \frac{1}{2.75 \times 10^{-9}} - \frac{1}{4.78 \times 10^{-9}} = 154431342.7 \text{ F}$$

$$C_1 = \frac{1}{154431342.7} = 6.47 \times 10^{-9} \text{ F}$$

$$C_1 = 6.5 \text{ nF}$$

b)  $C_1 \rightarrow V_1 = 8750 \text{ V}$   $U = \frac{U_c}{Ad}$   
 $d = 2.50 \text{ mm}$

$$U_c = \frac{C V^2}{2} = \frac{(6.5 \times 10^{-9}) (8750)^2}{2} = 0.2488 \text{ J}$$

$$C_1 = \frac{\epsilon_0 A}{d} \Rightarrow \frac{d C_1}{\epsilon_0} = A \Rightarrow A = \frac{(2.5 \times 10^{-3}) (6.5 \times 10^{-9})}{\epsilon_0}$$

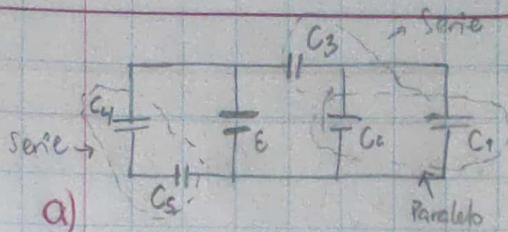
$$A = 1.8352 \text{ m}^2$$

$$U = \frac{0.2488}{(1.84) (2.5 \times 10^{-3})} = 54.08 \text{ J/m}^3$$

$$U = 54.1 \text{ J/m}^3$$



P.2



$$E = 10.0V$$

$$C_4 = 4.00 \mu F$$

$$C_1 = 5.00 \mu F$$

$$C_5 = 1.00 \mu F$$

$$C_2 = 2.00 \mu F$$

$$C_3 = 3.00 \mu F$$

$$C_{45} = \left( \frac{1}{C_4} + \frac{1}{C_5} \right)^{-1} = \left( \frac{1}{4\mu} + \frac{1}{1\mu} \right)^{-1} = 0.8 \mu F$$

$$C_{12} = C_1 + C_2 = 5\mu + 2\mu = 7\mu F$$

$$C_{312} = \left( \frac{1}{C_3} + \frac{1}{C_{12}} \right)^{-1} = \left( \frac{1}{3\mu} + \frac{1}{7\mu} \right)^{-1} = 2.1 \mu F$$

$$C_{eq} = 0.8\mu + 2.1\mu = 2.90 \mu F$$

$$C_{eq} = 2.90 \mu F$$

$$b) C = \frac{Q}{V} \Rightarrow Q = C_{45} V$$

$$Q = (0.8\mu)(10) = 8 \mu C$$

$$Q = 8 \mu C$$

$$c) Q_{312} = E C_{312} = (10)(2.1\mu) = 21 \mu C$$

$$V_{12} = \frac{21 \mu C}{7 \mu F} = 3V$$

$$U_1 = 22.5 \mu J$$

$$U = \frac{1}{2} C_1 V_1^2 = \frac{1}{2} (5\mu)(3)^2 = 22.5 \mu J$$

P.3

$$\rho_{Cu} = 1.70 \times 10^{-8} \Omega \cdot m$$

$$V = 55.5V$$

$$R = \frac{V}{I} \Rightarrow I = \frac{Q}{t}$$

$$a) n_0 = 12.5 \times 10^{21} \text{ en } t = 15 \text{ min}$$

$$t = 15 \text{ min} \times \frac{60s}{1 \text{ min}} = 900s$$

$$I = \frac{(12.5 \times 10^{21})(1.6022 \times 10^{-19})}{(900)} = 2.22 A$$

$$R = 25 \Omega$$

$$R = \frac{55.5}{2.22} = 25 \Omega$$

$$b) A = 0.18 m^2$$

$$v_d = 1 \times 10^{-4} m/s$$

$$J = \frac{I}{A}$$

$$n = \frac{J}{qv_d}$$

$$n = \frac{(2.22)/(0.18)}{(1 \times 10^{-4})(1.6 \times 10^{-19})(0.18)} = 7.71 \times 10^{23}$$

$$n = 7.71 \times 10^{23} \text{ e/m}^3$$



P.4

$$V_0 = 120 \text{ V}$$

$$P = 3000 \text{ W}$$

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

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

$$\alpha = 0.003 \text{ } ^\circ \text{C}^{-1}$$

$$a) R = R_0 [1 + \alpha (T - T_0)]$$

$$R = (4.8) [1 + (0.003)(120 - 20)]$$

$$R = 6.24 \Omega$$

$$P = \frac{V^2}{R} \Rightarrow R = \frac{V^2}{P} = \frac{(120)^2}{3000} = 4.8 \Omega$$

$$R = 6.24 \Omega$$

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

$$t = 4 \text{ h en 1 mes}$$

$$\Phi = 0.150 \text{ kWh}$$

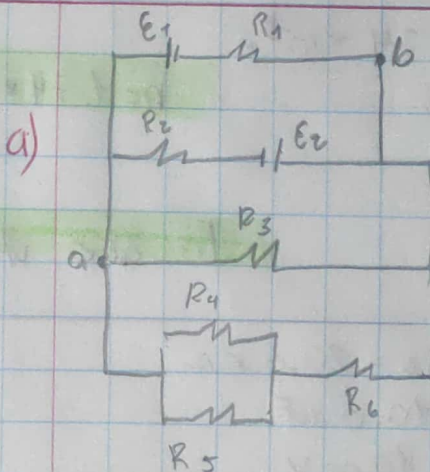
$$P = \frac{(120)^2}{6.24} = 2307.69 \text{ W}$$

$$E = (4)(30)(2307.69) = 276.92 \text{ kWh}$$

$$C = (276.92)(1.50) = 415.38$$

$$C = 415.38$$

P.5



$$E_1 = 10.0 \text{ V}$$

$$R_1 = 5.00 \Omega$$

$$R_2 = 3.00 \Omega$$

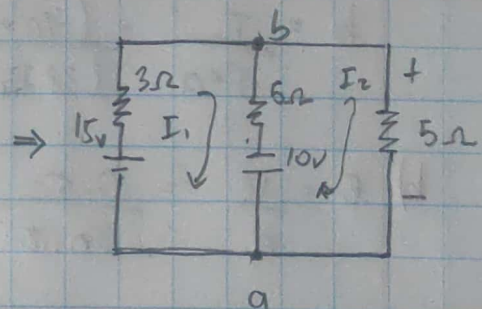
$$E_2 = 15.0 \text{ V}$$

$$R_3 = 10.0 \Omega$$

$$R_4 = 6.00 \Omega$$

$$R_5 = 12.0 \Omega$$

$$R_6 = 6.00 \Omega$$



$$8I_1 - 5I_2 = 25$$

$$-5I_1 + 10I_2 = -10$$

$$I_1 = 40/11 \text{ A}, I_2 = 9/11 \text{ A}$$

$$I_{3\Omega} = 3.64 \text{ A}$$

$$I_{3\Omega} = I_1 = 3.64 \text{ A}$$

$$b) P = (45)(40/11) + (10)(40/11 - 9/11) = 82.72 \text{ W}$$

$$P = 82.7 \text{ W}$$

$$c) V_a - V_b = -I_2(5) = -4.09 \text{ V}$$

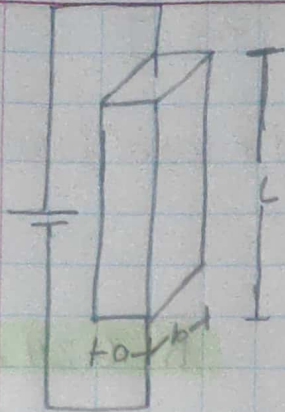
$$V_a - V_b = -4.09 \text{ V}$$

$$d) I_{R6} = \frac{9}{22} \text{ A}$$

$$P = 1.00 \text{ W}$$

$$P = \left(\frac{9}{22}\right)^2 (6) = 1.004 \text{ W}$$





P.6

$$J = 8.70 \times 10^{-4} \text{ A/m}^2$$

$$V = 0.50 \text{ V}$$

$$P = 5.00 \text{ mW}$$

$$L = 0.2 \text{ m}$$

$$a = 2 \times 10^{-3} \text{ m}$$

$$n = 1.23 \times 10^{23} \text{ e}^-/\text{m}^3$$

a)

$$I = \frac{P}{V} = \frac{5 \times 10^{-3}}{0.5} = 10 \times 10^{-3} \text{ A}$$

$$J = \frac{I}{A} \Rightarrow I = \frac{J}{J}$$

$$\Delta V = Ed \Rightarrow E = \frac{V}{d} = \frac{0.50}{0.2} = 2.50 \text{ V/m}$$

$$J = \frac{2.50}{8.70 \times 10^{-4}} = 2873.563 \text{ A/m}^2$$

$$\Rightarrow A = \frac{I}{J} = a \times b = \frac{I}{J}$$

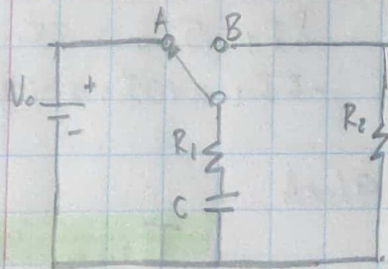
$$b = \frac{I}{J \cdot a} = \frac{(10 \times 10^{-3})}{(2873.563)(2 \times 10^{-3})} = 1.74 \times 10^{-3} \text{ m}$$

$$b = 1.74 \times 10^{-3} \text{ m}$$

b)  $E = \frac{V}{d} = \frac{0.50}{0.2} = 2.50 \text{ V/m}$

$$E = 2.50 \text{ V/m}$$

P.7



t=0

$$R_1 = R_2 = 20.0 \text{ k}\Omega$$

$$C = 10.0 \text{ }\mu\text{F}$$

$$V_0 = 10.00 \text{ V}$$

$$q(t) = CV(1 - e^{-t/RC})$$

$$q(3t) = (10 \mu)(10)(1 - e^{-3}) = 95.02 \times 10^{-6} \text{ C}$$

$$q(t) = 95.0 \text{ }\mu\text{C}$$

b)  $I = 125 \text{ }\mu\text{A}$

$$I_0 = \frac{10}{40 \times 10^3} = 0.25 \text{ mA}$$

$$i = I_0 e^{-t/\tau}$$

$$t = -(400 \times 10^{-3}) \ln\left(\frac{0.125}{0.250}\right)$$

$$t = RC = (40 \times 10^3)(10 \mu) = 400 \text{ ms}$$

$$t = 277 \text{ ms}$$