Solución 2o Parcial Física 2 – Temario 22 y Temario 28
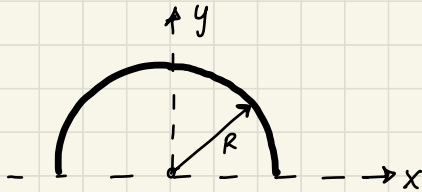
Problema 1.

$\lambda = 30 \, nC/m \quad R = 8 \, cm$

$dV = \dfrac{k \, dq}{r} \qquad dq = \lambda \, ds = \lambda R \, d\theta$

$r = R$

$V = \displaystyle\int_0^{\pi} \dfrac{k \, \lambda R \, d\theta}{R} = k \lambda \pi$

$V = 9 \times 10^9 (30 \times 10^{-9}) \pi$

$\boxed{V = 848.23 \; Volts}$

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b) $U_0 + K_0 = \cancel{U_f} + K_f$

Inicial $\rightarrow$ origen
final $\rightarrow$ infinito

$q V_0 + K_0 = K_f$

$\Delta K = -q V_0$

$\Delta K = -(-7.5)(848.23)$

$\boxed{\Delta K = 6361.725 \; J}$

$V = 3x^3 y - 2x^2 z + 4zy$

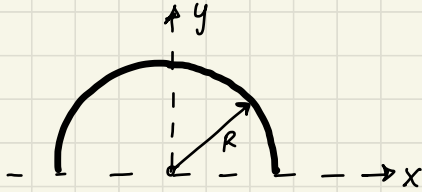$E_x = -\dfrac{\partial V}{\partial x} = -\left[9x^2 y - 4xz \right]$

$E_x (2, 1, -2) = -9(2)^2(1) + 4(2)(-2)$

$E_x (2, 1, -2) = -36 - 16 =$

$= \boxed{-52 \dfrac{N}{C} \; \hat{\imath}}$

Problema 1.

$\lambda = 50 \, nC/m \quad R = 10 \, cm$

$dV = \dfrac{k \, dq}{r} \qquad dq = \lambda \, ds = \lambda R \, d\theta$

$\qquad\qquad\qquad\qquad r = R$

$V = \displaystyle\int_{0}^{\pi} \dfrac{k \, \lambda \cancel{R} \, d\theta}{\cancel{R}} = k \lambda \pi$

$V = 9 \times 10^{9} (50 \times 10^{-9}) \pi$

$\boxed{V = 1413.72 \; Volts}$

$\qquad 1.41 \; kV$

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b) $\quad U_o + K_o = \cancel{U_f} + K_f$

Inicial $\rightarrow$ origen
final $\rightarrow$ infinito

$q V_o + K_o = K_f$

$\Delta K = -q V_o$

$\Delta K = -(-9)(1413.72)$

$\Delta K = 12\,723.4 \; J$
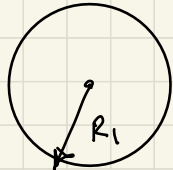
$\boxed{12.7 \; kJ}$

$V = 2x^{3}y - 4x^{2}z + 3yz$

$E_x = -\dfrac{\partial V}{\partial x} = -\left[6x^{2}y - 8xz \right]$

$E_x (2,1,-2) = -\left[6(2)^{2}(1) - 8(2)(-2) \right]$

$E_x (2,1,-2) = \boxed{-56 \, \dfrac{N}{C} \, \hat{\imath}}$

Problema 2

<u>**Temario 22**</u>

$R_2 = 8 cm$

$Q_2 = -6nC$

$Q_{2f} = 3.2 nC$

R_1
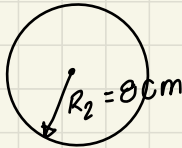
$Q_{10} = 14nC$

$Q_{10} + Q_{20} = 14nC - 6nC = 8nC$

$\Rightarrow 8nC = Q_{1f} + Q_{2f}$
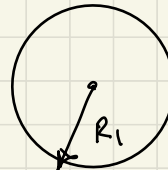
$Q_{1f} = 8nC - 3.2 = 4.8nC$

$V_{2f} = \dfrac{k Q_{2f}}{R_2} = \dfrac{9\times10^9 (3.2\times10^{-9})}{0.08} = 360V$

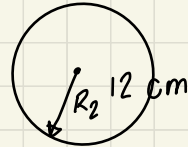$V_{1f} = 360V = \dfrac{k Q_{1f}}{R_1}$ $R_1 = \dfrac{9\times10^9 (4.8\times10^{-9})}{360}$

$\boxed{R_1 = 0.12 m}$

<u>**Temario 28**</u>

R_2 12 cm

$Q_2 = -9nC$

$Q_{2f} = 4.8nC$

R_1

$Q_{10} = 21nC$

$Q_{10} + Q_{20} = Q_{1f} + Q_{2f}$

$12nC = Q_{1f} + 4.8nC$ $Q_{1f} = 7.2 nC$

$V_{2f} = \dfrac{k Q_{2f}}{R_2} = \dfrac{9\times10^9 (4.8\times10^{-9})}{0.12} = 360V$

$V_{1f} = \dfrac{k Q_{1f}}{R_1}$ $\rightarrow R_1 = \dfrac{9\times10^9 (7.2\times10^{-9})}{360}$
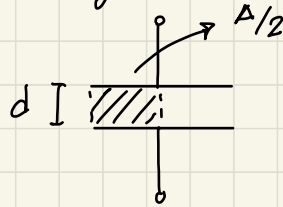
$\boxed{R_1 = 0.18 m}$

Problema 3

$L = 10 cm$

$d = 0.25 cm$

$K = 15$

$A = 0.01 m^2$

$A/2 = 5 \times 10^{-3} m^2$

grosor $0.25 cm$

$A/2$

d I ⦀

$C = C_1 + C_2 = \boxed{283.2 \, pF}$

$A/2$

d I d
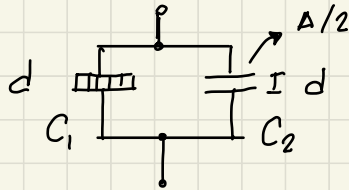
C_1 C_2

$C_1 = \dfrac{K \varepsilon_0 A/2}{d}$ $C_2 = \dfrac{\varepsilon_0 A/2}{d}$

$C_1 = \dfrac{15 \varepsilon_0 (5 \times 10^{-3})}{0.0025}$ $C_2 = \dfrac{\varepsilon_0 (5 \times 10^{-3})}{0.0025}$

$C_1 = 265.5 \, pF$ $C_2 = 17.7 \, pF$

$u_1 = \dfrac{U_1}{A/2 \, d}$

$U_1 = \dfrac{1}{2} C_1 V_1^2$

$U_1 = 0.5 (265.5 \times 10^{-12}) \, 120^2$

$U_1 = 1.9116 \times 10^{-6} J$

$u_1 = 0.153 \, \dfrac{J}{m^3}$ ó $\boxed{152.9 \, mJ/m^3}$

Problema 3

$L = 12 cm$ $A = 0.0144 m^2$

$d = 0.3 cm$ $A/2 = 7.2 \times 10^{-3}$

$K = 18$ grosor $\rightarrow 0.3 cm$

$A/2$

$d \, I$

$C = C_1 + C_2 = \boxed{403.4 \, pF}$

$A/2$

d $\quad I \, d$
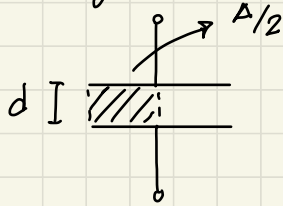
$C_1 \qquad C_2$
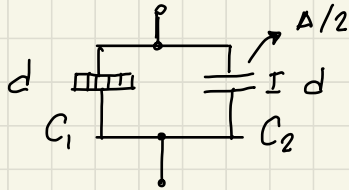
$C_1 = \dfrac{K \varepsilon_0 A/2}{d}$ $C_2 = \dfrac{\varepsilon_0 A/2}{d}$

$C_1 = \dfrac{18 \varepsilon_0 (7.2 \times 10^{-3})}{0.3 \times 10^{-2}}$ $C_2 = \dfrac{\varepsilon_0 (7.2 \times 10^{-3})}{0.3 \times 10^{-2}}$

$C_1 = 382.32 \, pF$ $C_2 = 21.24 \, pF$

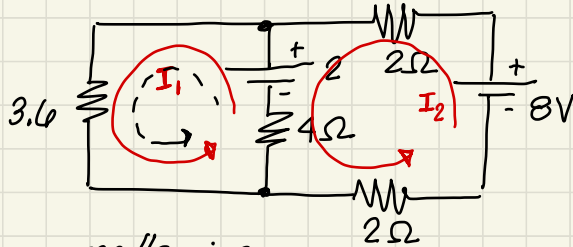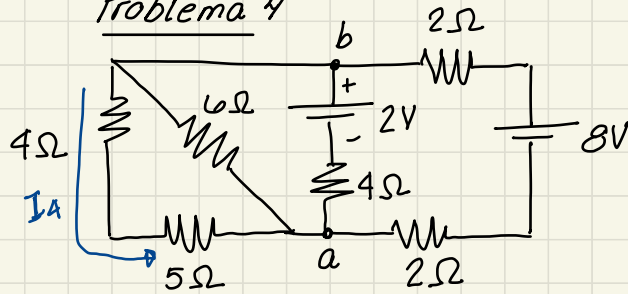$u_1 = \dfrac{U_1}{A/2 \, d}$ $U_1 = \dfrac{1}{2} C_1 V_1^2$

$U_1 = 0.5 (382.32 \times 10^{-12})(120)^2$

$U_1 = 2.7527 \, \mu J$

$u_1 = \dfrac{2.7527 \times 10^{-6}}{7.2 \times 10^{-3}(0.3 \times 10^{-2})} = \boxed{127.44 \, \dfrac{mJ}{m^3}}$

Problema 4

b 2Ω

6Ω $+$ $2V$ $-$ $8V$

4Ω

I_A

5Ω a 2Ω 4Ω

3.6 $+$ 2 2Ω $+$ $8V$

I_1 4Ω I_2

2Ω

malla izq

$$-4I_1 + 4I_2 + 2 - 3.6I_1 = \emptyset$$

$$\boxed{-7.6 I_1 + 4I_2 = -2}$$

$$I_1 = 0.8929\ A$$

$$I_2 = \boxed{1.196\ A}$$

malla ext

$$-3.6 I_1 - 4I_2 + 8 = \emptyset$$

$$\boxed{-3.6 I_1 - 4 I_2 = -8}$$

b 2Ω

3.6 $2V$ I_2 $8V$

I_1 4Ω

a 2Ω
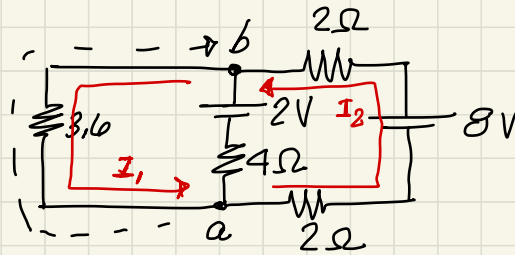
b) $\quad V_a + 3.6\, I_1 = V_b$

$$V_b - V_a = 3.6\,(0.8929) = \boxed{3.214\ V}$$

c) $\quad I_4 = \dfrac{V_{ba}}{4+5} = \dfrac{3.2144}{9} = 0.35716\ A$

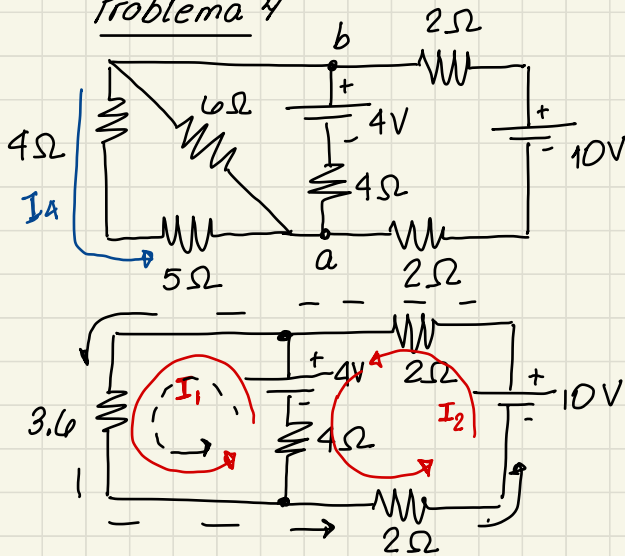$$\text{Potencia en } R = 5\Omega = I_4^{\,2}(5)$$
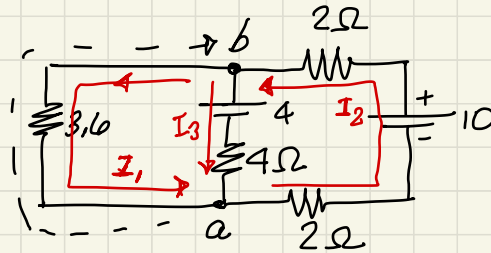
$$= \boxed{0.6378\ Watts}$$

Problema 4

b 2Ω

6Ω $4V$ $10V$

4Ω 4Ω

I_A

5Ω a 2Ω

5Ω 2Ω

$+4V$ 2Ω $+10V$

3.6 I_1 4Ω I_2

2Ω

malla izq.

$$-7.6\,I_1 + 4I_2 = -4$$

malla externa

$$-3.6\,I_1 - 4I_2 = -10$$

$$I_1 = 1.25A \qquad \boxed{I_2 = 1.375A}$$

b 2Ω

3.6 I_3 4 I_2 10

I_1 4Ω

a 2Ω

$I_3 = 0.125A$

$$V_b - 4 - I_3(4) = V_a$$

$$V_b - V_a = 4 + I_3(4)$$

$$= 4.5\,V$$

b) $V_a + 3.6\,I_1 = V_b$

$$V_b - V_a = +3.6\,(1.25) = \boxed{4.5\,V}$$

c) $I_4 = \dfrac{V_{ba}}{4+5} = 0.5\,A$

Potencia en $R = 5\Omega$

$$I_4^{\,2}\,R_5 = \boxed{1.25\,Watts}$$

Problema 5

diámetro $= 0.840 \text{ mm}$
radio $= 0.420 \text{ mm}$

$E = 0.49 \text{ V/m}$

$\rho = 2.44 \times 10^{-8} \, \Omega \cdot m$

$J = \dfrac{E}{\rho} \qquad \dfrac{I}{A} = \dfrac{E}{\rho}$

$\Rightarrow \quad I = \dfrac{EA}{\rho} = \dfrac{0.49 \, \pi \, (0.42 \times 10^{-3})^2}{2.44 \times 10^{-8}}$

$\boxed{I = 11.129 \text{ A}}$

$\Rightarrow \quad R = \dfrac{\rho L}{A} = \dfrac{2.44 \times 10^{-8} (6.4)}{\pi \, (0.42 \times 10^{-3})^2}$

$\boxed{R = 0.2818 \, \Omega}$

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diámetro $= 0.924 \text{ mm}$
radio $= 0.462 \text{ mm}$

$E = 0.539 \text{ V/m}$

$\rho = 2.44 \times 10^{-8} \, \Omega \cdot m$

$J = \dfrac{E}{\rho} \qquad \dfrac{I}{A} = \dfrac{E}{\rho}$

$\Rightarrow \quad I = \dfrac{EA}{\rho} = \dfrac{0.539 \, \pi \, (0.462 \times 10^{-3})^2}{2.44 \times 10^{-8}}$

$\boxed{I = 14.685 \text{ A}}$

$\Rightarrow \quad R = \dfrac{\rho L}{A} = \dfrac{2.44 \times 10^{-8} (7.04)}{\pi \, (0.462 \times 10^{-3})^2}$

$\boxed{R = 0.256 \, \Omega}$

Problema 6

	V	Potencia (W)	tiempo h	Energía (kW·h)
motor 1	220	150,000	300	45,000 kw·h
motor 2	220	120,000	300	36,000 kw·h

120,000 ↳ 120 kW

$$81,000 \ kw \cdot h$$

b) motor 1   precio 0.15/kw·h

$$\$ \ costo = 45,000 * 0.15 = \boxed{6750}$$

	V	Potencia (W)	tiempo (h)	Energía (kW·h)
motor 1	220	180,000	240	43,200
motor 2	220	144,000	240	34,560

144,000 ↳ 144 kW

$$77,760$$

b) motor 1   precio unitario   0.18/kw·h

$$\$ \ costo = 43200 * 0.18 = \boxed{7776}$$

Problema 7
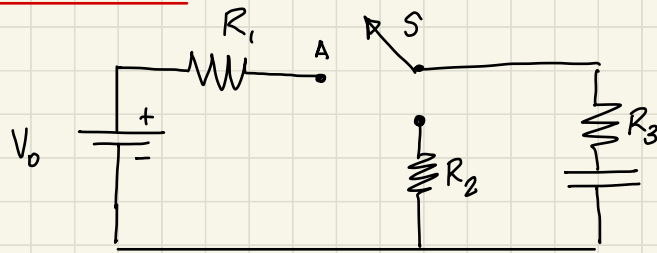
$R_1 = 10\,k\Omega$
$R_2 = R_3 = 5\,k\Omega$
$C = 6\mu F$
$V_0 = 15\,V$

a) $\quad I = I_0\, e^{-t/RC}$

$\tau = (R_1 + R_3)C = 0.09\,s$

$I_0 = \dfrac{V_0}{R_1 + R_3} = \dfrac{15}{15,000} = 1\,mA$

$I = I_0\, e^{-t/RC}$

$0.750 \times 10^{-3} = 1\times 10^{-3}\, e^{-t/0.09}$

$\boxed{t = 25.89\,ms}$

b) $\quad V_C = \mathcal{E}\,[1 - e^{-t/RC}]$

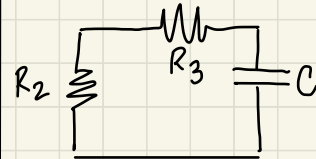$10 = 15\,[1 - e^{-t/0.09}]$ $\qquad \boxed{t = 98.9\,ms}$

Temario 22

DESCARGA

$V = V_0\, e^{-t/RC}$ $\tau = (R_2 + R_3)C$
$\tau = 0.06\,s$

c) $\quad U_0 = \frac{1}{2} C\, V_C^2$

$U_0 = 6.75 \times 10^{-4}\,J$

$\dfrac{U_0}{2} = 3.375 \times 10^{-4}\,J$

$3.375 \times 10^{-4} = \frac{1}{2} C\, V_C^2$

$V_C = 10.6066\,V$

$\Rightarrow \quad 10.6066 = 15\, e^{-t/0.06}$

$\boxed{t = 20.79\,ms}$

$R_1 = 14 k\Omega$

$R_2 = R_3 = 7 k\Omega$

$C = 8.4 \mu F$
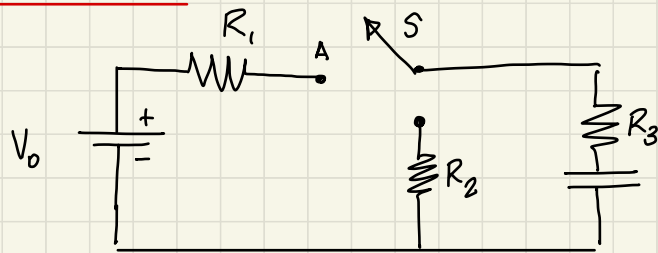
$V_0 = 21 V$

DESCARGA

$V = V_0 e^{-t/RC}$

$\mathcal{T} = (R_2 + R_3)C$

$\mathcal{T} = 0.1176 s$

a) $I = I_0 e^{-t/RC}$

$\mathcal{T} = (R_1 + R_3)C = 21,000 \times 8.4 \times 10^{-6}$

$\mathcal{T}_{CARGA} = 0.1764 s$

$I_0 = \dfrac{21}{21,000} = 1 mA$

$I = I_0 e^{-t/RC}$

$0.75 \times 10^{-3} = 1 \times 10^{-3} e^{-t/0.1764} \rightarrow t = \boxed{50.7 ms}$

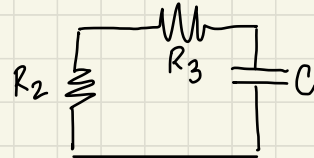b) $V_c = \mathcal{E}[1 - e^{-t/0.1764}]$

$14 = 21[1 - e^{-t/0.1764}] \rightarrow t = \boxed{193.8 ms}$

$V_{0_c} = 21 V$

$U_0 = \dfrac{1}{2} C V_{0_c}^2 = 1.8522 mJ$

$\dfrac{U_0}{2} = 9.261 \times 10^{-4}$

$9.261 \times 10^{-4} = \dfrac{1}{2} C V_c^2$

$V_c = 14.8492 V$

$\rightarrow 14.849 = 21 e^{-t/0.1176}$

$t = \boxed{40.8 ms}$