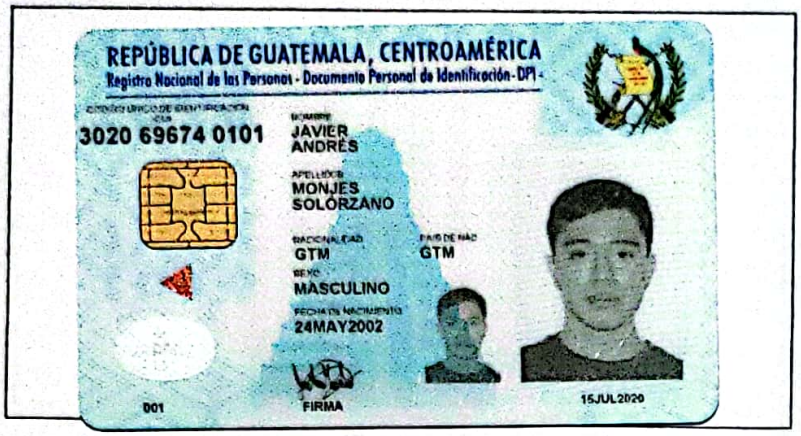

UNIVERSIDAD DE SAN CARLOS
FACULTAD DE INGENIERIA
DEPARTAMENTO DE FISICIA
CURSO DE VACACIONES JUNIO 2022

Firma:

Carné : 20210008 1 Curso: Física 2 Sección: C

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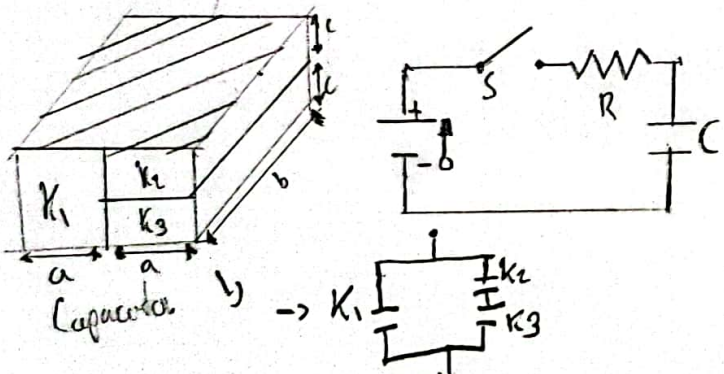
----------Puede iniciar su examen a partir de aquí ----------

Problema #1

La figura muestra un circuito RC, completamente descargado. La resistencia tiene un valor de 1.406Ω. Una fuente de voltaje de 24 V se conecta en el circuito. El capacitor está de placas paralelas con dieléctricos entre sus placas. Si $K_1 = 10.0$, $K_2 = 5.00$, $K_3 = 12.0$, $a = 5.00cm$ $b = 9.00cm$ y $c = 2.00m$



Datos:
$K_1 = 10.0$
$K_2 = 5.00$
$K_3 = 12.0$
$a = 5.00cm$
$b = 9.00cm$
$c = 2.00cm$
$V = 24V$
$R = 1.426\Omega$

$$C_1 = \frac{K\varepsilon_0 A}{d} = \frac{10\varepsilon_0(0.05)(0.09)}{2(0.02)}$$

$$C_1 = 9.96\times10^{-12}F$$

$$C_2 = \frac{5\varepsilon_0(0.05)(0.09)}{0.02} = 9.96\times10^{-12}F$$

$$C_3 = \frac{12\varepsilon_0(0.05)(0.09)}{(0.02)} = 7.39\times10^{-11}F$$

$$C_{23} = \left[\frac{1}{C_2} + \frac{1}{C_3}\right]^{-1} = \left[\frac{1}{9.96\times10^{-12}} + \frac{1}{2.39\times10^{-11}}\right]^{-1} = 7.031\times10^{-12}F$$

a) $C_{eq} = C_1 + C_{23} = 9.96\times10^{-12} + 7.031\times10^{-12} = 1.699\times10^{-11} = 1.70\times10^{-11}F$

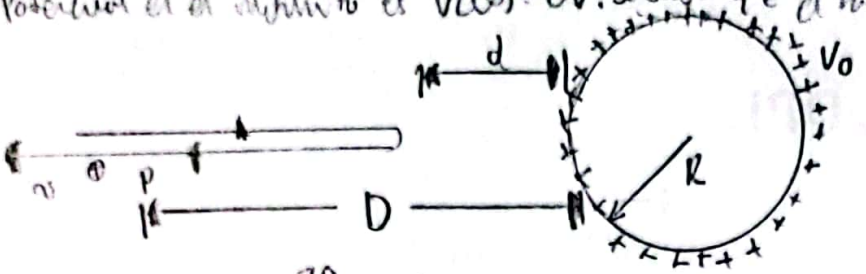
b) $q(t) = \varepsilon C\left[1 - e^{-t/RC}\right] \rightarrow q(60) = 24(1.70\times10^{-11})\left[1 - e^{-60/RC}\right]$

$q_{max} = 408\times10^{-12} = 408pC$

Respuestas
a) $1.70\times10^{-11}F$
b) 408 pC

Problema #2

Una esfera conductora cargada se encuentra aislada y posee un potencial $V_0 = 900V$, el potencial en el infinito es $V(\infty) = 0V$. Se sabe que el radio de la esfera es $R = 0.25m$



$V =$

$V(\infty) = 0V$

$R = 0.25m$

a) $V_1 - V_0 = \int E\,dr$ → $\oint E\,dA = \frac{q_{inc}}{\epsilon_0}$

$V_1 = 900V$ dado

$V_1 - V(\infty) = \int_{\infty}^{0} E\,dr$

$\oint E\,dA = \frac{q_{enc}}{\epsilon_0}$

$E(4\pi R^2) = \frac{q_{enc}}{\epsilon_0}$

b) $V = \int_{1}^{\infty} \frac{q_{inc}}{4\pi\epsilon_0 r^2}\,dr$

$E = \frac{q_{enc}}{4\pi\epsilon_0 r^2}$

$V = \frac{q_{enc}}{4\pi\epsilon_0}\left[-\frac{1}{r}\right]_{0.25}^{\infty}$

$V = \frac{q_{enc}}{4\pi\epsilon_0}\left[\frac{-q}{\infty} + \frac{q}{0.25}\right]$ ↔ $900(4\pi\epsilon_0)(0.25) = q_{enc}$

$q_{enc} = 25.0nC$

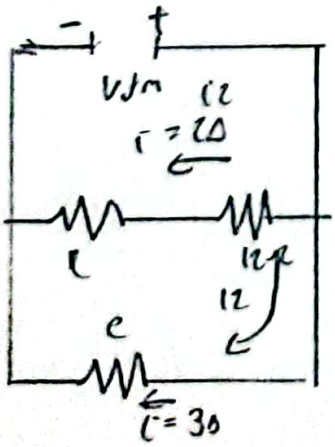
c) $V = \frac{25nC}{4\pi\epsilon_0}\left[-\frac{1}{\infty} + \frac{1}{0.5}\right] = 450V$

a) $V_1 = 900V$

b) $q_{enc} = 25.0nC$

c) $450V$

Problema #3



Malla 1

$V = i_1(20) + R(i_1 - i_2) - 20i_2$

$V = 5(20) + 5R_1 - 3R - 20(3)$

$V = 100 - 60 + 2R$

$V - 2R = 40$

Malla 2

$0 = i_2R + 20i_2 + R_{i_2} - R_{i_1} - 20i_1$

$0 = 3R + 20(3) + R(3) - 5R - 20(5)$

$0 = R - 40$

$R = 40$

$V = 40 + 2(40)$

$V = 120$

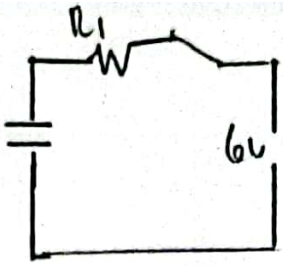
$i_1 = 2 + i_2$

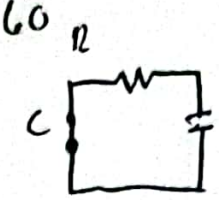
$i_1 = 2 + 3 = 5A$

a) $i2a$

b) 40Ω

Pregunta #4





$V = IR$

$I = \frac{x}{R} = \frac{6}{1000}$

$I = 6 \times 10^{-3} A$

$L = 2000\ \Omega$

$V = 3v$

$R_1 = 1000\ \Omega$

$C_1 = 4700\ \mu F$

$V_F = 3v$

b

$Q = CV - V = \frac{q}{C} = V_0[1 - e^{-t/RC}]$

$3 \cdot 6[1 - e^{-t/RC}]$

$\frac{3}{6} = 1 = -e^{-t/RC}$

$\ln 0.5 = \ln e$

$\ln 0.5 = \frac{-t}{1000(4700 \times 10^{-6})}$

$t = 3.26\ seg$

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

$V_F = 1,80$

$V_0 = 3v$

$L = 1000 + 2000 = 3000\ \Omega$

$1,8 = 3e^{-t/RC}$

$\ln \frac{1.8}{3} = \ln e^{-t/RC}$

$t = 10.51(3000)(4700 \times 10^{-6})$

$t = 7.20$

a) $6 \times 10^{-3} A$

b) 3.26 seg

c) 7.20 s

Problema 5

$q_1 = 4.5 \mu C$

$m_2 = 6g$

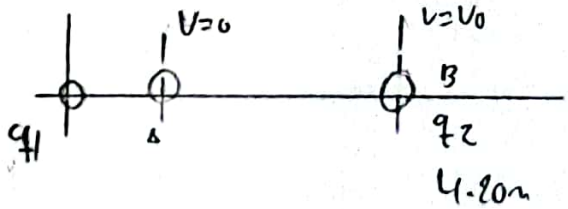
$q_2 = 3 \mu C$

$V_0 = 66 m/s$

$d_1 = 4.2 cm$

$\Sigma F = ma$

$F_c = ma$



$U_A + K_A^{\vec{0}} = U_B + K_B$

$q_2 V_0 = q_2 V_B + \frac{1}{2} m V_B^2$

$q_2 V_A - q V_B = \frac{1}{2} m V_B^2 \rightarrow V_A - V_B = \frac{1}{2} \frac{m V_B^2}{q_2}$

$V_{AB} = \frac{\frac{1}{2}(6 \times 10^{-3})(66)}{3 \times 10^{-6}}$

$V_{AB} = 1.36\ MV$

$F_e = \frac{kq_1 q_2}{r^2} = \frac{9 \times 10^9 (4.5\mu)(3\mu)}{0.042^2}$

$\frac{68.87 = a}{6 \times 10^{-3}} = 17.479\ m/s^2$

$v_f^2 = v_0^2 + 2a\Delta x$

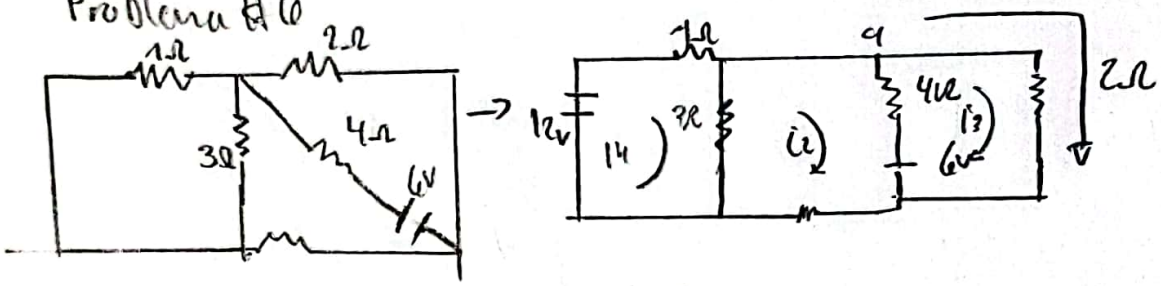
$0 = 66^2 + 2(-11,479)\Delta x$

$\Delta x = 0.189\,m = 190\,mm$

a) 4.36 MV

b) 190 mm

Problema #6



Malla 1

$12 = 1i_1 + 3(i_1 - i_2)$

① $12 = 4i_1 - 3i_2$

Malla 2

$6 = 5i_2 + 3i_2 + 4i_2 - 3i_1 - 4i_3$

② $6 = -3i_1 + 12i_2 - 4i_3$

Malla 3

$-6 = 4i_3 - 2i_3 - 4i_2$

③ $-6 = -4i_2 + 6i_3$

Resolviendo ① ② ③

$i_1 = 4.14$

$i_2 = 7.55$

$i_3 = 0.0353\,A$

$V_a = 2(i_3) = V_b$

$V_a - V_0 = (2)(0.035) = 0.0706\,V$

a) i_1 4.16 A

i_2 7.55 A

i_3 0.0353 A

b) 0.0706 V