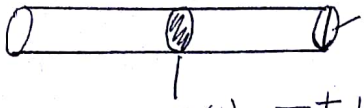
Tema 5. Corrientes eléctricas

1)



$d = 0{,}8\ cm \Rightarrow R = 0{,}4\ cm = 0{,}004\ m$

$q(t) = \pi t + 6$

a)

$I = \frac{Q}{t} \qquad I = \frac{dq}{dt} = \pi$ Amperios

b)

Corriente continua.

c) $J = \frac{I}{S} = \frac{\pi}{\pi R^2} = \frac{\cancel{\pi}}{\cancel{\pi} R^2} = \frac{1}{0{,}004\ m} = 6{,}25 \cdot 10^4\ A/m$

d) E en el interior del conductor.

$I = \frac{V}{R} \Rightarrow \boxed{J = \sigma E}$

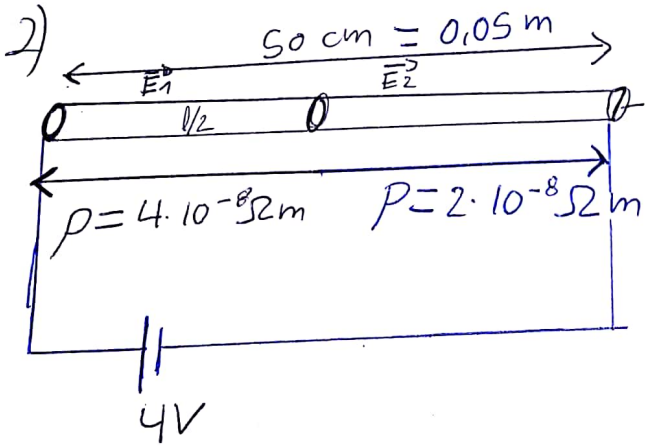
$\rho = \frac{1}{\sigma}$

$6{,}25 \cdot 10^4 = \sigma E$

$E = \frac{6{,}25 \cdot 10^4}{\sigma} = \rho \cdot 6{,}25 \cdot 10^4 = 1{,}06 \cdot 10^{-3}\ N/C$

$dV = 4\ V$

2)



$d = 0{,}20\ mm \Rightarrow R = 0{,}1\ mm = 0{,}001\ m$

$R_T = R_1 + R_2 = 0{,}32 + 0{,}16 = 0{,}48\ \Omega$

$R_1 = \rho_1 \frac{l}{S} = \rho_1 \frac{0{,}25}{\pi (0{,}0001)^2} = 4 \cdot 10^{-8} \frac{0{,}25}{\pi (0{,}0001)^2} = 0{,}32\ \Omega$

$R_2 = \rho_2 \frac{0{,}25}{\pi R^2} = 2 \cdot 10^{-8} \frac{0{,}25}{\pi (0{,}0001)^2} = 0{,}16\ \Omega$

b) $I = \frac{V}{R} = \frac{4}{0,48} = 8,3\ A$

c) $J = \frac{I}{S} = \frac{8,3}{\pi(0,0001)^2} = 2,65 \cdot 10^8\ A/m^2$

d) $\vec{J} = \sigma E$ $\qquad \rho = \frac{1}{\sigma}$

$E = \frac{J}{\sigma}$

$E_1 = \rho_1 \cdot J = 4 \cdot 10^{-8} \cdot 2,65 \cdot 10^8 = 10,6\ V/m$

$E_2 = \rho_2 J = 2 \cdot 10^{-8} \cdot 2,65 \cdot 10^8 = 5,3\ V/m$

3) cable de cobre = 1 mm diametro $\Rightarrow d = 0,001\ m$ $\qquad \rho = 1,7 \cdot 10^{-8}\ \Omega m$

$I = 10\ A$

a) Si el cable transporta $I = 10$ (max I)

[La potencia es el trabajo por unidad de tiempo.]

P ?

$P = I \cdot V = \frac{V^2}{R} = I^2 R \Rightarrow 10^2 \cdot 0,122 = [22\ W]$

$I = \frac{V}{R}$

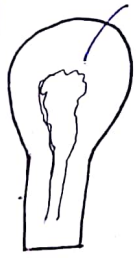
$V = IR$

$R_1 = \rho \frac{l}{S} = 1,7 \cdot 10^{-8} \frac{10\ m}{\pi(0,001)^2} = 0,122\ \Omega$

b) $\frac{R}{2} = \frac{1}{2} \rho \frac{l}{S}$ $\qquad S = \pi R^2$ $\qquad R = \frac{d}{2}$

4B)

5) $P = I^2 R$



$P = 60\ W$

$V = 220\ V$

$d = 0{,}01\ mm = 00001$

$\gamma = 19 \cdot 10^6\ \Omega^{-1} m^{-1}$

a) R? I?

$P = IV \quad I = \frac{V}{R}$

$P = I^2 R = \frac{V^2}{R} = IV$

$60 = \frac{220^2}{R}$

$R = \frac{220^2}{60} = 807\ \Omega$

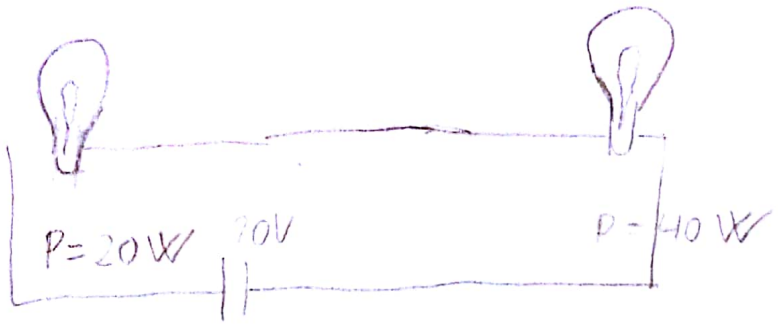
$I = \frac{V}{R} = \frac{220}{807} = 0{,}27\ A$

b) $R = \rho \frac{l}{S}$; $l = \frac{RS}{\rho} = \sigma RS = 1{,}2\ m$

$S = \pi R^2$

$r = \frac{d}{2} = 0{,}0005$

6)



a) $P = IV$

$P_T = P_1 + P_2 = 60\ W$

$60 = I \cdot 20$

$I = 3\ A$

$P_1 = I^2 R_1$

$R_1 = 3^2 \cdot R_1$

$20 = 9 \cdot R_1$

$R_1 = 2{,}2\ \Omega$

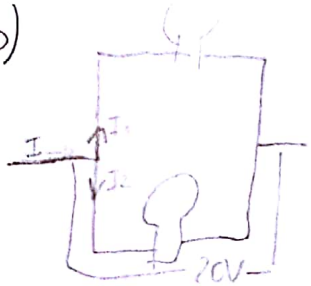
$P_2 = I^2 R_2$

$40 = 3^2 R_2$

$\frac{40}{9} = R_2$

$R_2 = 4{,}4\ \Omega$

b)

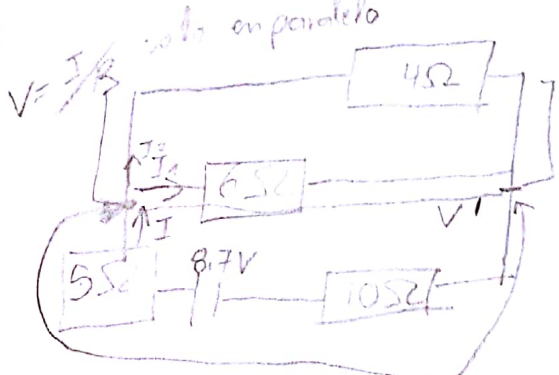


La dV es común para ambas resistencias (a no en condensadores)

$P_1 = \frac{V^2}{R_1} = \frac{20^2}{2{,}2} = 181{,}8\ W$

$P_2 = \frac{V^2}{R_2} = \frac{20^2}{4{,}4} = 90{,}9\ W$

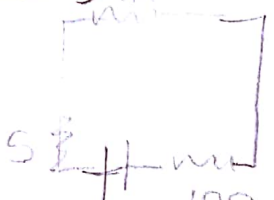
7)



$V = IR$

$P_{no} = I^2 R$

$\Rightarrow R_e = \frac{R_1 R_2}{R_1 + R_2} = \frac{6 \cdot 4}{6+4} = \frac{24}{10} = 2{,}4\ \Omega$



$I = \frac{V}{R} = \frac{8{,}7}{17{,}4} = 0{,}5\ A$

El potencial que llega ahí no es 8,7 ya que algunos se consumen al pasar por la resistencia.

$P_5 = 0{,}5^2 \cdot 5 = 1{,}25\ W$

$P_6 = 0{,}5^2 \cdot 10 = 2{,}5\ W$

$I = I_1 + I_2$

$0{,}5 = I_1 + I_2$

$V' = I_2 R_2$ $\quad V' = I_1 R_1$

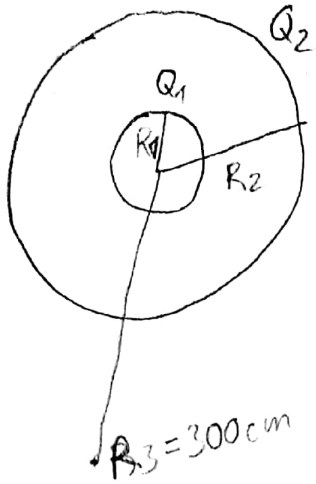
$V' = I_2 \cdot 4$ $\quad V' = I_1 \cdot 6$

$I_2 \cdot 4 = I_1 \cdot 6$

$I_1 = \frac{4}{6} I_2$

$0{,}5 = \frac{5}{3} I_2 + I_2$

P3

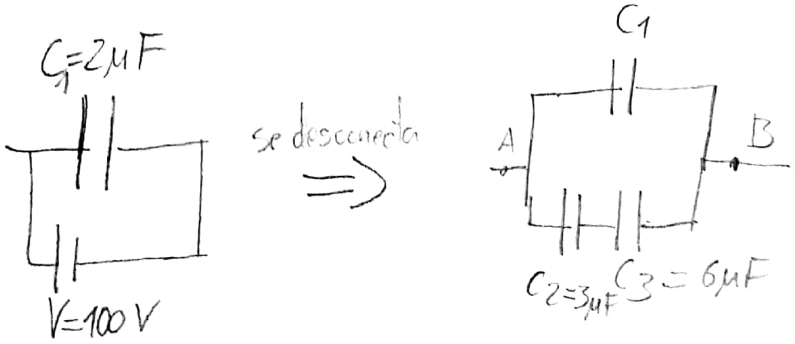
3) 

$R_1 = 50\,cm = 0{,}5\,m$ $\quad Q_1 = 5nC$

$R_2 = 100\,cm = 1\,m$ $\quad Q_2 = 10nC$

$W = -\Delta U = -(U_3 - U_1) = (U_1 - U_3$

V1

5) 

a) $C_1 = \frac{Q}{V}$

$Q_1 = 2 \cdot 10^{-6} \cdot 1000 = 2 \cdot 10^{-3} C$

b) $C_{23} = \frac{C_2 \cdot C_3}{C_2 + C_3} \Rightarrow C_{23} = \frac{3 \cdot 10^{-6} \cdot 6 \cdot 10^{-6}}{3 \cdot 10^{-6} + 6\,10^{-6}} = 2 \cdot 10^{-6}$

$C_T = C_1 + C_{23} = 2 \cdot 10^{-6} + 2 \cdot 10^{-6} = 4 \cdot 10^{-6} F$

c) $(V_A - V_B) = \frac{Q_T}{C_e} = \frac{2 \cdot 10^{-3}}{4 \cdot 10^{-6}} = 500\,V$

d) $Q_1' + Q_2' + Q_3' = 2 \cdot 10^{-3}$