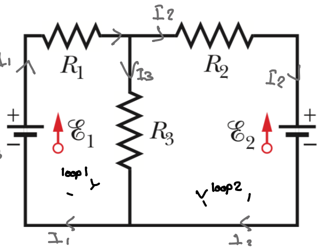
Leen Sabri

Q2 ideal : مثالي

$\mathcal{E}_1 = 12V$, $\mathcal{E}_2 = 0.5\mathcal{E}_1 = 6V$, $R_1 = R_2 = R_3 = 4\Omega$

يمشي من عالي لواطي للاكبر



Using the Junction rule ($I_1 = I_2 + I_3$) ... ①

loop 1 :

$0 = \mathcal{E}_1 - I_1R_1 - I_3R_3 \Rightarrow \mathcal{E}_1 = I_1R_1 + I_3R_3 \Rightarrow 12 = 4I_1 + 4I_3 \Rightarrow 3 = I_1 + I_3$ ... ②

loop 2:

$0 = \mathcal{E} + I_2R_2 - I_3R_3 \Rightarrow \mathcal{E} = I_3R_3 - I_2R_2 \Rightarrow 6 = 4I_3 - 4I_2$ ∴ ③

Put ① in ② $\Rightarrow 3 = I_2 + 2I_3$ ...④

multiply ④ by 4 $\Rightarrow 12 = 4I_2 + 8I_3$ ..⑤

③+⑤ $\Rightarrow 18 = 12I_3 \Rightarrow I_3 = 18/12 = 1.5A$,, from ② $\Rightarrow I_1 = 3 - I_3 = 3 - 1.5 = 1.5A$,,, from ① $I_2 = I_1 - I_3 = 1.5 - 1.5 = 0$

Q15 بده t بدلالة τ اللي بلزم لشحن الكاباسيتور من الأول لحد 89% من شحنته النهائية

$q(t) = q_0(1 - e^{-t/RC})$ ← During charging

$0.89\, q_0 = q_0(1 - e^{-t/RC}) \Rightarrow 0.89 = 1 - e^{-t/RC} \Rightarrow 0.11 = e^{-t/RC} \Rightarrow \frac{t}{\underset{\tau}{RC}} = -\ln 0.11 \Rightarrow t = 2.21\tau$

Q18 $\overset{\mathcal{E}}{V_0} = 80V$, $V(10) = 1V$, $\tau = ??$, $V_c \rightarrow t = 17s = ??$ 7U$ 1293

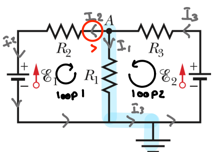
* notice : whene the switch is closed at $t=0$, the capacitor starts to discharge through a resistor

$q_c = q_0 e^{-t/RC}$ → The charge equation of a RC circuit

a) $V = \frac{q}{c} \Rightarrow V_c = \underset{\text{ثابتة}}{V_0}\, e^{-t/RC} \Rightarrow 1 = 80e^{-t/RC} \Rightarrow \ln\frac{1}{80} = \frac{-t}{RC} \Rightarrow \ln\frac{1}{80} = \frac{-10}{\tau} \Rightarrow \tau = \frac{10}{\ln 80} \Rightarrow \tau = 2.28$ sec

b) at $t = 17 \Rightarrow V = 80e^{-\frac{t}{\tau}} = 80e^{-\frac{17}{2.28}}$

Q20



$\mathcal{E}_1 = 8V$, $\mathcal{E}_2 = 12V$, $R_1 = 100\Omega$, $R_2 = 200\Omega$, $R_3 = 300\Omega$

$I_3 = I_1 + I_2$ ...①

loop 1 $\Rightarrow \mathcal{E}_1 + I_2R_2 - I_1R_1 = 0 \Rightarrow \mathcal{E}_1 = I_1R_1 - I_2R_2 \Rightarrow 8 = 100I_1 - 200I_2$ ...②

loop 2 $\Rightarrow \mathcal{E}_2 - I_3R_3 - I_1R_1 = 0 \Rightarrow \mathcal{E}_2 = I_1R_1 + R_3I_3 \Rightarrow 12 = 100I_1 + 300I_3$ ...③

put ① in ③ $\Rightarrow 12 = 100I_1 + 300I_1 + 300I_2 \Rightarrow 12 = 400I_1 + 300I_2$ ...④

$4\times$② $\Rightarrow 32 = 400I_1 - 800I_2$ ...⑤

⑤-④ $\Rightarrow 20 = -1100I_2 \Rightarrow I_2 = -0.0182$ عكس الاتجاه الدارسنه

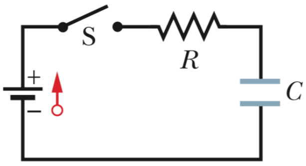
from ④ $\rightarrow 12 = 400I_1 + 300(-0.0182) \Rightarrow I_1 = 0.0436A$

from ① $\Rightarrow I_3 = I_1 + I_2 = -0.0182 + 0.043 = 0.025A$

B) حسب الرسمة الجانبية المعلقة A بمشي منها I_1 ∴

$V_R = I_1R_1 = 0.0436 \times 100 = 4.36V$

Q21



$C = 49\mu F = 49\times10^{-6}F$, $R = 32\Omega$, whene $V_R = V_c$??

$V_c = \mathcal{E}(1 - e^{-t/\tau})$,,, $V_R = \mathcal{E}e^{-t/\tau}$, $\tau = RC = 32\times49\times10^{-6} = 1.568\times10^{-3}$ sec

$V_c = V_R \Rightarrow \cancel{\mathcal{E}}(1 - e^{-t/\tau}) = \cancel{\mathcal{E}}e^{-t/\tau} \Rightarrow 1 - e^{-t/\tau} = e^{-t/\tau} \Rightarrow 1 = 2e^{-t/\tau} \Rightarrow 0.5 = e^{-t/\tau} \Rightarrow \ln 0.5 = \frac{-t}{\tau} \Rightarrow \ln 0.5 = \frac{-t}{1.568\times10^{-3}} \Rightarrow t = 1.087$ sec

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Q30 lose $\Rightarrow$ discharge

a) $0.75\, \cancel{q_0} = \cancel{q_0}e^{-t/\tau} \Rightarrow \ln 0.75 = \frac{-t}{\tau} \Rightarrow t = -\ln 0.75\,\tau = 0.2877\,\tau$ sec

b) $0.5\, q_0 = q_0 e^{-t/\tau} \Rightarrow \ln 0.5 = \frac{-t}{\tau} \Rightarrow t = -\ln 0.5\,\tau = 0.69\,\tau$ sec

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Q59 $\mathcal{E} = 20\,V$ $q_e = 1.6 \times 10^{-19}$

a) The work done by the battery relates to the potential energy

80

$$\boxed{P_{\mathcal{E}} = n_e \mathcal{E}}$$

$W = q\mathcal{E} \Rightarrow W = q_e \mathcal{E} = 20\,eV$

b) $P_{\mathcal{E}} = \mathcal{E} I$,,, $I = \frac{q}{t}$ and $q = \underset{\text{عدد الالكترونات}}{N} e \Rightarrow I \frac{Ne}{t} \Rightarrow P = \frac{N}{t} e V = \underset{\text{الكثافة}}{n} e\, V = ne\, \mathcal{E} = (5.17 \times 10^{18}/s)(1.6 \times 10^{-19})(20)$

Q62 $C = 1 \times 10^{-6}\,F$, $U = 0.6\,J$, $R = 1\,M\Omega = 1 \times 10^{6}\,\Omega$

a) The initial energy stored in a capacitor is given by $U_c = \frac{q_o^2}{2C} \Rightarrow q_o = \sqrt{2UC} = \sqrt{2(0.6)(1 \times 10^{-6})} = 1.095 \times 10^{-3}$

b) $I_{discharge} \Rightarrow I = -\frac{q_o}{RC} e^{-t/\tau}$, befor that we want to find $\tau \Rightarrow \tau = RC = 1 \times 10^{-6} \times 10^{6} = 1\,s$

and because we want to find I when the discharge starts $\therefore t = 0 \therefore$ the equation become $\Rightarrow I_o = \frac{q_o}{RC} = \frac{q_o}{\tau} = \frac{1.095 \times 10^{-3}}{1} = 1.095 \times 10^{-3}\,A$

c) $V_c = \frac{q}{C} \Rightarrow$ Now $q = q_o e^{-t/\tau}$ $\therefore V_c = \frac{q_o e^{-t/\tau}}{C} = \frac{1.095 \times 10^{-3} e^{-t/1}}{1 \times 10^{-6}} = 1095\, e^{-t}\, V$

d) $V_R = IR = (1.095 \times 10^{-3})(1 \times 10^{6})\, e^{-t/1} = 1095\, e^{-t}$

e) $P = I^2 R = (1.095 \times 10^{-3})^2 (1 \times 10^{6})\, e^{-2t/1}$ مربّع التيار