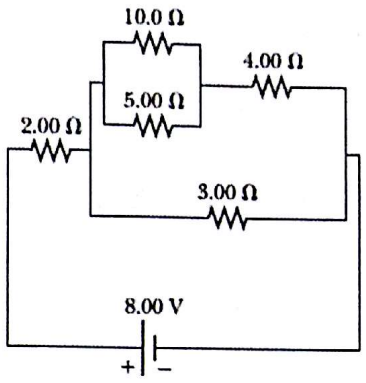
BRAC University QUIZ - 3 FALL SEMESTER – 2016 CHD

COURSE CODE: PHY 112 TITLE: Principles of Physics I I MARKS: 20 TIME: 20 MINUTES

Name: Student ID: Section:

1. A 2.00nF capacitor with an initial charge of 5.10 μC is discharged through a 1.30$k\Omega$ resistor.
   (a) **(3 marks)** Calculate the current in the resistor 9.00 μs after the resistor is connected across the terminals of the capacitor.
   (b) **(2 marks)** What charge remains on the capacitor after 8.00 μs?
   (c) **(2 marks)** What is the maximum current in the resistor?

2. Consider the circuit shown in Figure.
   (a) **(3 marks)** Find the voltage across each of the resistors.
   (b) **(3 marks)** Find the current through each of the resistors.
   (c) **(2 marks)** Find the energy stored in the 3.00Ω resistor.



1 a) $I = \frac{Q_0}{RC} e^{-t/RC}$

$= \frac{5.1\times10^{-6}}{1.3\times10^{3}\times2\times10^{-9}} e^{-\frac{9\times10^{-6}}{1.3\times10^{3}\times2\times10^{-9}}}$

$= 0.06$ Amp.

b) $q = Q_0 e^{-t/RC} - \frac{8\times10^{-6}}{1.3\times10^{3}\times2\times10^{-9}}$

$= 5.1\times10^{-6} \times e$

$= 2.35\times10^{-7}$ C

c) $I_{max} = \frac{Q_0}{RC}$

$= \frac{5.1\times10^{-6}}{1.3\times10^{3}\times2\times10^{-9}}$

$= 1.96$ Amp.

(Ans.)

2 $R_{eq} = 2 + \frac{1}{\frac{1}{7.33} + \frac{1}{3}} = 4.13\,\Omega$

$\therefore I_{eq} = 1.94\,A = I_2 = I_{10,5,4,3}$

$V_{10,5,4,3} = 2.13\Omega \times 1.94 = 4.13$ V

$= V_3 = V_{10,5,4}$

$I_{10,5,4} = 0.56\,A = I_4 = I_{10,5}$

$V_{10,5} = 3.33\Omega \times 0.56 = 1.86$ V

$= V_{10} = V_5$

$\therefore I_2 = 1.94$ A ; $V_2 = 3.88$ V

$I_{10} = 0.186$ A ; $V_{10} = 1.86$ V

$I_5 = 0.37$ A ; $V_5 = 1.86$ V

$I_4 = 0.56$ A ; $V_4 = 2.24$ V

$I_3 = 1.38$ A ; $V_3 = 4.13$ V

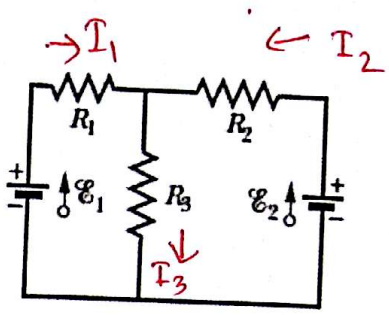
c) $P_3 = I_3^2 R_3 = (1.38)^2 \times 3$

$= 5.7$ W. (Ans.)

3. The ideal batteries have emfs $\varepsilon_1 = 10V$ and $\varepsilon_2 = 0.50\varepsilon_1 V$. The values of resistances in each resistors 4Ω. What is the current in

(a) **(3 marks)** resistance 2 and

(b) **(2 marks)** resistance 3?



$I_1 + I_2 = I_3$

$\mathcal{E}_1 - I_1 R_1 - I_3 R_3 = 0$

$\mathcal{E}_2 - I_2 R_2 - I_3 R_3 = 0$

$I_1 + I_2 - I_3 = 0 \quad -(I)$

$-4I_1 - 4I_3 = -10 \quad -(II)$

$0 - 4I_2 - 4I_3 = -5 \quad -(III)$

Solving (I), (II), (III) $\Rightarrow$

$I_1 = 1.25$ Amp

$I_2 = 0$ Amp

$I_3 = 1.25$ Amp.

(Ans.)

CHD

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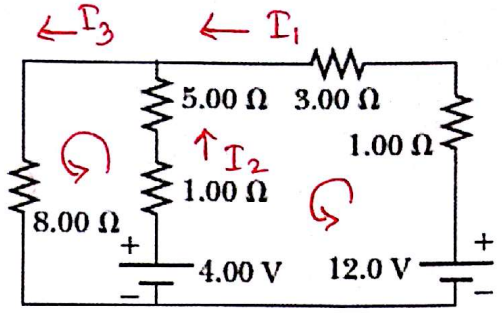
Name: **Student ID:** **Section:**

1. Consider the circuit shown in Figure.
   (a) **(3 marks)** Find the voltage across each of the resistors.
   (b) **(3 marks)** Find the current through each of the resistors.
   (c) **(2 marks)** Find the energy stored in the 3.00Ω resistor.



2. A $4.00nF$ capacitor with an initial charge of $7.10\ \mu C$ is discharged through a $2.30k\Omega$ resistor.
   (a) **(3 marks)** Calculate the current in the resistor $8.00\ \mu s$ after the resistor is connected across the terminals of the capacitor.
   (b) **(2 marks)** What charge remains on the capacitor after $7.00\ \mu s$?
   (c) **(2 marks)** What is the maximum current in the resistor?

1 $I_1 + I_2 = I_3$ — (i)

$12 - 4I_1 + 5I_2 + I_2 - 4 = 0$

$\Rightarrow -4I_1 + 6I_2 = -8$ — (ii)

$4 - I_2 - 5I_2 - 8I_3 = 0$

$\Rightarrow -6I_2 - 8I_3 = -4$

$$\left.\begin{aligned} I_1 + I_2 - I_3 &= 0 \\ -4I_1 + 6I_2 + 0 &= -8 \\ 0 \quad -6I_2 - 8I_3 &= -4 \end{aligned}\right\}$$

b) $I_1 = 1.3A$; $I_2 = -0.46\ A$;

$I_3 = 0.846$ Amp.

a) V across $8\Omega = 8 \times 0.846 = 6.77$ V

V " $5\Omega = 5 \times 0.46 = 2.3$ V

V " $1\Omega = 1 \times 0.46 = 0.46$ V

V " $3\Omega = 3 \times 1.3 = 3.9$ V.

V " $1\Omega = 1 \times 1.3 = 1.3$ V

c) P across $3\Omega = I^2R = (1.3)^2 \times 3$

$= 5.07$ W (Ans.)

2 a) $I = \frac{Q_0}{RC} e^{-t/RC}$

$\Rightarrow I = \frac{7.1 \times 10^{-6}}{2.3 \times 10^3 \times 4 \times 10^{-9}} e^{-\frac{8 \times 10^{-6}}{2.3 \times 10^3 \times 4 \times 10^{-9}}}$

$= 0.32$ Amp

b) $Q = Q_0 e^{-t/RC}$

$= 7.1 \times 10^{-6} \times e^{-\frac{7 \times 10^{-6}}{2.3 \times 10^3 \times 4 \times 10^{-9}}}$

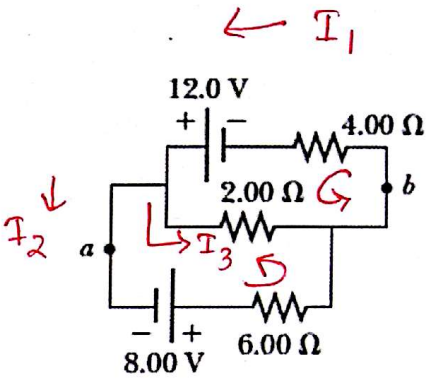
$= 3.32 \times 10^{-6}$ C

c) $I_{max} = \frac{Q_0}{RC}$

$= \frac{7.1 \times 10^{-6}}{2.3 \times 10^3 \times 4 \times 10^{-9}}$

$= 0.77$ Amp.

3. Calculate:
(a) **(3 marks)** the current in 2Ω resistor.
(b) **(2 marks)** the current in 6Ω resistor?



$I_1 = I_2 + I_3$

$12 - 2I_3 - 4I_1 = 0$

$8 - 6I_2 + 2I_3 = 0$

$I_1 - I_2 - I_3 = 0$ — (i)

$-4I_1 \quad -2I_3 = -12$ — (ii)

$-6I_2 + 2I_3 = -8$ — (iii)

Solving (i), (ii), (iii) ⇒

$I_1 = 2.55$ Amp

$I_2 = 1.64$ Amp across 6Ω

$I_3 = 0.91$ Amp. across 2Ω.

(Ans.)