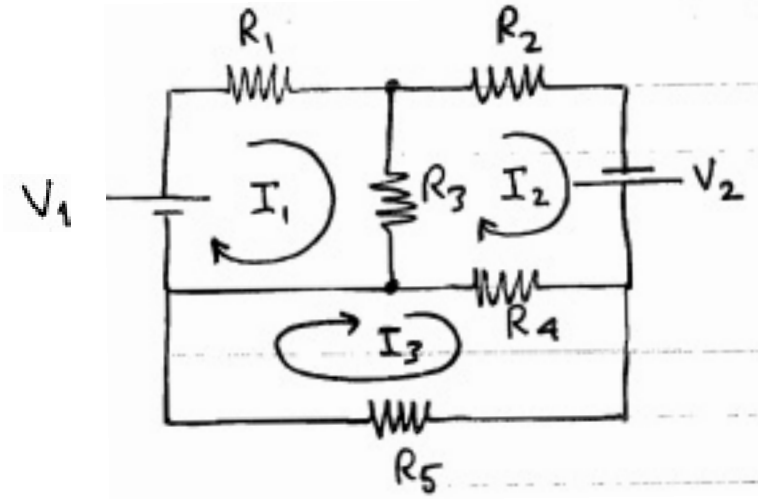
Solución del Parcial.

1.-



Malla 1:

$$V_1 - I_1 R_1 - I_1 R_3 + I_2 R_3 = 0$$
$$V_1 - I_1 (R_1 + R_3) + I_2 R_3 = 0$$
$$V_1 = I_1 (R_1 + R_3) - I_2 R_3$$

Malla 2:

$$V_2 - I_2 R_4 - I_2 R_3 - I_2 R_2 + I_1 R_3 + I_3 R_4 = 0$$
$$V_2 - I_2 (R_4 + R_3 + R_2) + I_1 R_3 + I_3 R_4 = 0$$
$$V_2 = -I_1 R_3 + I_2 (R_4 + R_3 + R_2) - I_3 R_4$$

Malla 3:

$$-I_3 R_4 - I_3 R_5 + I_2 R_4 = 0$$
$$-I_3 (R_4 + R_5) + I_2 R_4 = 0$$
$$-I_2 R_4 + I_3 (R_4 + R_5) = 0$$

$$\begin{bmatrix} V_1 \\ V_2 \\ 0 \end{bmatrix} = \begin{bmatrix} R_1 + R_3 & -R_3 & 0 \\ -R_3 & R_4 + R_3 + R_2 & -R_4 \\ 0 & -R_4 & R_4 + R_5 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix}$$

$$\begin{bmatrix} 10V \\ 20V \\ 0 \end{bmatrix} = \begin{bmatrix} 7K\Omega & -2K\Omega & 0 \\ -2K\Omega & 9K\Omega & -4K\Omega \\ 0 & -4K\Omega & 6K\Omega \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix}$$

Resolviendo el sistema de ecuaciones

$I_1 = 2.58\ mA$
$I_2 = 3.98\ mA$
$I_3 = 2.67\ mA$

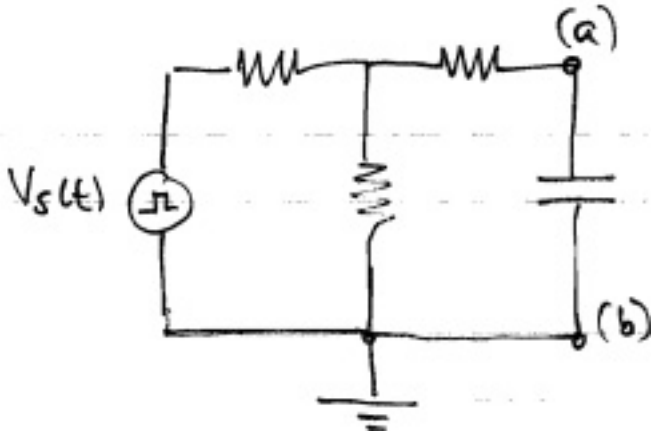
Elemento	Potencia
V_1	$+25.8\ mW$
V_2	$+79.6\ mW$
R_1	$-33.28\ mW$
R_2	$-47.52\ mW$
R_3	$-3.92\ mW$
R_4	$-6.86\ mW$
R_5	$-14.26\ mW$

$+ \equiv$ "Potencia Entregada"
$- \equiv$ " " Disipada"

Balance de Potencia (Redondeando decimales)

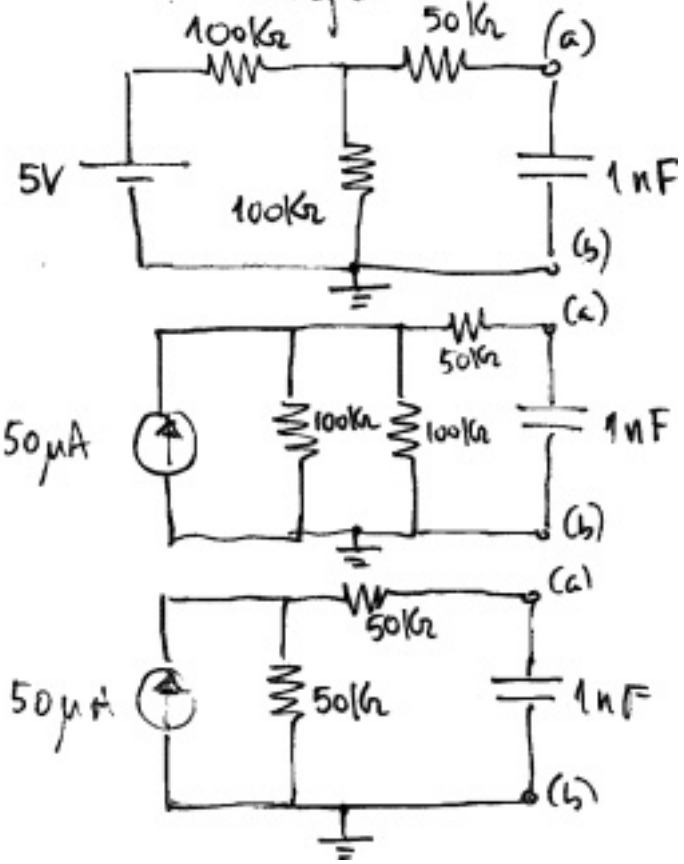
$26\ mW + 80\ mW = 33\ mW + 48\ mW + 4\ mW + 7\ mW + 14\ mW$
$106\ mW = 106\ mW$

2.

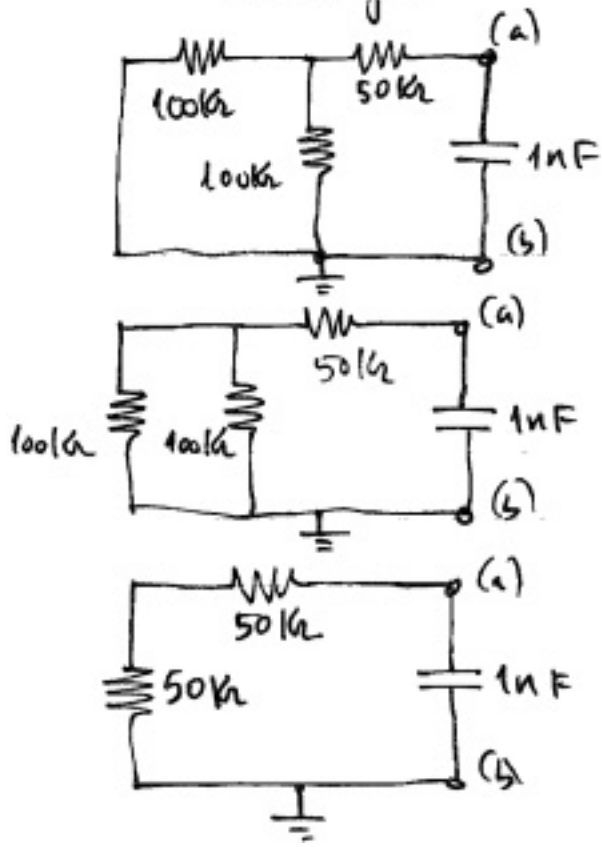


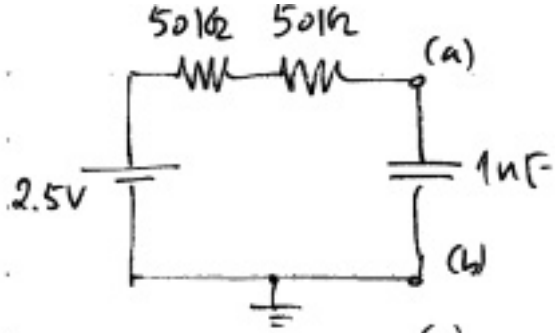
Simplificamos el circuito utilizando Thévenin.

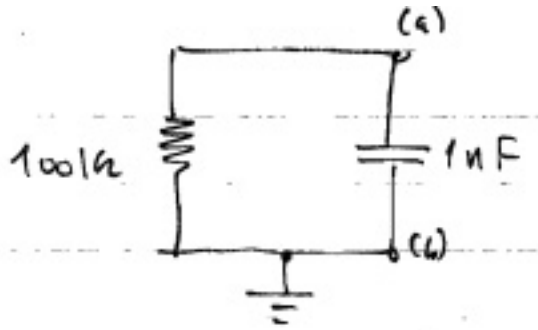
Circuito de Carga

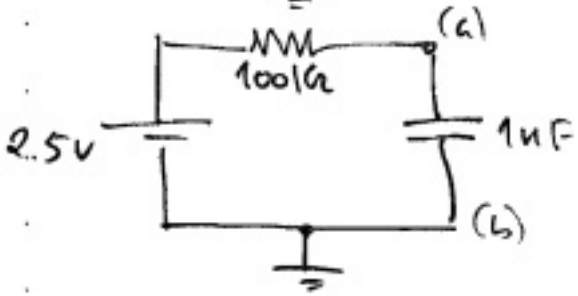


Circuito de Descarga









$$V_c(t) = E\,e^{-t/RC}$$

$$I_c(t) = -\frac{E}{R}\,e^{-t/RC}$$

$$V_c(t) = E\,(1 - e^{-t/RC})$$

$$I_c(t) = \frac{E}{R}\,e^{-t/RC}$$

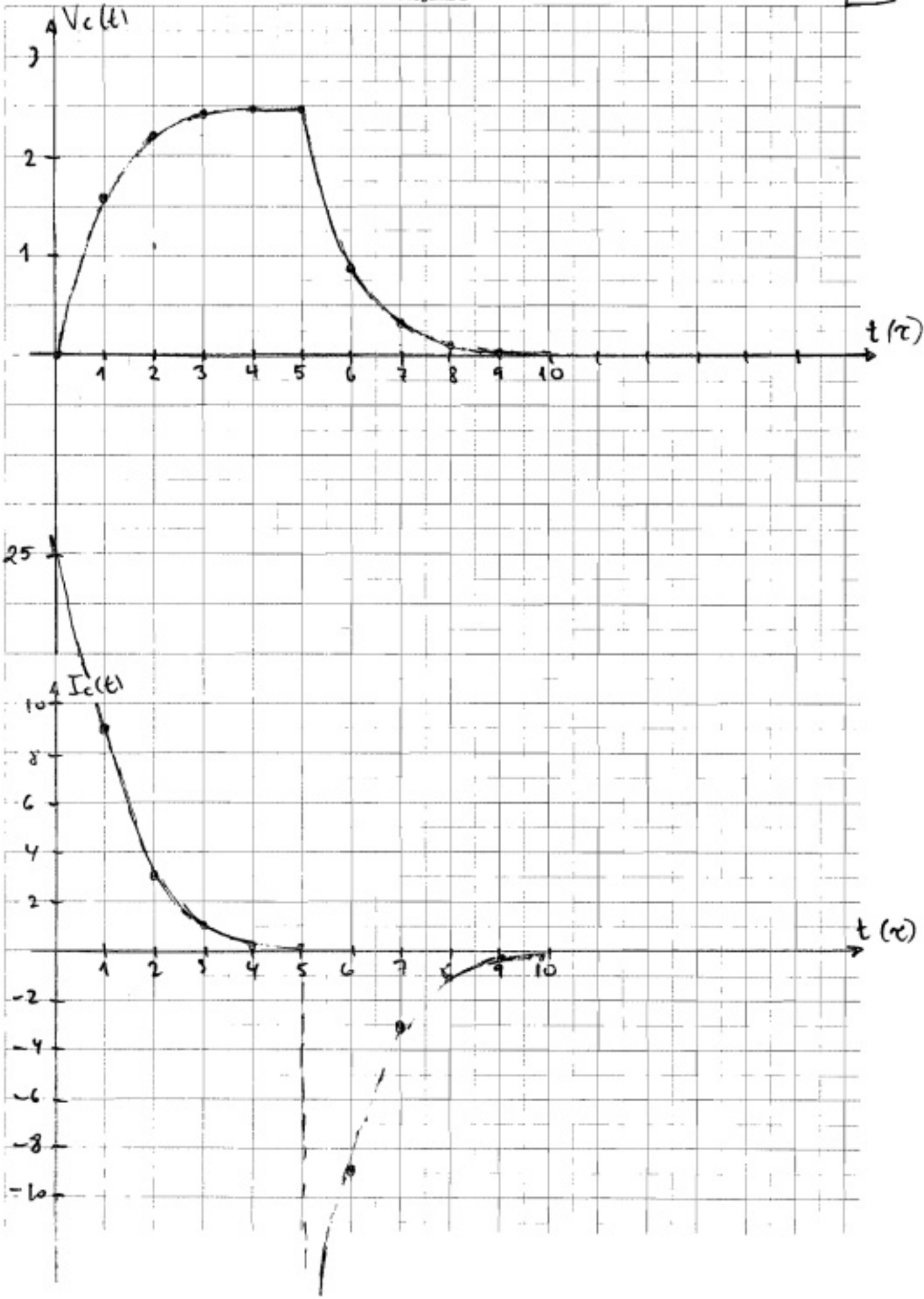
<s>	<V>	<μA>	<V>	<μA>
t	V_c	I_c	V_c	I_c
1τ	1.58	9.2	0.92	-9.2
2τ	2.16	3.4	0.34	-3.4
3τ	2.38	1.2	0.12	-1.2
4τ	2.45	0.5	0.05	-0.5
5τ	2.48	0.2	0.02	-0.2
	carga		descarga	

$f = 1\,KHz \Rightarrow T = 1\,ms \Rightarrow T/2 = 500\,\mu s$

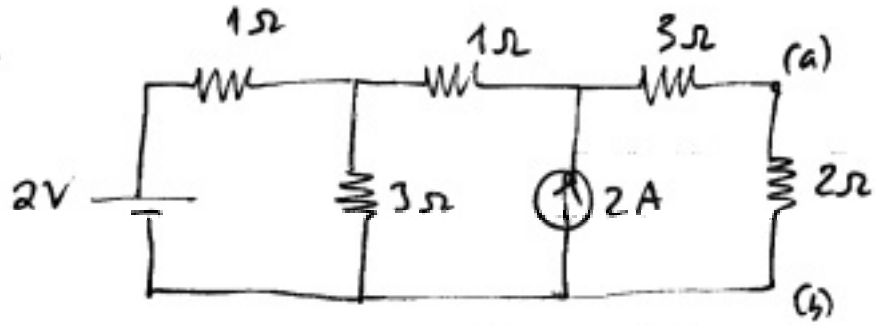
$\tau = RC \Rightarrow \tau = 100\,\mu s \Rightarrow 5\tau = 500\,\mu s$

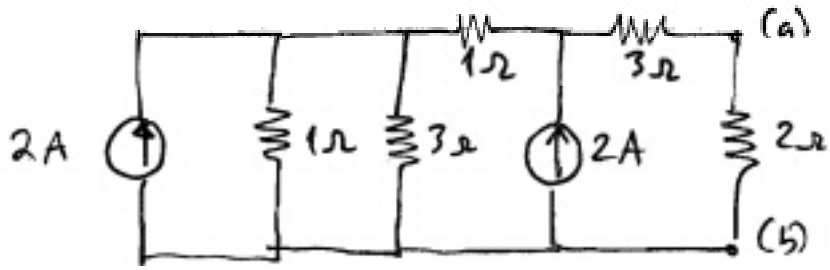
5

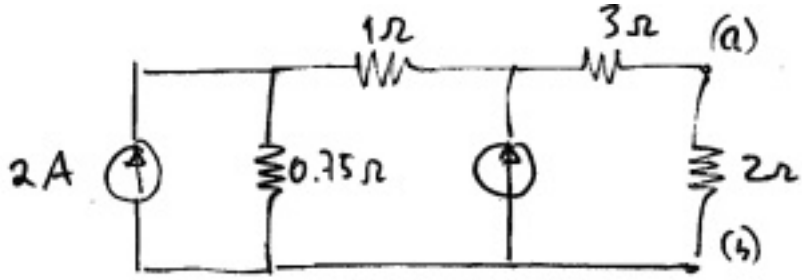
Pregunta 2

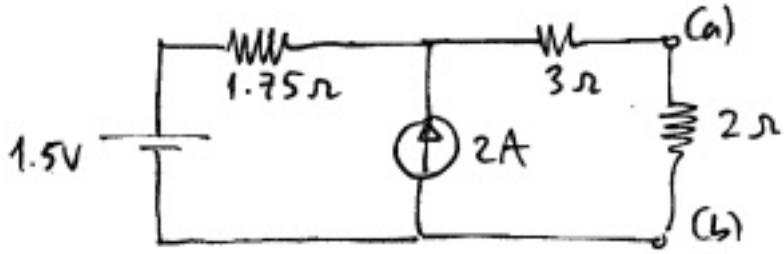


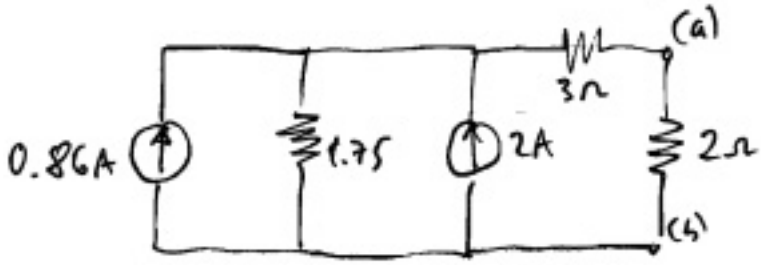
3.-

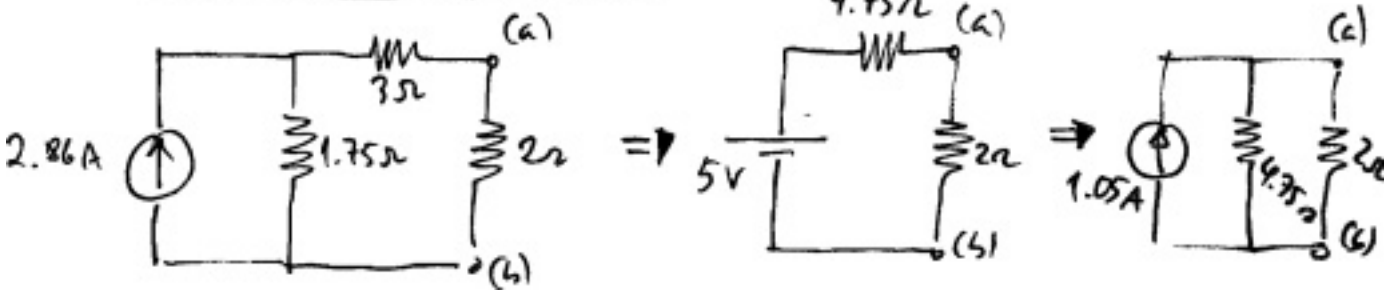

1Ω
1Ω
3Ω
(a)
2V
3Ω
2A
2Ω
(b)


(a)
1Ω
3Ω
2A
1Ω
3Ω
2A
2Ω
(b)

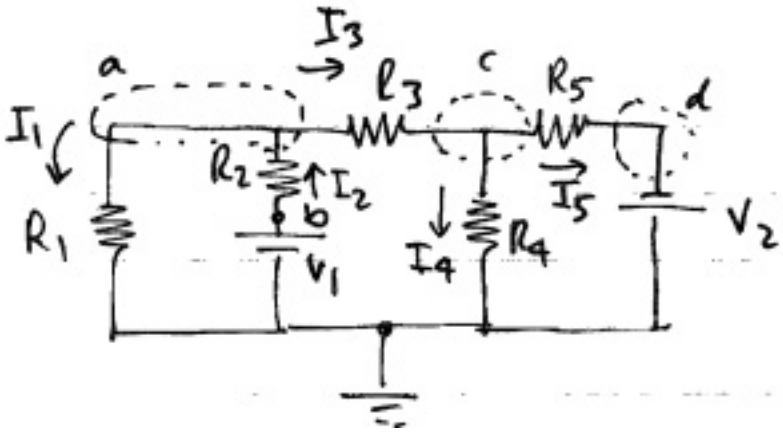

1Ω
3Ω
(a)
2A
0.75Ω
2Ω
(b)


(a)
1.75Ω
3Ω
1.5V
2A
2Ω
(b)


(a)
3Ω
0.86A
1.75
2A
2Ω
(b)


(a)
3Ω
2.86A
1.75Ω
2Ω
(b)
4.75Ω
(a)
5V
2Ω
(b)
(a)
1.05A
4.75Ω
2Ω
(b)

4-



$$I_1 = \frac{V_a}{R_1}$$

$$I_2 = \frac{V_b - V_a}{R_2}$$

$$I_3 = \frac{V_a - V_c}{R_3}$$

$$I_4 = \frac{V_c}{R_4}$$

$$I_5 = \frac{V_c - V_d}{R_5}$$

$$V_b = V_1$$

$$V_d = -V_2$$

$$I_2 = I_1 + I_3$$

$$I_3 = I_4 + I_5$$

$$\frac{V_1 - V_a}{R_2} = \frac{V_a}{R_1} + \frac{V_a - V_c}{R_3}$$

$$\frac{V_1}{R_2} = \frac{V_a}{R_1} + \frac{V_a}{R_2} + \frac{V_a}{R_3} - \frac{V_c}{R_3}$$

(I) $$\boxed{\frac{V_1}{R_2} = V_a\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right) - \frac{V_c}{R_3}}$$

$$\frac{V_a - V_c}{R_3} = \frac{V_c}{R_4} + \frac{V_c + V_2}{R_5}$$

$$\frac{V_a}{R_3} - \frac{V_c}{R_3} = \frac{V_c}{R_4} + \frac{V_c}{R_5} + \frac{V_2}{R_5}$$

(II) $$\boxed{\frac{V_2}{R_5} = \frac{V_a}{R_3} - V_c\left(\frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5}\right)}$$

(I) $$5A = V_a \frac{8}{10} - \frac{V_c}{10}$$

(II) $$25A = \frac{V_a}{10} - V_c \frac{68}{80}$$

$V_a = 2.61\ V$

$V_b = -29.1\ V$

$I_1 = 1.30\ A$

$I_2 = 10.45\ A$

$I_3 = 3.17\ A$