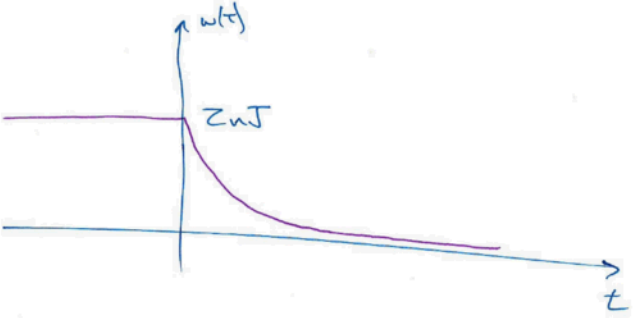
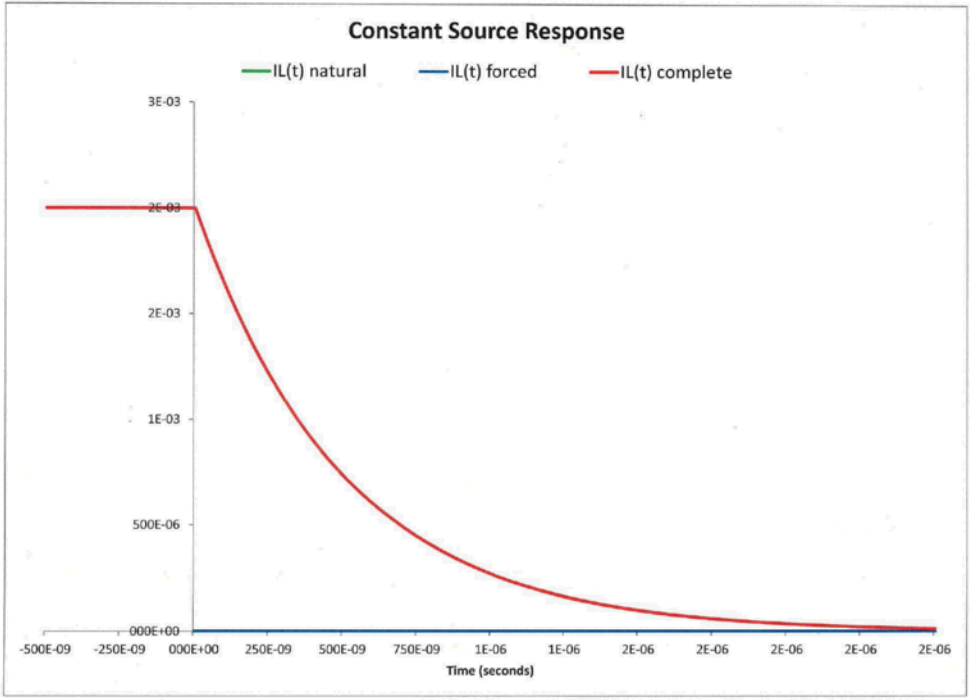
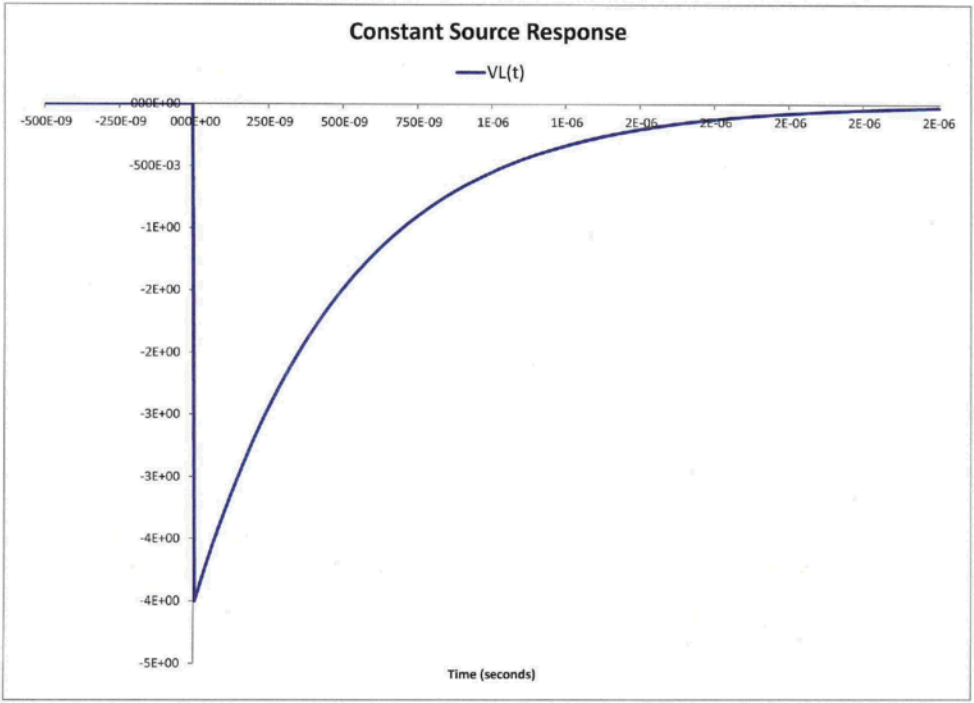
$$w(t) = \frac{1}{2} L i_L^2(t)$$

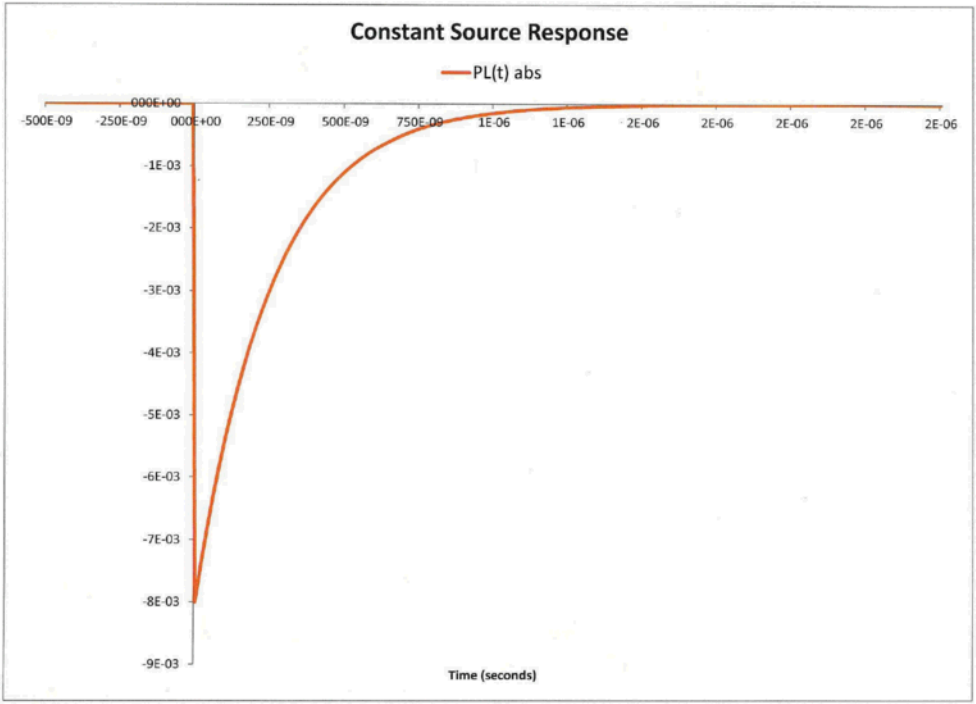
$$= \frac{.001}{2} \left(.002 e^{-2\times10^6 t}\right)^2$$

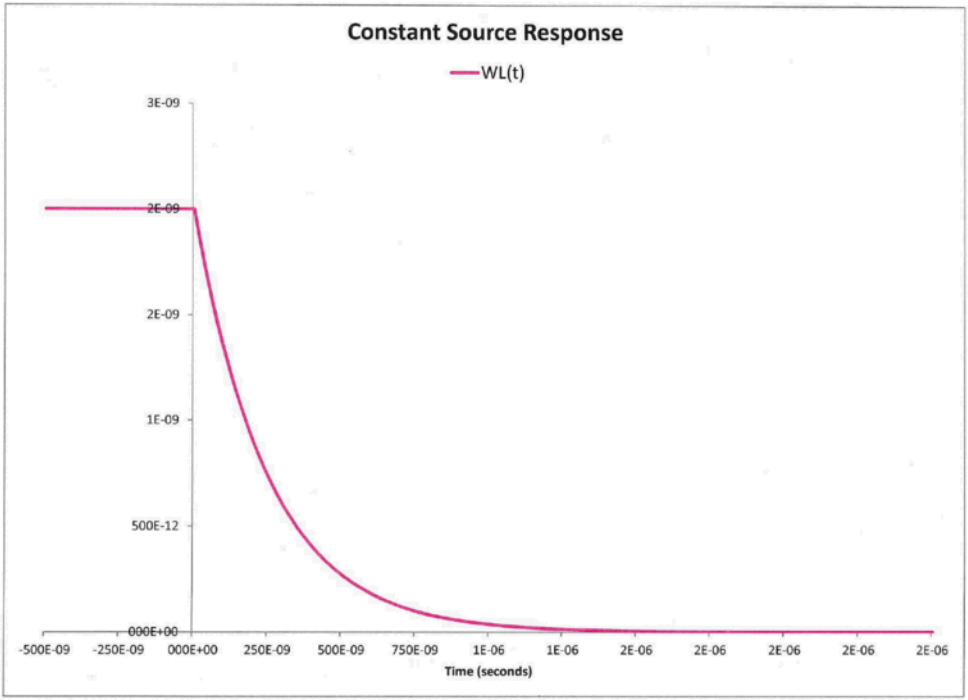
$$= 2\times10^{-9} e^{-4\times10^6 t} \quad J$$



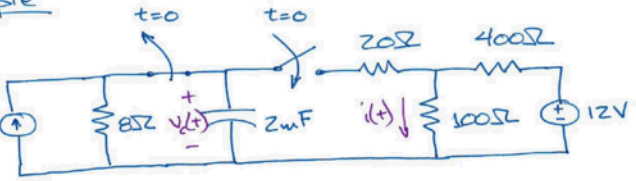

Constant Source Response
IL(t) natural
IL(t) forced
IL(t) complete
3E-03
2E-03
2E-03
1E-03
500E-06
000E+00
-500E-09
-250E-09
000E+00
250E-09
500E-09
750E-09
1E-06
1E-06
2E-06
2E-06
2E-06
2E-06
2E-06
Time (seconds)


Constant Source Response
VL(t)
000E+00
-500E-09
-250E-09
000E+00
250E-09
500E-09
750E-09
1E-06
1E-06
2E-06
2E-06
2E-06
2E-06
2E-06
-500E-03
-1E+00
-2E+00
-2E+00
-3E+00
-3E+00
-4E+00
-4E+00
-5E+00
Time (seconds)


Constant Source Response
PL(t) abs
000E+00
-500E-09
-250E-09
000E+00
250E-09
500E-09
750E-09
1E-06
1E-06
2E-06
2E-06
2E-06
2E-06
2E-06
-1E-03
-2E-03
-3E-03
-4E-03
-5E-03
-6E-03
-7E-03
-8E-03
-9E-03
Time (seconds)


Constant Source Response
WL(t)
3E-09
2E-09
2E-09
1E-09
500E-12
000E+00
-500E-09
-250E-09
000E+00
250E-09
500E-09
750E-09
1E-06
1E-06
2E-06
2E-06
2E-06
2E-06
2E-06
Time (seconds)

Exawple

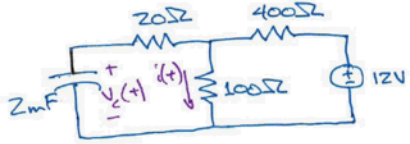


Determine $i(t)$.

- Determine the initial condition for the capacitor voltage $v_c(0)$.

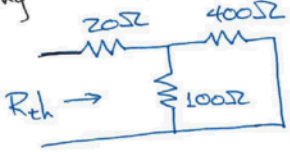
$$V_c(0) = 1A(8\Omega) = 8V$$

- After the switches are thrown the circuit is:

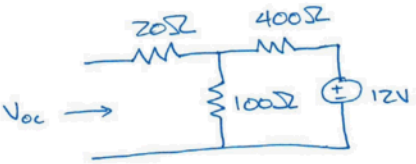


$$V_c(0) = 8V$$

- Find the Thevenin equivalent of the circuit facing the capacitor.

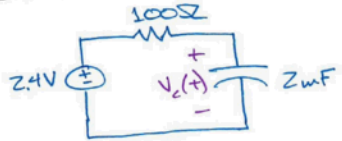


$$R_{th} = 20 + 100 \| 400$$
$$= 20 + 80$$
$$= 100\Omega$$



$$V_{oc} = \frac{100}{100+400}(12V)$$
$$= 2.4V$$

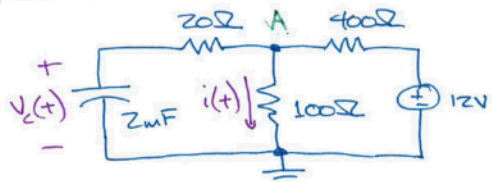
- So our circuit is:



$V_{oc} = 2.4V$
$R = 100\Omega$
$C = 2mF$
$\tau = RC = 0.2\,sec$
$v_c(0) = 8V$

$$v_c(t) = V_{oc} + [v_c(0) - V_{oc}]e^{-t/\tau}$$
$$= 2.4 + (8-2.4)e^{-t/.2}$$
$$= 2.4 + 5.6e^{-5t}\ V$$

- Now to find $i(t)$



Write a KCL equation at Node A:

$$\frac{v_c(t) - v_a(t)}{20} + \frac{12 - v_a(t)}{400} = \frac{v_a(t)}{100}$$

$$20\{v_c(t) - v_a(t)\} + 12 - v_a(t) = 4v_a(t)$$

$$20v_c(t) - 20v_a(t) + 12 - v_a(t) = 4v_a(t)$$

$$v_a(t) = \frac{20v_c(t) + 12}{25}$$

$$i(t) = \frac{v_a(t)}{100}$$

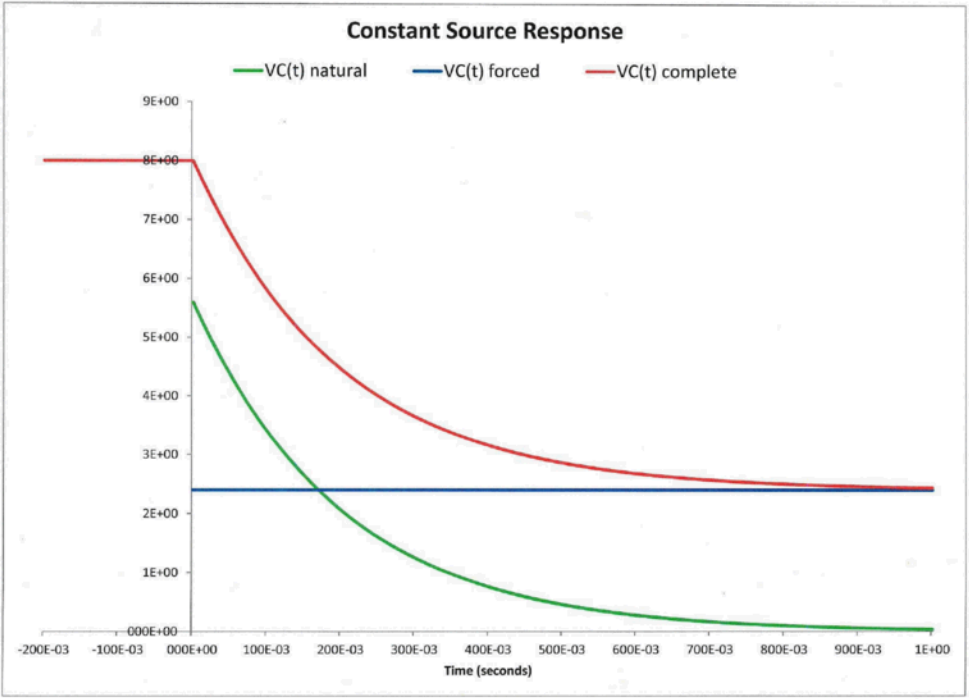
$$= \frac{20v_c(t) + 12}{25 \cdot 100}$$

$$= .008v_c(t) + .0048$$

$$= .008\{2.4 + 5.6e^{-5t}\} + .0048$$

$$= .024 + .0448e^{-5t} \text{ A}$$

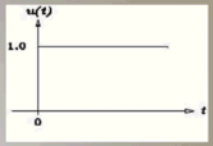
$$= \underline{24 + 44.8e^{-5t} \text{ mA}}$$


Constant Source Response
VC(t) natural
VC(t) forced
VC(t) complete
9E+00
8E+00
7E+00
6E+00
5E+00
4E+00
3E+00
2E+00
1E+00
000E+00
-200E-03
-100E-03
000E+00
100E-03
200E-03
300E-03
400E-03
500E-03
600E-03
700E-03
800E-03
900E-03
1E+00
Time (seconds)

Unit Step Function

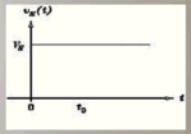
- Unit Step Function

$$u(t) = \begin{cases} 0 & \text{for } t < 0 \\ 1 & \text{for } t \geq 0 \end{cases}$$



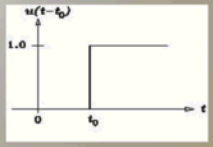
- Step Voltage Source

$$v_S(t) = V_S u(t) = \begin{cases} 0 & \text{for } t < 0 \\ V_S & \text{for } t \geq 0 \end{cases}$$



- Unit Step Function for $t_0 \neq 0$

$$u(t - t_0) = \begin{cases} 0 & \text{for } t < t_0 \\ 1 & \text{for } t \geq t_0 \end{cases}$$



- Step Voltage Source for $t_0 \neq 0$

$$v_S(t) = V_S u(t - t_0) = \begin{cases} 0 & \text{for } t < t_0 \\ V_S & \text{for } t \geq t_0 \end{cases}$$