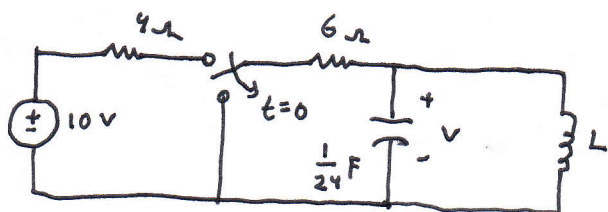
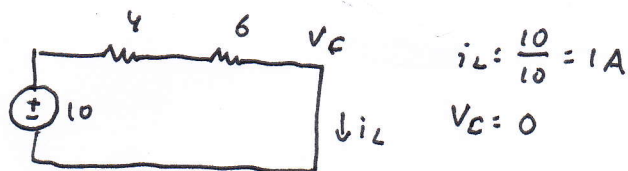


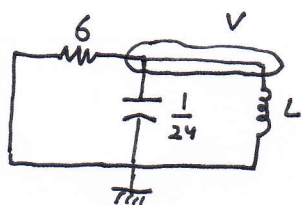
9.12 The circuit is in steady state at  $t=0^-$ . Find  $v$  for  $t>0$  if  $L$  is (a)  $8\text{H}$ , (b)  $6\text{H}$  and (c)  $4.8\text{H}$



Circuit at  $t=0^-$



Circuit at  $t=0^+$



node  $V$ :

$$\frac{V}{6} + \frac{1}{24} \frac{dV}{dt} + \frac{1}{L} \int V + k = 0 \quad \times 24$$

$$4V + \frac{dV}{dt} + \frac{24}{L} \int V + k = 0$$

differential

$$4 \frac{dV}{dt} + \frac{d^2 V}{dt^2} + \frac{24}{L} V = 0 \quad \dots (1)$$

$$i_L = -\frac{V}{6} - \frac{1}{24} \frac{dV}{dt} \quad \dots (2)$$

transformasi (1):

$$s^2 + 4s + \frac{24}{L} = 0$$

(a) if  $L=8$ :

$$s^2 + 4s + 3 = 0$$

$$(s+3)(s+1) = 0$$

$$V = A_1 e^{-3t} + A_2 e^{-t}$$

$$i_L = -\frac{A_1}{6} e^{-3t} - \frac{A_2}{6} e^{-t}$$

$$= -\frac{1}{24} \cdot -3A_1 e^{-3t} - \frac{1}{24} \cdot -A_2 e^{-t}$$

$$i_L = -\frac{A_1}{6} e^{-3t} - \frac{A_2}{6} e^{-t} + \frac{1}{8} A_1 e^{-3t} + \frac{A_2}{24} e^{-t}$$

at  $t=0$ :

$$V = V_C = 0 = A_1 + A_2$$

$$i_L = 1 = -\frac{A_1}{6} - \frac{A_2}{6} + \frac{A_1}{8} + \frac{A_2}{24} \quad \times 24$$

$$\begin{aligned} A_1 + A_2 &= 0 \\ -4A_1 - 4A_2 + 3A_1 + A_2 &= 24 \end{aligned}$$

$$\begin{aligned} A_1 + A_2 &= 0 \\ -A_1 - 3A_2 &= 24 \\ -2A_2 &= 24 \\ A_2 &= -12 \\ A_1 &= 12 \end{aligned}$$

$$\therefore V = 12 e^{-3t} - 12 e^{-t}$$

(b) if  $L=6$ :

$$s^2 + 4s + 4 = 0$$

$$(s+2)(s+2) = 0$$

$$V = (A_1 + A_2 t) \cdot e^{-2t}$$

$$i_L = -\frac{A_1}{6} e^{-2t} - \frac{A_2 t}{6} e^{-2t} - \frac{1}{24} [A_2 e^{-2t} + -2(A_1 + A_2 t) e^{-2t}]$$

at  $t=0$ :

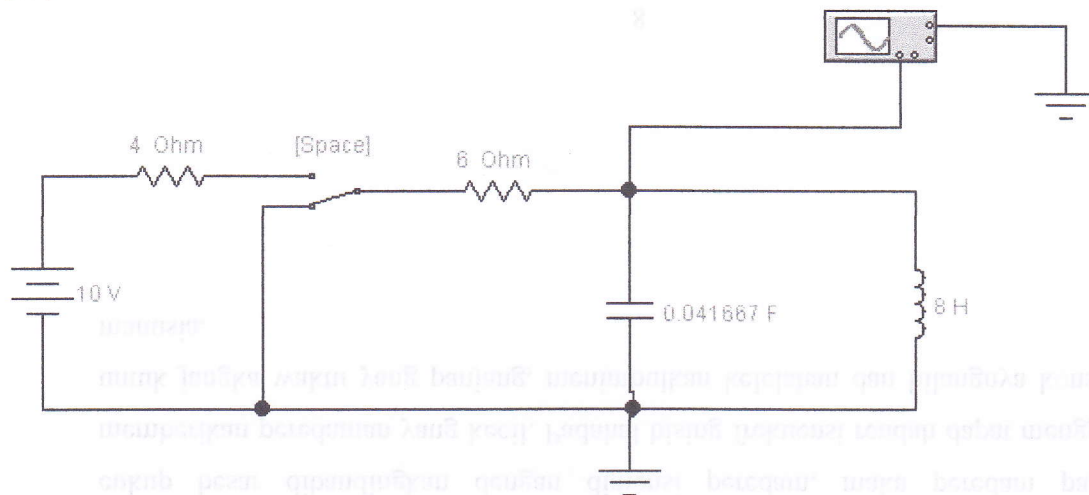
$$V = V_C = 0 = A_1$$

$$i_L = 1 = -\frac{A_2}{24} \Rightarrow A_2 = -24$$

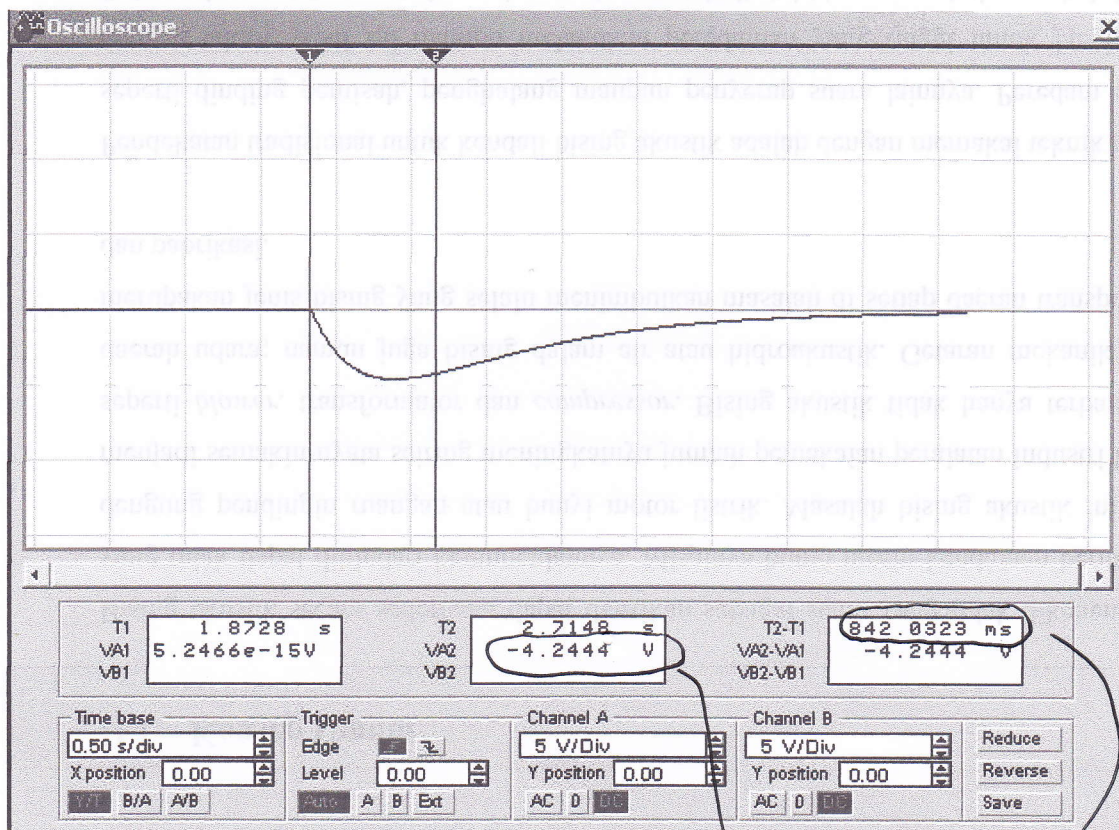
$$V = -24t \cdot e^{-2t}$$

Using EWB for solving Problem 9.12 a

EWB



Example EWB Simulation



from analysis:

at  $t = 842,0323 \text{ ms}$   
 $V = -4,2444 \text{ V}$

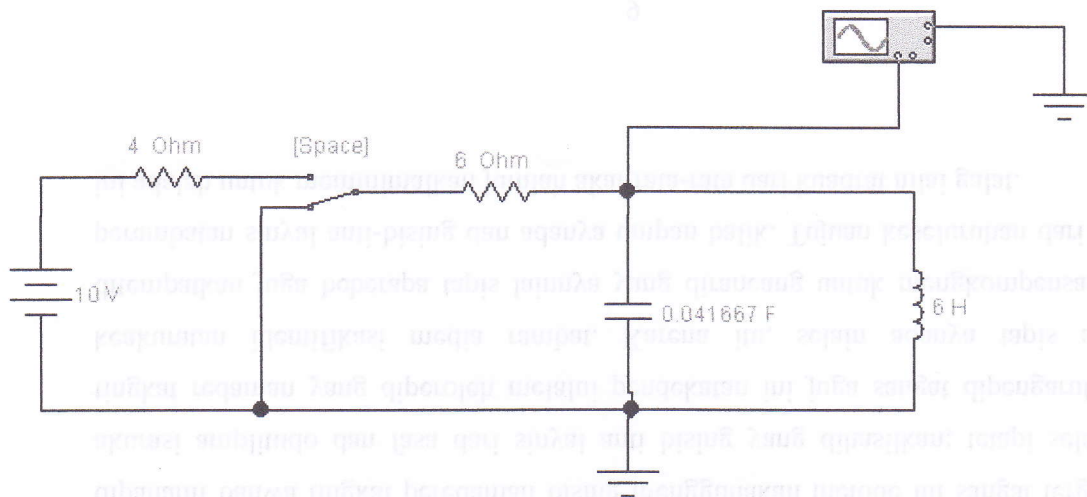
$$\text{at } t = 0,842, V = 12 \cdot e^{-3 \cdot 0,842} - 12 \cdot e^{-0,842}$$

$$= -4,2104$$

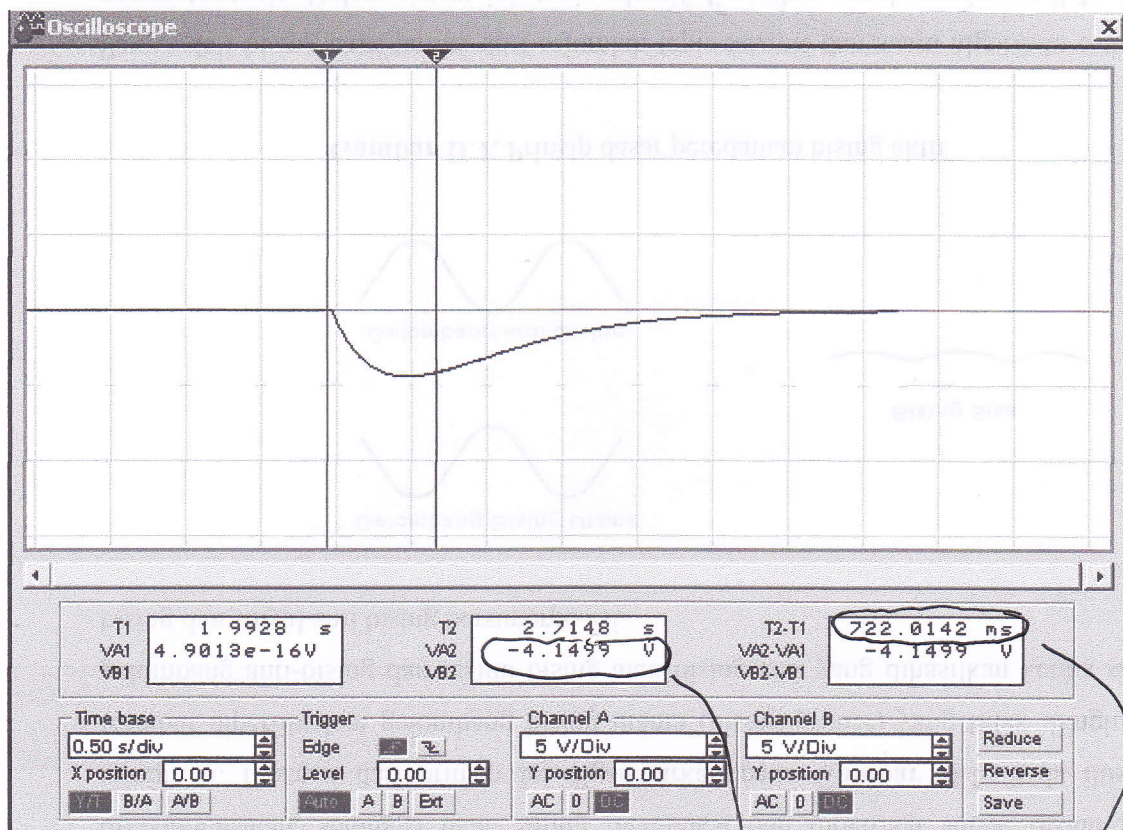


Using EWB for solving Problem 9.12 b

EWB



Example EWB Simulation



from analysis:

at  $t = 0.722$ ,  $V = -24.0722 \cdot e^{-2.0722}$   
 $= -4.08906$

at  $t = 722.0142 \text{ ms}$   
 $V = -4.1499 \text{ V}$