Signature

Name (print, please)

Student No.

ECE 2300 Circuit Analysis
Summer 2009

Quiz 6

DO NOT OPEN THIS QUIZ BOOKLET UNTIL INSTRUCTED TO DO SO

This quiz has 4 pages including this cover page. If you are missing any pages, raise your hand. You have 30 minutes to complete the quiz.

Notes

1. Be sure your name and signature appear above.
2. The quiz is closed-book. You may have a calculator and one 8 ½ " x 11" crib sheet.
3. To receive full credit for a problem, you must:

- Show all work necessary to solve the problem;
- Define all variables and parameters and label them on circuit diagrams;
- Use the proper notation for all variables.
- Show all units explicitly in intermediate and final results;
- Indicate clearly whether power being calculated is absorbed or delivered;

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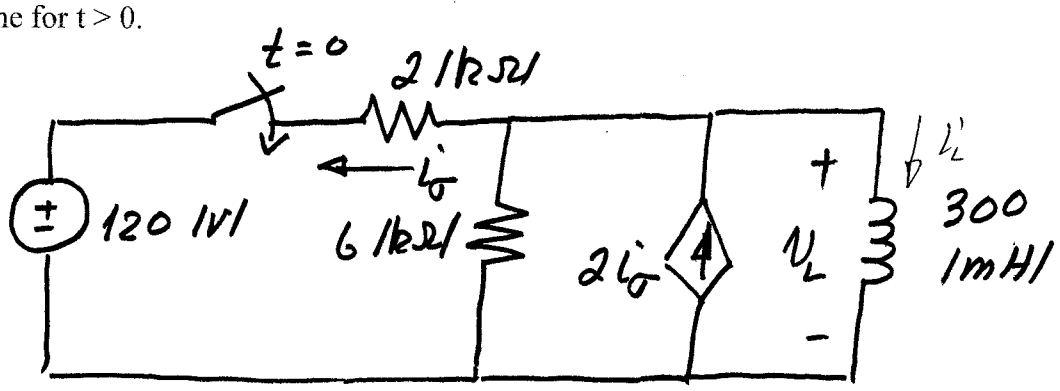
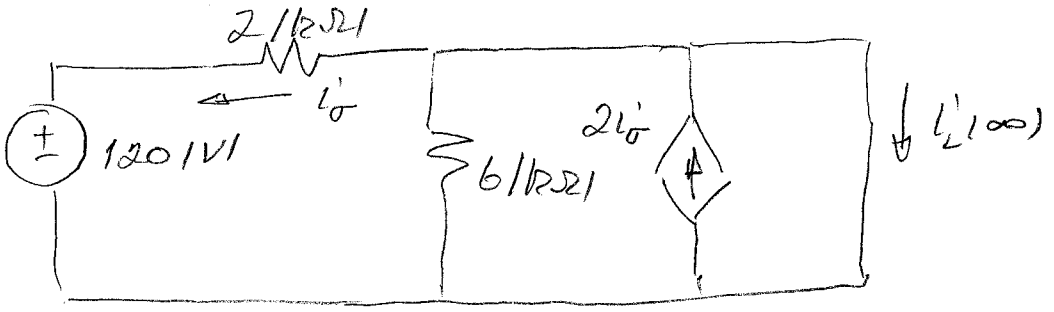
The switch in the circuit shown was open for a long time, and then closed at t = 0. Find the voltage v_L as a function of time for t > 0.



$i_L(0^-) = i_L(0^+) = 0$

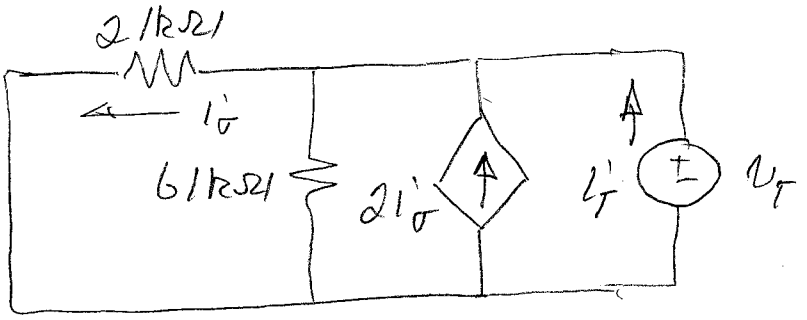
$i_L(\infty)$: Set L to a short:



$$i_\sigma = -\frac{120}{2000} = -60 \text{ mA}$$

$$i_L(\infty) = 2i_\sigma - i_\sigma = -60 \text{ mA}.$$

R_{th}:



Room for Extra Work

$$i_0' = \frac{v_T}{2000} \qquad i_T' = -2i_0' + i_0' + \frac{v_T}{6000}$$

$$= -\frac{v_T}{2000} + \frac{v_T}{6000}$$

$$= v_T\left(-\frac{1}{2000} + \frac{1}{6000}\right)$$

$$\therefore R_{Th} = \frac{v_T}{i_T'} = -3\ |k\Omega|$$

So $$\tau_L = L/R_{Th} = -10^{-4}\ |s|$$

$$i_L'(t) = i_L'(\infty) + [i_L'(0) - i_L'(\infty)]\, e^{t/10^{-4}}\ |A| \quad t \geq 0\ |s|$$

$$= -60\,(1 - e^{t/10^{-4}})\ |mA| \quad t \geq 0\ |s|$$

$$v_L(t) = L\frac{di_L'}{dt} = 0.3\left[60\times10^{-3}\cdot\frac{1}{10^{-4}}\right]e^{t/10^{-4}}\ |V| \quad t > 0\ |s|$$

$$\boxed{v_L(t) = 180\, e^{t/10^{-4}}\ |V| \quad t > 0\ |s|}$$