

Name: SOLUTION (please print)

Signature: _____

ECE 2300 – Quiz #1
June 16, 2016

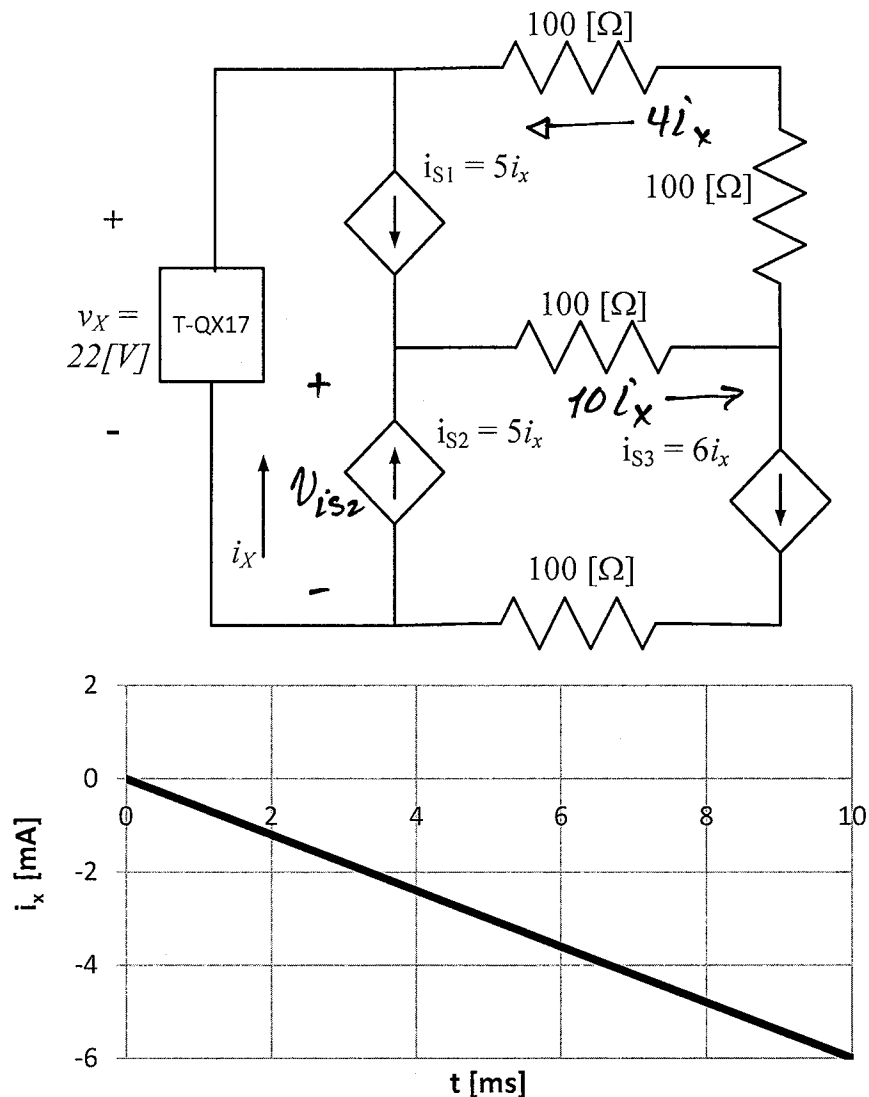
Keep this quiz closed and face up until you are told to begin.

1. This quiz is closed book, closed notes. You may use one 8.5" x 11" crib sheet, or its equivalent.
2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
4. If the grader has difficulty following your work because it is messy or disorganized, you will lose credit.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz.

40 /40

A revolutionary new device called the Trombettamax QX-17 (T-QX17 for short) is inserted into the circuit below. It generates a fixed voltage $v_X = 22$ [V] and a current i_X that changes with time as shown in the graph.

- Find an expression for the power delivered by the source i_{S2} .
- Find the energy delivered by i_{S2} over the time period 4 [ms] to 5 [ms].



We start by noting that using KCL, we know all the branch currents in terms of i_X . The missing currents are labeled on the diagram.

Now, a judicious choice of KVL allows us to find $v_{i_{S2}}$ directly, in terms of i_X :

Room for extra work

$$\begin{aligned} \text{KVL: } V_{i's_2} &= 1000 i'_x + 800 i'_x + 22 \\ &= 1800 i'_x + 22 \quad [\text{V}] \end{aligned}$$

By inspection of the graph:

$$i'_x(t) = -\frac{6}{10} \left[\frac{\text{mA}}{\text{ms}} \right] t = -0.6 \left[\frac{\text{A}}{\text{s}} \right] t \quad t \text{ in } [\text{s}]$$

So...

$$P_{\text{del by } i's_2}(t) = +(1800(-0.6t) + 22) \cdot 5(-0.6t) \quad [\text{W}] \quad t \text{ in } [\text{s}]$$

a)

$$P_{\text{del by } i's_2}(t) = -66t + 3240t^2 \quad [\text{W}] \quad t \text{ in } [\text{s}]$$

b)

$$\begin{aligned} W_{\text{del by } i's_2} &= \int_{4 \times 10^{-3} [\text{s}]}^{5 \times 10^{-3} [\text{s}]} (-66t + 3240t^2) dt \\ &= -231.11 \quad [\mu\text{J}] \end{aligned}$$