Name: _____ (please print)

Signature: _____

ECE 2300 – Quiz #2
June 23, 2016

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

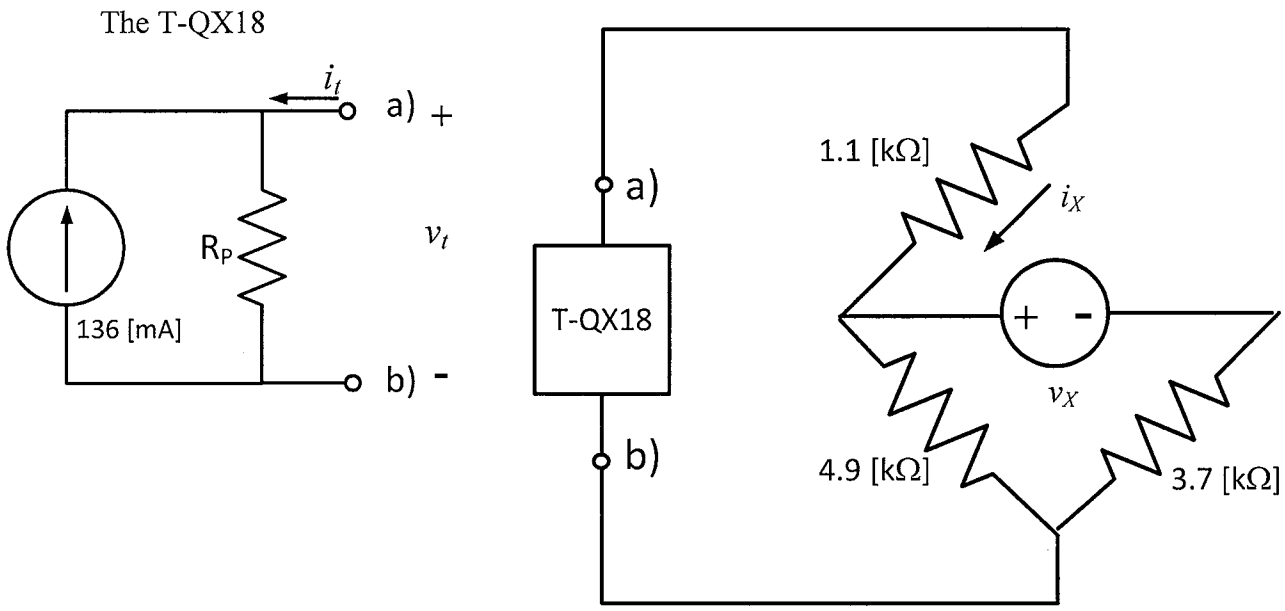
1. This quiz is closed book, closed notes. You may use one 8.5" x 11" crib sheet, or its equivalent.
2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order 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 35 minutes to work on this quiz.

_____/40

Room for extra work

A newly released version of the Trombettamax, called the T-QX18, can be modeled by a current source in parallel with a resistor, as shown in the figure on the left. It is inserted into the circuit on the right, connecting terminals a) and b) as shown.

When the voltage source $v_X = 12$ [V], the current $i_X = -14.81$ [mA]. Find the power delivered by the T-QX18 when $v_X = -12$ [V].



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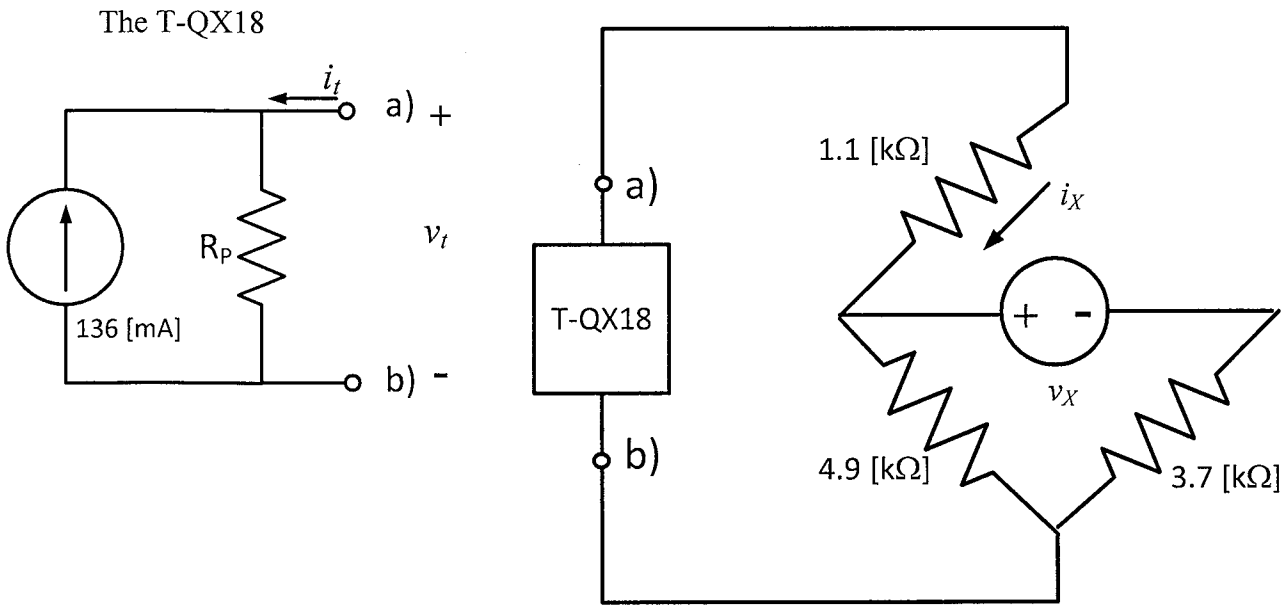
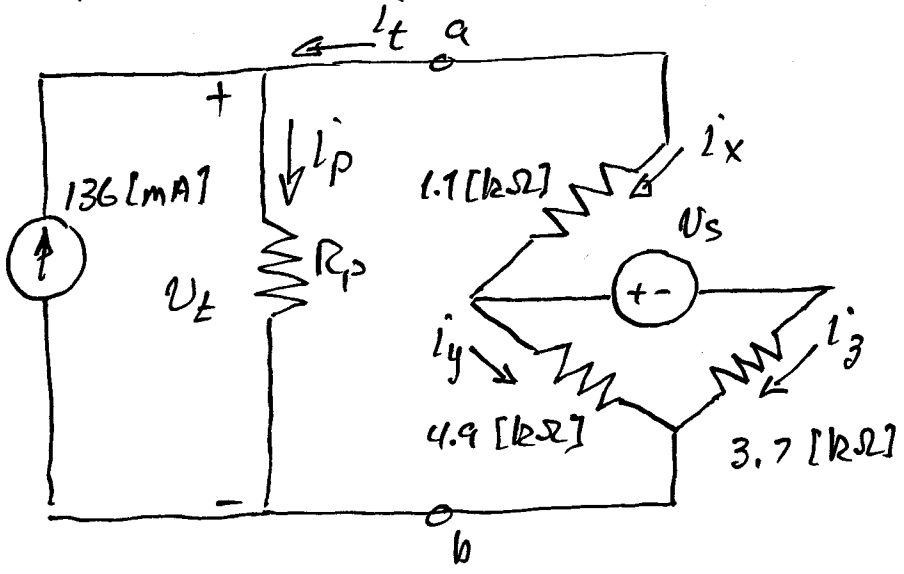


We will need to find R_P. Let's re-draw with the circuit model in place.



I have also identified the terminal voltage v_t and current i_t.

Room for extra work

KCL says $i'_x = -0.01481 = i'_y + i'_z$

KVL: $v_s = 12\,[V] \Rightarrow 12 + 3700\,i'_z - 4900\,i'_y = 0$

Solve: $i'_y = -4.976\,[mA]$ $\quad i'_z = -9.833\,[mA]$

KVL: $v_t = 1100\,i'_x + 4900\,i'_y = -40.67\,[V]$

$i'_p = -i'_x + 0.136 = 0.1508\,[A]$

So $R_p = \dfrac{v_t}{i'_p} = -270\,[\Omega]$

Now we change v_s to $-12\,[V]$, and note that power delivered by T-QX18 is $P_{\text{del by QX18}} = -v_t \cdot i'_t$

$$\left.\begin{aligned} i'_x &= i'_y + i'_z \\ -12 + 3700\,i'_z - 4900\,i'_y &= 0 \\ v_t &= 1100\,i'_x + 4900\,i'_y \\ -0.136 - \frac{v_t}{270} + i'_x &= 0 \end{aligned}\right\} \quad \begin{aligned} i'_x &= -10.17\,[mA] \\ i'_y &= -5.771\,[mA] \\ i'_z &= -4.400\,[mA] \\ v_t &= -39.47\,[V] \end{aligned}$$

Also, $i'_t = -i'_x$ so

$$P_{\text{del by QX18}} = v_t \cdot i'_x = (-39.47)(-10.17 \times 10^{-3})$$
$$= 401.4\,[mW]$$