Name: _____ (please print)

Signature: _____

ECE 2201 – Quiz #1 VERSION 1.
September 10, 2019

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.

_____/25

Room for extra work

The Model X-15 Trombetterator is shown connected to a voltage source in the diagram below. It is known that the Trombetterator is absorbing energy as a function of time as follows:

$$w_{abs\ by\ Tr} = 1.875[\mu J] - 1.875[\mu J]e^{-4\left[\frac{1}{ms}\right]t}.$$

It is also know that the voltage source value is

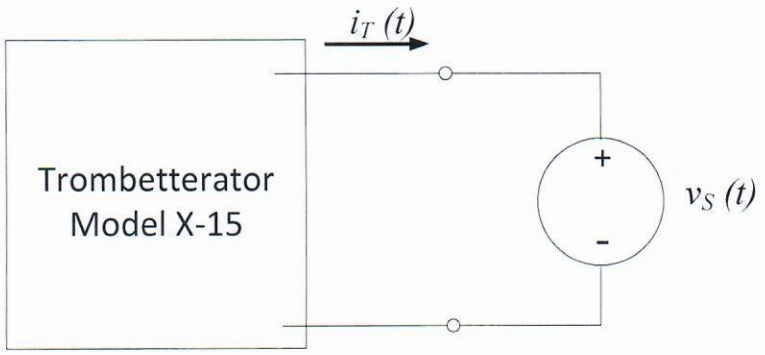
$$v_S = 15[V]e^{-2\left[\frac{1}{ms}\right]t}.$$

a) Find the power delivered by the voltage source as a function of time.

b) How much energy is delivered by the voltage source between 1 and 2.5 [s]?

c) Find the current $i_T(t)$ as a function of time.

d) If charge carriers flowing through this circuit are positive, are they gaining or losing energy as they go through the voltage source?



Room for extra work

Name: _____ (please print)

Signature: _____

ECE 2201 – Quiz #1 VERSION 2.
September 10, 2019

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.

_____/25

Room for extra work

The Model X-15 Trombetterator is shown connected to a voltage source in the diagram below. It is known that the Trombetterator is absorbing energy as a function of time as follows:

$$w_{abs\ by\ Tr} = 07.5[\mu J] - 0.75[\mu J]e^{-6\left[\frac{1}{ms}\right]t} .$$

It is also know that the voltage source value is

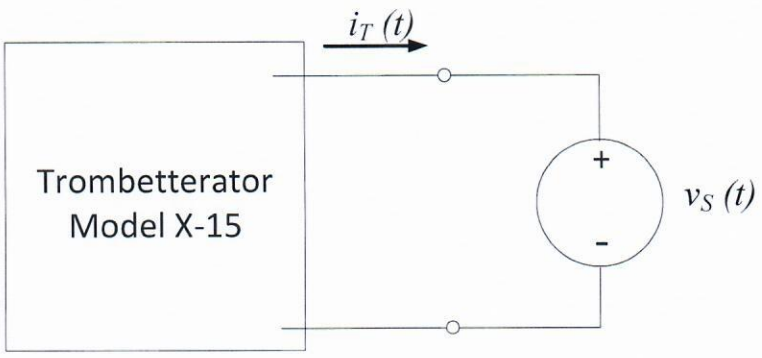
$$v_S = 12[V]e^{-3\left[\frac{1}{ms}\right]t} .$$

a) Find the power delivered by the voltage source as a function of time.

b) How much energy is delivered by the voltage source between 2 and 3.5 [s]?

c) Find the current $i_T(t)$ as a function of time.

d) If charge carriers flowing through this circuit are positive, are they gaining or losing energy as they go through the voltage source?



Room for extra work

The Model X-15 Trombetterator is shown connected to a voltage source in the diagram below. It is known that the Trombetterator is absorbing energy as a function of time as follows:

$$w_{abs\ by\ Tr} = 1.875[\mu J] - 1.875[\mu J]e^{-4\left[\frac{1}{ms}\right]t}.$$

It is also know that the voltage source value is

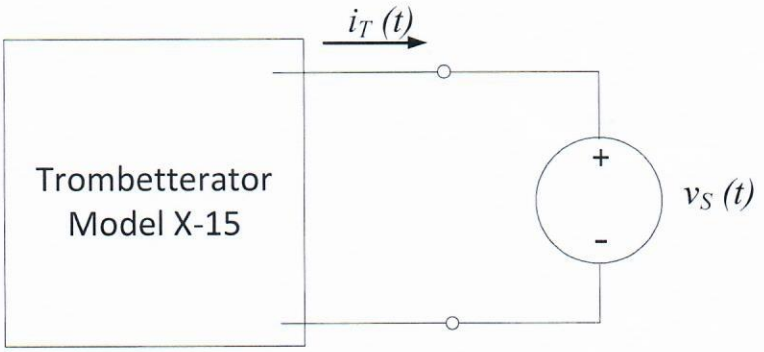
$$v_S = 15[V]e^{-2\left[\frac{1}{ms}\right]t}.$$

a) Find the power delivered by the voltage source as a function of time.

b) How much energy is delivered by the voltage source between 1 and 2.5 [s]?

c) Find the current $i_T(t)$ as a function of time.

d) If charge carriers flowing through this circuit are positive, are they gaining or losing energy as they go through the voltage source?



+8

a) $P_{del\ by\ v_s} = -v_s(t)\,i_T(t) = P_{abs\ by\ Tr} = \frac{d}{dt}[w_{abs\ by\ Tr}]$

$\frac{d}{dt}[w_{abs\ by\ Tr}] = \frac{d}{dt}\left[1.875\,[mJ] - 1.875\,[mJ]\,e^{-4\left[\frac{1}{ms}\right]t}\right]$

$= -4\left[\frac{1}{ms}\right](-1.875\,[mJ])\,e^{-4\left[\frac{1}{ms}\right]t}$

$\therefore \boxed{P_{del\ by\ v_s}(t) = 7.5\,e^{-4\left[\frac{1}{ms}\right]t}\ [mW]}$ t in $[ms]$

Room for extra work

+6

b) $w_{\text{del by } v_s} = w_{\text{abs by } T_r} = \left[1.875\,[\mu J] - 1.875\,[\mu J]\, e^{-4\,[\frac{1}{ms}]\,t} \right]_{1000\,[ms]}^{2500\,[ms]}$

$\approx 0.$

+7

c) $p_{\text{del by } v_s} = -v_s(t)\, i_T(t) = 2.5\, e^{-4\,[\frac{1}{ms}]\,t} \quad [mW]$

$\therefore i_T(t) = \dfrac{-2.5\, e^{-4\,[\frac{1}{ms}]\,t}\ [mW]}{15\, e^{-2\,[\frac{1}{ms}]\,t}\ [V]}$

$i_T(t) = -0.5\, e^{-2\,[\frac{1}{ms}]\,t} \quad [mA]$

+4

d) Power is being delivered by the voltage source, so carriers - whether positive or negative - are gaining energy.

The Model X-15 Trombetterator is shown connected to a voltage source in the diagram below. It is known that the Trombetterator is absorbing energy as a function of time as follows:

$$w_{abs\ by\ Tr} = 07.5[\mu J] - 0.75[\mu J]e^{-6\left[\frac{1}{ms}\right]t}\ .$$

It is also know that the voltage source value is

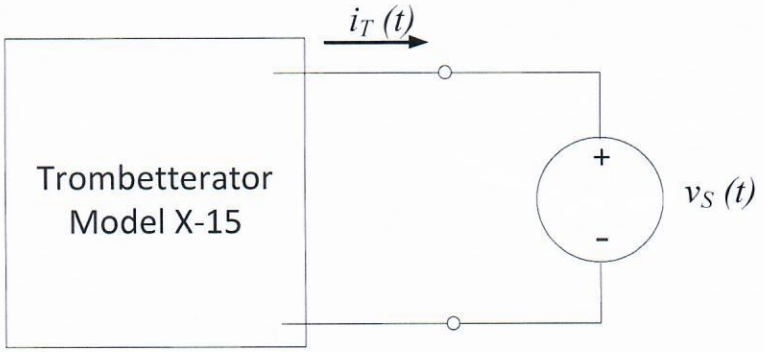
$$v_S = 12[V]e^{-3\left[\frac{1}{ms}\right]t}\ .$$

a) Find the power delivered by the voltage source as a function of time.

b) How much energy is delivered by the voltage source between 2 and 3.5 [s]?

c) Find the current $i_T(t)$ as a function of time.

d) If charge carriers flowing through this circuit are positive, are they gaining or losing energy as they go through the voltage source?



a) $P_{del\ by\ v_s} = -v_s(t)\, i_T(t) = P_{abs\ by\ Tr} = \frac{d}{dt}[w_{abs\ by\ Tr}]$

$\frac{d}{dt}[w_{abs\ by\ Tr}] = \frac{d}{dt}\left[2.5[\mu J] - 0.75[\mu J]\, e^{-6\left[\frac{1}{ms}\right]t}\right]$

$= \left(-6\left[\frac{1}{ms}\right]\right)\left(-0.75[\mu J]\, e^{-6\left[\frac{1}{ms}\right]t}\right)$

+8

$P_{del\ by\ v_s} = 4.5\, e^{-6\left[\frac{1}{ms}\right]t}\ [mW] \quad t\ in\ [ms]$

+6 Room for extra work

b) $w_{del\ by\ v_s} = w_{abs\ by\ R} = \left[2.5\ [\mu J] - 0.25\ [\mu J]\, e^{-6\left[\frac{1}{ms}\right]t} \right]_{2000\ [ms]}^{3500\ [ms]}$

$\approx 0.$

+7

c) $p_{del\ by\ v_s} = -v_s(t)\, i_r(t) = 4.5\, e^{-6\left[\frac{1}{ms}\right]t}$ [mW]

$$\therefore\ i_r(t) = \frac{-4.5\, e^{-6\left[\frac{1}{ms}\right]t}\ [mW]}{12\, e^{-3\left[\frac{1}{ms}\right]t}\ [V]}$$

$$i_r(t) = -0.375\, e^{-3\left[\frac{1}{ms}\right]t}\ [mA]$$

+4

d) Power is being delivered by the voltage source so carriers - whether positive or negative - are gaining energy.