Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (please print)

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ECE 2201 – Quiz #1 – 4pm Section

February 13, 2024

Do not open this quiz until you are told to begin.

1. Print your name, and sign your name, at the top of this page.
2. This quiz is closed book, closed notes. You may use one 8.5” x 11” crib sheet, or its equivalent. You may use a calculator. You should **not** use a cell phone, tablet computer, or laptop computer, as you work on this quiz.
3. Show all work on these pages, and you may use both sides of each page. 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. You may separate the pages as you work.
4. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz.

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Room for extra work

Use the circuit below to solve. The plot of *vA(t)* is shown in Figure 2. The equations for two currents are shown below. The charge carriers are electrons.







1. Find the power absorbed by the battery at t = 5[ms].
2. Find the energy delivered by the battery during the time 5[ms] < t < 10[ms].
3. Which way are the electrons moving through the ammeter at   
   t = 5[ms]? Explain your answer using complete sentences.

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Room for extra work

**Solutions:**

Use the circuit below to solve. The plot of *vA(t)* is shown in Figure 2. The equations for two currents are shown below. The charge carriers are electrons.







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For part a), we need an expression for the power absorbed by the battery. Since *vA* is the voltage across the battery, and *iB* is the current through the battery, and since they are in the active sign relationship for the battery, we can write



We can see that 5[ms] is midway between 0 and 10[ms], on a straight line, for *vA*, so we know that *vA* is midway between 18[V] and 25[V], or 21.5[V]. Thus, we can write



For part b), we need an expression for power delivered by the battery, to insert into the integral,



This time, we need the equation for *vA(t)*. We see that the slope is -7[V]/10[ms], or -700[V/s]. The intercept is 25[V]. Therefore, we have



We plug this integral into our calculator, and we get



For part c), we note that the current *iC* is going from left to right through the ammeter. We know that



So, the value at 5[ms] is



This is a negative value, so the actual polarity of the current is opposite that of the reference polarity, and positive charges would move from right to left. However, the electrons are negatively charged, so

electrons will move from left to right through the ammeter.

There are four versions for the quiz. For the other three versions, there are different denominators in the exponent for the current equations.

Version 2: 

1. 
2. 
3. So, the value at 5[ms] is



This is a negative value, so the actual polarity of the current is opposite that of the reference polarity, and positive charges would move from right to left. However, the electrons are negatively charged, so

electrons will move from left to right through the ammeter.

Version 3: 

1. 
2. 
3. So, the value at 5[ms] is



This is a negative value, so the actual polarity of the current is opposite that of the reference polarity, and positive charges would move from right to left. However, the electrons are negatively charged, so

electrons will move from left to right through the ammeter.

Version 4: 

1. 
2. 
3. So, the value at 5[ms] is



This is a negative value, so the actual polarity of the current is opposite that of the reference polarity, and positive charges would move from right to left. However, the electrons are negatively charged, so

electrons will move from left to right through the ammeter.