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

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

ECE 2300 – Quiz #1

February 10, 2015

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. It is assumed that your work will begin on the same page as the problem statement. If you choose to begin your work on another page, you must indicate this on the page with the problem statement, with a clear indication of where the work can be found. **If your work continues on to another page, indicate clearly where your work can be found. Failure to indicate this clearly will result in a loss of credit.**

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.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/20

Room for extra work

The components of a cell phone are shown in the diagram below. Assume that the charge carriers are electrons.

1. Find the power absorbed by the battery at *t* = 3[ms].
2. Find the energy delivered by the charger during the third [millisecond], counting [milliseconds] starting at *t* = 0.
3. Determine whether the electrons flowing through the charger at *t* = 3[ms] are gaining or losing energy. Explain your answer.



 



Room for extra work

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Room for extra work

ECE 2300 -- Quiz #1 – February 10, 2015 – Solution Version 1. Only the solution for this version is shown. We will assume that you can determine the solution for other versions from this solution.

The components of a cell phone are shown in the diagram below. Assume that the charge carriers are electrons.

1. Find the power absorbed by the battery at *t* = 3[ms].
2. Find the energy delivered by the charger during the third [millisecond], counting [milliseconds] starting at *t* = 0.
3. Determine whether the electrons flowing through the charger at *t* = 3[ms] are gaining or losing energy. Explain your answer.



 



Solution:

1. We note that the current through the battery is *iB.* So, we can find *iB* at *t* = 3[ms] from the plot given for that current. The time value is halfway between 2[ms] and 4[ms], so since it is a straight line, the current *iB*(3[ms]) must be -5.5[mA]. The voltage *vCHAR* is the voltage across the battery, so in a similar way we find that *vCHAR* (3[ms]) = 1.25[V].
Since *vCHAR* and *iB* are in the active sign convention for the battery, that means
*pABS.BY.BAT = -vCHAR iB.*Plugging in the values at *t* = 3[ms], we get
*pABS.BY.BAT*(3[ms]) *= -*{1.25[V]} {-5.5[mA]} =
*pABS.BY.BAT*(3[ms]) *=* 6.875[mW].
2. We can see that because *vCHAR* and *iC* are in the passive sign convention for the charger,
*pDEL.BY.CHAR = -vCHAR iC.*So, to get the energy, we integrate of the time period from 2[ms] to 3[ms], which would be the third [millisecond] after *t* = 0.
Then, we integrate the product of *vCHAR* and *iC*, from 2[ms] to 3[ms], to get our solution, which involves getting the equation for *vCHAR* for this time period. We can use the slope intercept method to write that
*vCHAR* = (0.2[V]/2[ms])*t* + 0.95[V].
Then, using our calculator to integrate, we have
*wDEL.BY.CHAR *
*wDEL.BY.CHAR =* 15.6[J].
3. At t = 3[ms], we have *pDEL.BY.CHAR = -vCHAR iC.* Since at 3[ms], we have
*pDEL.BY.CHAR* = -(1.25[V])(-13[mA]) = 16.25[mW]. This tells us that the charger is delivering positive power at 3[ms]. Because of that, we know that the electrons are gaining energy as they go through the charger at that time.