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

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

ECE 2300 – Quiz #1

September 11, 2013

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. A

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

Room for extra work

Four devices, labeled A, B, C, and D, are connected as shown in the circuit diagram given in Figure 1. The current *iX(t)* is defined in the plot in Figure 2, and the voltage *vX(t)* is defined in the plot in Figure 3. The voltage *vW(t)* and the current *iW(t)* are defined in the equations below. The currents in this circuit are made up of the flow of electrons.

1. Are the electrons gaining or losing energy as they move through Device A at *t* = 6[ms]? Explain your answer.
2. Find the power absorbed by Device C at *t* = 15[ms].
3. Find the energy absorbed by Device A during the second [millisecond] after *t* = 0.





 

Room for extra work

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

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

ECE 2300 – Quiz #1

September 11, 2013

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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. B

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

Room for extra work

Four devices, labeled A, B, C, and D, are connected as shown in the circuit diagram given in Figure 1. The current *iX(t)* is defined in the plot in Figure 2, and the voltage *vX(t)* is defined in the plot in Figure 3. The voltage *vW(t)* and the current *iW(t)* are defined in the equations below. The currents in this circuit are made up of the flow of electrons.

1. Are the electrons gaining or losing energy as they move through Device A at *t* = 6[ms]? Explain your answer.
2. Find the power absorbed by Device C at *t* = 15[ms].
3. Find the energy absorbed by Device A during the second [millisecond] after *t* = 0.





 

Room for extra work

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

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

ECE 2300 – Quiz #1

September 11, 2013

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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. C

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

Room for extra work

Four devices, labeled A, B, C, and D, are connected as shown in the circuit diagram given in Figure 1. The current *iX(t)* is defined in the plot in Figure 2, and the voltage *vX(t)* is defined in the plot in Figure 3. The voltage *vW(t)* and the current *iW(t)* are defined in the equations below. The currents in this circuit are made up of the flow of electrons.

1. Are the electrons gaining or losing energy as they move through Device A at *t* = 6[ms]? Explain your answer.
2. Find the power absorbed by Device C at *t* = 15[ms].
3. Find the energy absorbed by Device A during the third [millisecond] after *t* = 0.





 

Room for extra work

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

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

ECE 2300 – Quiz #1

September 11, 2013

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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. D

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

Room for extra work

Four devices, labeled A, B, C, and D, are connected as shown in the circuit diagram given in Figure 1. The current *iX(t)* is defined in the plot in Figure 2, and the voltage *vX(t)* is defined in the plot in Figure 3. The voltage *vW(t)* and the current *iW(t)* are defined in the equations below. The currents in this circuit are made up of the flow of electrons.

1. Are the electrons gaining or losing energy as they move through Device A at *t* = 6[ms]? Explain your answer.
2. Find the power absorbed by Device C at *t* = 15[ms].
3. Find the energy absorbed by Device A during the third [millisecond] after *t* = 0.





 

Room for extra work

ECE 2300 -- Quiz #1 – September 11, 2013 – Solution

Four devices, labeled A, B, C, and D, are connected as shown in the circuit diagram given in Figure 1. The current *iX(t)* is defined in the plot in Figure 2, and the voltage *vX(t)* is defined in the plot in Figure 3. The voltage *vW(t)* and the current *iW(t)* are defined in the equations below. The currents in this circuit are made up of the flow of electrons.

1. Are the electrons gaining or losing energy as they move through Device A at *t* = 6[ms]? Explain your answer.
2. Find the power absorbed by Device C at *t* = 15[ms].
3. Find the energy absorbed by Device A during the second [millisecond] after *t* = 0.





 

Work begins on the next page.

Solution:

1. We note that the voltage across Device A is *vX*, and the current through Device A is *iX*, and that for Device A *vX* and *iX* are in the active sign convention. So, we can write  
      
   Looking at the plots for *vX* and *iX*, it is clear that at *t* = 6[ms], *vX* is positive and *iX* is negative. Thus, the power absorbed by Device A will be positive. Thus the charge carriers moving through Device A must be losing energy. This is because the power absorbed in that device is positive, at that point in time.  
   Note that we do not care about the nature of the charge carriers for this analysis. Note also that we do not need a value for the power to answer this question, only the sign.
2. For Device C, we know that since *vW* and *iW* are in the active sign convention for Device C, that  
     
   
3. As we noted in part a),   
     
   So, to get the energy, we integrate of the time period from 1[ms] to 2[ms], which would be the second [millisecond] after *t* = 0. For this integral, we need the expressions for *vX* and *iX* for this time period, which we get from the plots. We use the slope-intercept method to write  
     
   Then, we integrate,  
     
   So, our solution, using our calculator to integrate, is  
   

Four devices, labeled A, B, C, and D, are connected as shown in the circuit diagram given in Figure 1. The current *iX(t)* is defined in the plot in Figure 2, and the voltage *vX(t)* is defined in the plot in Figure 3. The voltage *vW(t)* and the current *iW(t)* are defined in the equations below. The currents in this circuit are made up of the flow of electrons.

1. Are the electrons gaining or losing energy as they move through Device A at *t* = 6[ms]? Explain your answer.
2. Find the power absorbed by Device C at *t* = 15[ms].
3. Find the energy absorbed by Device A during the second [millisecond] after *t* = 0.





 

Work begins on the next page.

Solution:

1. We note that the voltage across Device A is *vX*, and the current through Device A is *iX*, and that for Device A *vX* and *iX* are in the active sign convention. So, we can write  
      
   Looking at the plots for *vX* and *iX*, it is clear that at *t* = 6[ms], *vX* is positive and *iX* is negative. Thus, the power absorbed by Device A will be positive. Thus the charge carriers moving through Device A must be losing energy. This is because the power absorbed in that device is positive, at that point in time.  
   Note that we do not care about the nature of the charge carriers for this analysis. Note also that we do not need a value for the power to answer this question, only the sign.
2. For Device C, we know that since *vW* and *iW* are in the active sign convention for Device C, that  
     
   
3. As we noted in part d),   
     
   So, to get the energy, we integrate of the time period from 1[ms] to 2[ms], which would be the second [millisecond] after *t* = 0. For this integral, we need the expressions for *vX* and *iX* for this time period, which we get from the plots. We use the slope-intercept method to write  
     
   Then, we integrate,  
     
   So, our solution, using our calculator to integrate, is  
   

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1. Are the electrons gaining or losing energy as they move through Device A at *t* = 6[ms]? Explain your answer.
2. Find the power absorbed by Device C at *t* = 15[ms].
3. Find the energy absorbed by Device A during the third [millisecond] after *t* = 0.





 

Work begins on the next page.

Solution:

1. We note that the voltage across Device A is *vX*, and the current through Device A is *iX*, and that for Device A *vX* and *iX* are in the active sign convention. So, we can write  
      
   Looking at the plots for *vX* and *iX*, it is clear that at *t* = 6[ms], *vX* is positive and *iX* is negative. Thus, the power absorbed by Device A will be positive. Thus the charge carriers moving through Device A must be losing energy. This is because the power absorbed in that device is positive, at that point in time.  
   Note that we do not care about the nature of the charge carriers for this analysis. Note also that we do not need a value for the power to answer this question, only the sign.
2. For Device C, we know that since *vW* and *iW* are in the active sign convention for Device C, that  
     
   
3. As we noted in part g),   
     
   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. For this integral, we need the expressions for *vX* and *iX* for this time period, which we get from the plots. We use the slope-intercept method to write  
     
   Then, we integrate,  
     
   So, our solution, using our calculator to integrate, is  
   

Four devices, labeled A, B, C, and D, are connected as shown in the circuit diagram given in Figure 1. The current *iX(t)* is defined in the plot in Figure 2, and the voltage *vX(t)* is defined in the plot in Figure 3. The voltage *vW(t)* and the current *iW(t)* are defined in the equations below. The currents in this circuit are made up of the flow of electrons.

1. Are the electrons gaining or losing energy as they move through Device A at *t* = 6[ms]? Explain your answer.
2. Find the power absorbed by Device C at *t* = 15[ms].
3. Find the energy absorbed by Device A during the third [millisecond] after *t* = 0.





 

Work begins on the next page.

Solution:

1. We note that the voltage across Device A is *vX*, and the current through Device A is *iX*, and that for Device A *vX* and *iX* are in the active sign convention. So, we can write  
      
   Looking at the plots for *vX* and *iX*, it is clear that at *t* = 6[ms], *vX* is positive and *iX* is negative. Thus, the power absorbed by Device A will be positive. Thus the charge carriers moving through Device A must be losing energy. This is because the power absorbed in that device is positive, at that point in time.  
   Note that we do not care about the nature of the charge carriers for this analysis. Note also that we do not need a value for the power to answer this question, only the sign.
2. For Device C, we know that since *vW* and *iW* are in the active sign convention for Device C, that  
     
   
3. As we noted in part j),   
     
   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. For this integral, we need the expressions for *vX* and *iX* for this time period, which we get from the plots. We use the slope-intercept method to write  
     
   Then, we integrate,  
     
   So, our solution, using our calculator to integrate, is  
   