Classroom Response System Questions

Chapter 27 Circuits

Interactive Lecture Questions
27.3.1. In physics lab, two students measured the potential difference between the terminals of a battery and the current in a circuit connected to the battery. The students then made a graph of the two parameters as shown. They then drew a best fit line through the data. From their results, determine the approximate internal resistance of the battery.

a) 0.002 Ω
b) 0.08 Ω
c) 0.1 Ω
d) 0.3 Ω
e) 0.6 Ω
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a) 0.002 Ω
b) 0.08 Ω
c) 0.1 Ω
d) 0.3 Ω
e) 0.6 Ω
27.3.2. A non-ideal battery has a 6.0-V emf and an internal resistance of 0.6 Ω. Determine the terminal voltage when the current drawn from the battery is 1.0 A.

a) 5.0 V

b) 6.0 V

c) 5.4 V

d) 6.6 V

e) 5.8 V
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a) 5.0 V
b) 6.0 V
c) 5.4 V
d) 6.6 V
e) 5.8 V
27.4.1. Consider a circuit that contains an ideal battery and a resistor to form a complete circuit. Which one of the following statements concerning the work done by the battery is true?

a) No work is done by the battery in such a circuit.

b) The work done is equal to the thermal energy dissipated by the resistor.

c) The work done is equal to the work needed to move a single charge from one side of the battery to the other.

d) The work done is equal to the emf of the battery.

e) The work done is equal to the product of the current flowing through the circuit and the resistor.
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e) The work done is equal to the product of the current flowing through the circuit and the resistor.
27.5.1. Two 20-Ω resistors are connected in series. A potential difference of 9 V is then applied across the resistors. What is the resulting current through the resistors?

a) 0.23 A
b) 0.45 A
c) 0.90 A
d) 2.2 A
e) 4.4 A
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- a) 0.23 A
- b) 0.45 A
- c) 0.90 A
- d) 2.2 A
- e) 4.4 A
27.5.2. Consider the circuit shown in the drawing. Two identical light bulbs, labeled A and B, are connected in series with a battery and are illuminated equally. There is a switch in the circuit that is initially open. Which one of the following statements concerning the two bulbs is true after the switch is closed?

a) Bulbs A and B will be off.

b) Bulbs A and B will be equally illuminated.

c) Bulb A will be brighter and bulb B will be off.

d) Bulb A will be off and bulb B will be brighter.

e) Both bulbs will be dimmer than before the switch was closed.
27.5.2. Consider the circuit shown in the drawing. Two identical light bulbs, labeled A and B, are connected in series with a battery and are illuminated equally. There is a switch in the circuit that is initially open. Which one of the following statements concerning the two bulbs is true after the switch is closed?

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b) Bulbs A and B will be equally illuminated.

c) Bulb A will be brighter and bulb B will be off.

d) Bulb A will be off and bulb B will be brighter.

e) Both bulbs will be dimmer than before the switch was closed.
27.5.3. Consider the three resistors and the battery in the circuit shown. Which resistors, if any, are connected in series?

a) $R_1$ and $R_2$

b) $R_1$ and $R_3$

c) $R_2$ and $R_3$

d) $R_1$ and $R_2$ and $R_3$

e) No resistors are connected in series.
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b) $R_1$ and $R_3$

c) $R_2$ and $R_3$

d) $R_1$ and $R_2$ and $R_3$

e) No resistors are connected in series.
27.5.4. Consider the circuit shown. If the ideal emf in the circuit is 24 V and the three resistances are $R_1 = 2.5 \, \Omega$, $R_2 = 4.0 \, \Omega$, and $R_3 = 6.0 \, \Omega$, determine the current in the 4.0 $\Omega$ resistor.

a) 1.2 A  
b) 1.9 A  
c) 4.0 A  
d) 6.0 A  
e) 6.5 A
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a) 1.2 A

b) 1.9 A

c) 4.0 A

d) 6.0 A

e) 6.5 A
27.7.1 Two 20-Ω resistors are connected in parallel. A potential difference of 9 V is then applied across both resistors. What is the resulting total current through the two resistors?

a) 0.23 A
b) 0.45 A
c) 0.90 A
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c) $R_2$ and $R_3$

d) $R_1$ and $R_2$ and $R_3$

e) No resistors are connected in parallel.
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c) $R_2$ and $R_3$

d) $R_1$ and $R_2$ and $R_3$

e) No resistors are connected in parallel.
27.7.3. Consider the circuits shown in parts A and B in the picture. In part A, a light bulb is plugged into a wall outlet that has a voltage of 120 volts. A current $i$ passes through the circuit and the bulb turns on. In part B, a second, identical light bulb is connected in parallel in the circuit. How does the total current in circuit B compare with that in circuit A?

a) The current is the same, $i$, as in part A.

b) The current is twice as much, $2i$, as in part A.

c) The current in part B is zero amperes.

d) The current is one fourth as much, 0.25$i$, as in part A.

e) The current is one half as much, 0.5$i$, as in part A.
27.7.3. Consider the circuits shown in parts A and B in the picture. In part A, a light bulb is plugged into a wall outlet that has a voltage of 120 volts. A current $i$ passes through the circuit and the bulb turns on. In part B, a second, identical light bulb is connected in parallel in the circuit. How does the total current in circuit B compare with that in circuit A?

a) The current is the same, $i$, as in part A.

b) The current is twice as much, $2i$, as in part A.

c) The current in part B is zero amperes.

d) The current is one fourth as much, $0.25i$, as in part A.

e) The current is one half as much, $0.5i$, as in part A.
27.7.4. Two light bulbs, one “50 W” bulb and one “100 W” bulb, are connected in parallel with a standard 120 volt ac electrical outlet. The brightness of a light bulb is directly related to the power it dissipates. Therefore, the 100 W bulb appears brighter. How does the brightness of the two bulbs compare when these same bulbs are connected in series with the same outlet?

a) Both bulbs will be equally bright.

b) The “100 W” bulb will be brighter.

c) The “50 W” bulb will be brighter.
27.7.4. Two light bulbs, one “50 W” bulb and one “100 W” bulb, are connected in parallel with a standard 120 volt ac electrical outlet. The brightness of a light bulb is directly related to the power it dissipates. Therefore, the 100 W bulb appears brighter. How does the brightness of the two bulbs compare when these same bulbs are connected in series with the same outlet?

a) Both bulbs will be equally bright.

b) The “100 W” bulb will be brighter.

c) The “50 W” bulb will be brighter.
27.7.5. Consider the three identical light bulbs shown in the circuit. Bulbs B and C are wired in series with each other and are wired in parallel with bulb A. When the bulbs are connected to the battery as shown, how does the brightness of each bulb compare to the others?

a) Bulbs B and C are equally bright, but bulb A is less bright.

b) Bulbs B and C are equally bright, but less bright than bulb A.

c) All three bulbs are equally bright.

d) Bulbs A and B are equally bright, but bulb C is less bright.

e) Only bulb A is illuminated.
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b) Bulbs B and C are equally bright, but less bright than bulb A.

c) All three bulbs are equally bright.

d) Bulbs A and B are equally bright, but bulb C is less bright.

e) Only bulb A is illuminated.
27.7.6. A circuit is formed using a battery, three identical resistors, and connecting wires as shown. How does the current passing through \( R_3 \) compare with that passing through \( R_1 \)?

a) \( I_3 < I_1 \)

b) \( I_3 = I_1 \)

c) \( I_3 > I_1 \)

d) This cannot be determined without knowing the amount of current passing through \( R_2 \).
27.7.6. A circuit is formed using a battery, three identical resistors, and connecting wires as shown. How does the current passing through \( R_3 \) compare with that passing through \( R_1 \)?

a) \( I_3 < I_1 \)

b) \( I_3 = I_1 \)

c) \( I_3 > I_1 \)

d) This cannot be determined without knowing the amount of current passing through \( R_2 \).
27.7.7. What is the approximate equivalent resistance of the five resistors shown in the circuit?

a) 21 Ω  

b) 7 Ω  

c) 11 Ω  

d) 14 Ω  

e) 19 Ω
27.7.7. What is the approximate equivalent resistance of the five resistors shown in the circuit?

a) 21 Ω
b) 7 Ω
c) 11 Ω
d) 14 Ω
e) 19 Ω
27.7.8. What is the current through the 4-Ω resistor in this circuit?

a) 1.27 A

b) 1.75 A

c) 2.0 A

d) 3.3 A

e) 4.5 A
27.7.8. What is the current through the 4-Ω resistor in this circuit?

a) 1.27 A
b) 1.75 A
c) 2.0 A
d) 3.3 A
e) 4.5 A
27.7.9. What is the current through the 1-Ω resistor in this circuit?

a) 2.8 A

b) 3.0 A

c) 3.4 A

d) 4.3 A

e) 4.8 A
27.7.9. What is the current through the 1-Ω resistor in this circuit?

a) 2.8 A
b) 3.0 A

**c) 3.4 A**
d) 4.3 A

e) 4.8 A
27.7.10. Which one of the following equations is not correct relative to the other four equations determined by applying Kirchoff’s Rules to the circuit shown?

a) \( I_2 = I_1 + I_4 \)

b) \( I_2 = I_3 + I_5 \)

c) \( 6 \text{ V} - (8 \ \Omega) \ I_1 - (5 \ \Omega) \ I_2 - (4 \ \Omega) \ I_3 = 0 \)

d) \( 6 \text{ V} - (6 \ \Omega) \ I_4 - (5 \ \Omega) \ I_2 - (2 \ \Omega) \ I_5 = 0 \)

e) \( 6 \text{ V} - (8 \ \Omega) \ I_1 - (6 \ \Omega) \ I_4 - 6 \text{ V} - (2 \ \Omega) \ I_5 - (4 \ \Omega) \ I_3 = 0 \)
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a) \( I_2 = I_1 + I_4 \)

b) \( I_2 = I_3 + I_5 \)

c) \( 6 \, V - (8 \, \Omega) \, I_1 - (5 \, \Omega) \, I_2 - (4 \, \Omega) \, I_3 = 0 \)

d) \( 6 \, V - (6 \, \Omega) \, I_4 - (5 \, \Omega) \, I_2 - (2 \, \Omega) \, I_5 = 0 \)

e) \( 6 \, V - (8 \, \Omega) \, I_1 - (6 \, \Omega) \, I_4 - 6 \, V - (2 \, \Omega) \, I_5 - (4 \, \Omega) \, I_3 = 0 \)
27.7.11. Some light bulbs are connected in parallel to a 120 V source as shown in the figure. Each bulb dissipates an average power of 60 W. The circuit has a fuse F that burns out when the current in the circuit exceeds 9 A. Determine the largest number of bulbs, which can be used in this circuit without burning out the fuse.

a) 9  

b) 17  

c) 25  

d) 34  

e) 36
27.7.11. Some light bulbs are connected in parallel to a 120 V source as shown in the figure. Each bulb dissipates an average power of 60 W. The circuit has a fuse F that burns out when the current in the circuit exceeds 9 A. Determine the largest number of bulbs, which can be used in this circuit without burning out the fuse.

a) 9
b) 17

c) 25
d) 34
e) 36
27.9.1. What effect, if any, does increasing the battery emf in an RC circuit have on the time to charge the capacitor?

a) The charging time will decrease because the rate of charge flowing to the plates will increase.

b) The charging time will decrease because the rate of charge flowing to the plates will decrease.

c) The charging time will not change because the charging time does not depend on the battery emf.

d) The charging time will increase because the emf is increased.

e) The charging time will decrease because potential difference across the plates will be larger.
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c) The charging time will not change because the charging time does not depend on the battery emf.

d) The charging time will increase because the emf is increased.

e) The charging time will decrease because potential difference across the plates will be larger.
27.9.2. The resistance in an RC circuit is comprised of a $1.5\,\text{M}\Omega$ resistor in parallel with a $2.0\,\text{M}\Omega$ resistor. What is the time constant for this circuit if the capacitance is $2.5\,\mu\text{F}$?

a) $2.0\,\text{s}$

b) $7.0\,\text{ms}$

c) $5.0\,\mu\text{s}$

d) $120\,\text{s}$

e) $4000\,\text{s}$
27.9.2. The resistance in an RC circuit is comprised of a 1.5-MΩ resistor in parallel with a 2.0-MΩ resistor. What is the time constant for this circuit if the capacitance is 2.5 µF?

a) 2.0 s
b) 7.0 ms
c) 5.0 µs
d) 120 s
e) 4000 s
27.9.3. In physics lab, Rebecca measured the voltage across an unknown capacitor in an RC circuit, every ten seconds after a switch in the circuit that allows the capacitor to discharge is closed. The capacitor was initially fully charged. Using the graph, estimate the time constant.

a) 7.5 s
b) 15 s
c) 30 s
d) 45 s
e) 60 s
27.9.3. In physics lab, Rebecca measured the voltage across an unknown capacitor in an RC circuit, every ten seconds after a switch in the circuit that allows the capacitor to discharge is closed. The capacitor was initially fully charged. Using the graph, estimate the time constant.

- a) 7.5 s
- b) 15 s
- c) 30 s
- d) 45 s
- e) 60 s
27.9.4. An RC circuit contains a battery, a switch, a resistor, and a capacitor – all connected in series. Initially, the switch is open and the capacitor is uncharged. Which one of the following statements correctly describes the current in the circuit during the time the capacitor is charging?

a) The current is increasing with increasing time.

b) The current is constant with increasing time.

c) The current is decreasing with increasing time.

d) The current increases for the first half of the time until the capacitor is fully discharged, and then decreases during the second half of the time.

e) The current can either increase or decrease with increasing time depending on the value of the time constant.
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e) The current can either increase or decrease with increasing time depending on the value of the time constant.
27.9.5. An uncharged 5.0-μF capacitor and a resistor are connected in series to a 12-V battery and an open switch to form a simple RC circuit. The switch is closed at \( t = 0 \) s. The time constant of the circuit is 4.0 s. What is the charge on either plate of the capacitor after one time constant has elapsed?

a) 7.4 \times 10^{-5} \text{ C}

b) 5.5 \times 10^{-5} \text{ C}

c) 1.2 \times 10^{-5} \text{ C}

d) 3.8 \times 10^{-5} \text{ C}

e) 2.2 \times 10^{-5} \text{ C}
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a) $7.4 \times 10^{-5}$ C
b) $5.5 \times 10^{-5}$ C
c) $1.2 \times 10^{-5}$ C
d) $3.8 \times 10^{-5}$ C
e) $2.2 \times 10^{-5}$ C