

Circuit Lab (B) SSSS 2020 Answer Key

Ivan Chiang

Name: _____

School: _____

Team #: _____

Important Figures (14)

Matching (1 point each - Total 7)

1. B
2. F
3. C
4. E
5. D
6. G
7. A

T or F (1 point each - Total 7)

1. False
2. False
3. False
4. True
5. True
6. False
7. True

Properties of Electrical Charges and Fields (6)

Multiple Choice (1 point each - Total 6)

1. B
2. B
3. C
4. D
5. A
6. B

Magnetism (8)

Table (1 point for each correct. 1 point penalty for each incorrect - Total 4)

	Repelled by magnetic fields	Attracted by magnetic fields	Retains magnetic properties after removal of the magnetic field
Ferromagnetism		X	X
Paramagnetism		X	
Diamagnetism	X		

Magnetism

Multiple Choice (1 point each - Total 4)

1. B
2. A
3. D
4. C

Coulomb's Law (13)

Short Answer

1. $f = kq_1q_2/d^2$
 $f = (9 \times 10^9)(4 \times 10^{-7})(2 \times 10^{-7})/(0.32)^2$
 $f = 0.007 \text{ N (repulsive)}$ (5 points)
2. One thing that affects the magnitude of electric force is the charge on each object and is directly proportional to it. The second thing is the distance between the charges and is inversely proportional to the magnitude of the electric force. (1.5 points each - Total 3)
3. $f = kq_1q_2/d^2$ $f = kq^2/d^2$ $q^2 = fd^2/k$
 $q = \sqrt{fd^2/k}$ $q = 0.000007$
 $q = 7 \times 10^{-6} \text{ Coulombs}^*(\text{TB1})$ (5 points)

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Parts of a Circuit (13)

Fill in the Blank (1 point each - Total 10)

1. Capacitor
2. Inductor
3. Rectifier
4. Inverter
5. Transformer
6. Relay
7. Battery
8. Resistor
9. Diode
10. LED

Parts of a Circuit

Label the Diagram (0.5 point each - Total 3)

- A. Battery
- B. Wire
- C. Switch (0.25 Point for Relay)
- D. LED (0.25 Point for Diode)
- E. Inductor
- F. Resistor

Circuit Analysis (26)

Short Answer

1. $R_1 + R_2 = 20\Omega$. $1/(1/20\Omega + 1/20) = 10\Omega$.
 $10V/10\Omega = 1A$. First node = 10V.
 $10V/20\Omega = 0.5A$. The current entering node is the same as the current leaving the node. *(TB2)
 $i_{R1} = 0.5A$ $i_{R2} = 0.5A$ $i_{R3} = 0.5A$
(4 points)
2. $0.5A * 5\Omega = 2.5V$ **$V_{R1} = 2.5V$**
 $0.5A * 15\Omega = 7.5V$ **$V_{R2} = 7.5V$**
 $0.5A * 20\Omega = 10V$ **$V_{R3} = 10V$**
(4 points)

3. $V = I_2 R$. $V = (2.5)(6)$. $V = 15$. $I_1 = V/R$.
 $I_1 = (15)/(5)$. $I_1 = 3$. $I = I_1 + I_2$. $I = 2.5 + 3$.
 $I = 5.5 A$ (4 points)

4. If the switch was closed, the current would increase. Although one more resistor is added, it is a resistor in parallel. Resistors in parallel reduce the equivalent resistance of a circuit.*
(TB3) (4 points)

5. When calculating the total resistance of resistors in series, you add up the resistance values of each resistor. When calculating the total resistance of resistors in parallel, you add up the reciprocals of each resistor and divide that all by 1. (3 points)

6. Current is the same across components in series, while voltage is the same across components in parallel. (3 points)

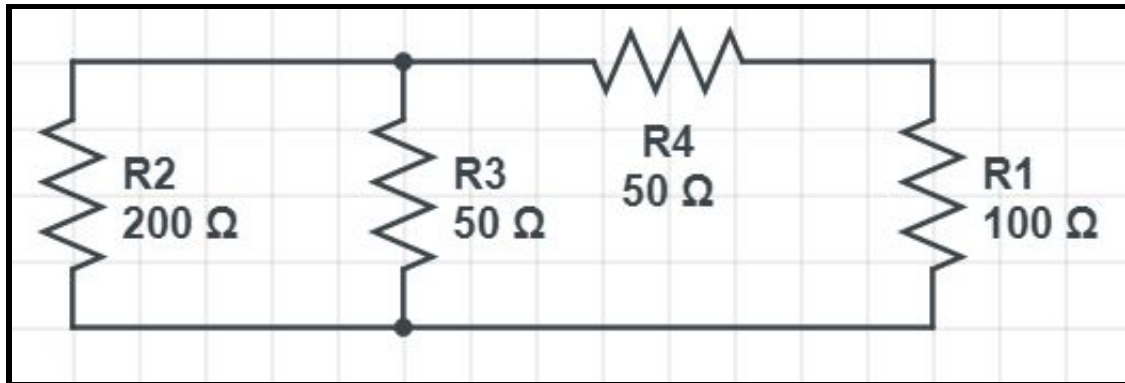
7. Capacitors preserve and store voltage while inductors preserve and store current. Capacitors store energy in electric fields while inductors store energy in magnetic fields.
(2 points each - Total 4)

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Lab Portion (20)

Configuration (20 points for a correct answer)



Partial Credit Rubric

Putting all 4 resistors on the page - **1 point**

Connecting and labeling (both the resistance value and resistor number) all resistors - **1 point**

Putting the resistors in the right pattern but without labeling - **3 points**

Putting the resistors in the right pattern but with the wrong labels - **4 points**

Page 1 Points (41) _____

Page 2 Points (39) _____

Page 3 points (20) _____

Total Points (100) _____