



SCIENCE OLYMPIAD
— AT THE —
UNIVERSITY OF FLORIDA

Northern Regional: January 19th, 2019

Circuit Lab C Answer Key

Name(s): _____

Team Name: _____

School Name: _____

Team Number: _____

Rank: _____

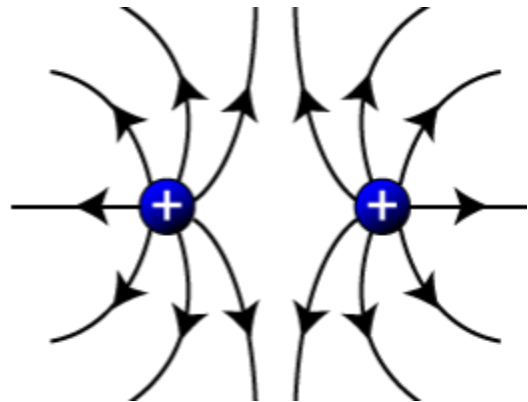
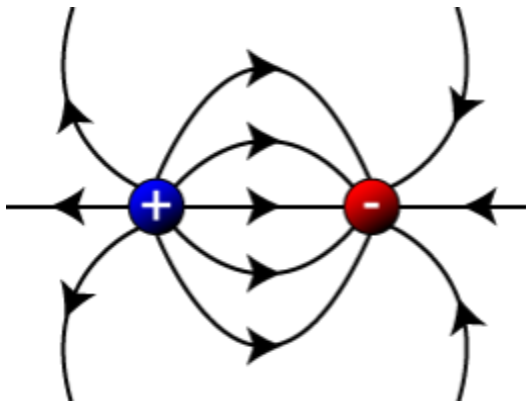
Score: _____

Section 1

1. A
2. C
3. C
4. A
5. E
6. D
7. D
8. A

Section 2

9. Triboelectric
10. a, c, f, h (1 point per correct answer)
11. (Tiebreaker 3) $4 \times 10^{10} \text{N}$ (1 point for attempting to use Coulomb's Law if incorrect)
12. (1 point per correct sign)



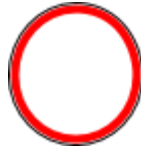
13. $7.1 \times 10^{-9} \text{J}$ (1 point for attempting to use $C = \epsilon_0 A/d$, 1 point for attempting to use $U_c = .5CV^2$ if incorrect)

Section 3

14. 8Ω
15. The circuit is shorted on the right side (2 points) so it may catch fire or melt the wire (2 points).
16. 5W (1 point for finding $R_{eq} = 10 \text{ Ohms}$ if incorrect)
17. Muscle Tetanus
18. Batteries

Section 4

19. They should indicate electrons are concentrated far away from the center, near the shaded region below.



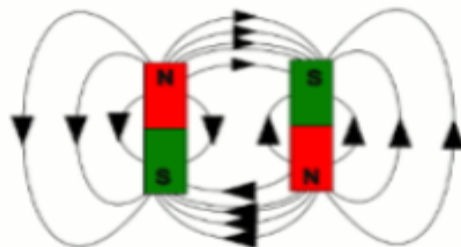
20. Heart fibrillation
21. True
22. False

Section 5

23. A
24. $\text{kg}\cdot\text{m}^2\cdot\text{s}^{-3}\cdot\text{A}^{-1}$
25. $\text{kg}\cdot\text{m}^2\cdot\text{s}^{-3}\cdot\text{A}^{-2}$
26. $\text{kg}\cdot\text{m}^2\cdot\text{s}^{-3}$
27. $\text{kg}\cdot\text{m}^2\cdot\text{s}^{-2}$
28. The voltage across a circuit (or resistor) is equivalent to the value of the current times the total resistance.

Section 6

29. To get full credit, there must be two lines going from each north end to the other magnet's south end, one line going from each north end to its own south end on the inside, two lines going from each north end to its own south end on the outside, and arrows must be going the correct direction. (If 3/4 conditions are met, award 2 points, if 2/4 are met, award 1 point)



30. Attracted
31. 3 coils

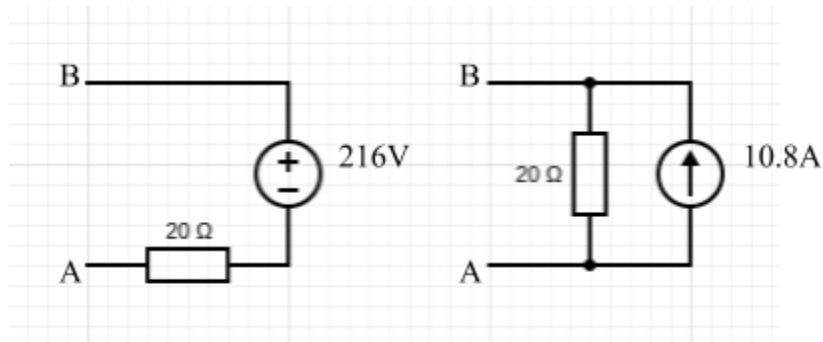
- 32. Permanent Magnet, Shunt, Series, Compound
- 33. Up

Section 7

- 34. Relay, Electromagnet (3 points each)

Section 8

- 35. $R_1 = 75\Omega$, $R_2 = 30\Omega$, $R_3 = 50\Omega$ (2 points each)
- 36. (Tiebreaker 2)
Thevenin: (1 point for resistor, 3 points for battery)
Norton: (1 point for resistor, 3 points for current source)



Section 9

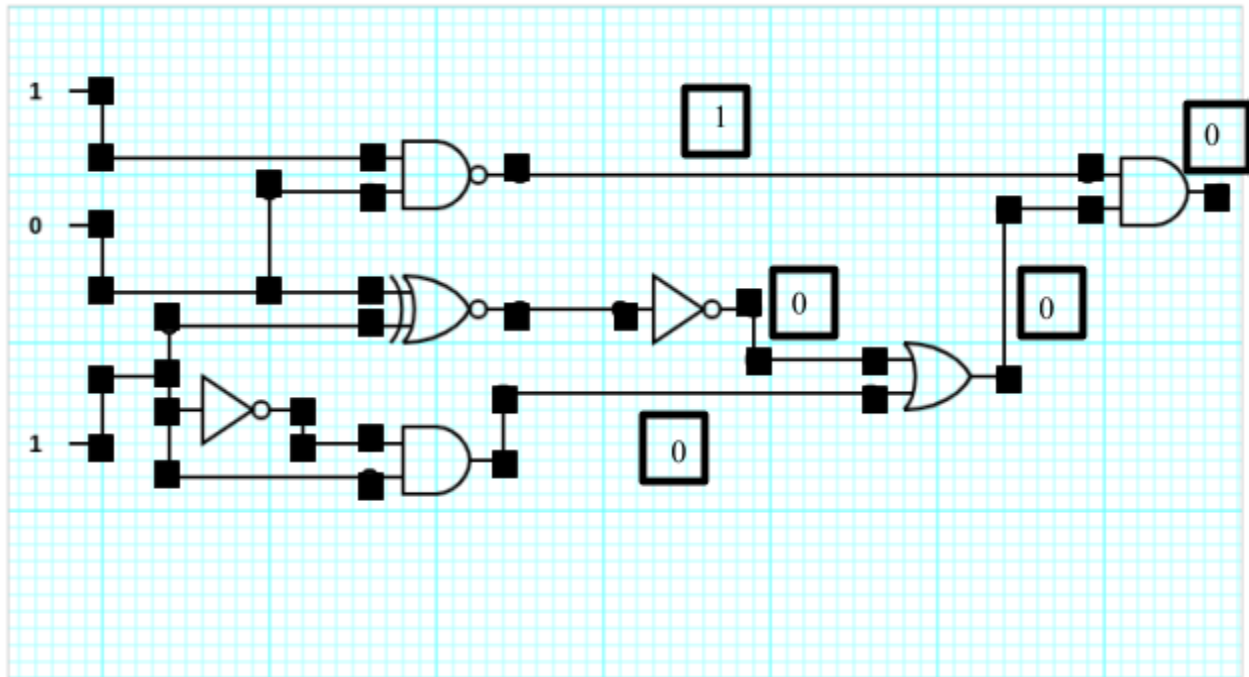
- 37. The black triangle should be circled.
- 38. Light Emitting Diode
- 39. 20mA

Section 10

- 40. 1.2A or 1.3A (Tiebreaker 1)
- 41. $V_1 = 50V$, $V_2 = 50V$

Section 11

42. (2 points per answer)



Section 12

43. 0.1s

Section 13

44. - Forward bias is achieved by hooking up the p-type region to the positive terminal and the n-type region to the negative terminal. (3 points)
- Reverse bias is achieved by hooking up the n-type region to the positive terminal and the p-type region to the negative terminal. (3 points)
- Forward bias draws holes and electrons toward each other, allowing for current to pass through. (3 points)
- Reverse bias pulls holes and electrons away from each other, which does not allow current to pass through. (3 points)

Section 14

45. -150V

Practical

1. N/A
2. There should be a 9V (square) battery hooked up to the blue resistor, which should be connected to all 4 tan resistors at the end, which come together to reconnect to the 9V battery.
3. $100\text{k}\Omega$

(Note: If question 3 is completed prior to question 2, do not award any points for question 2)