

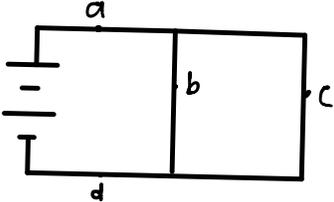
Names(s): _____ Team Name: _____
_____ Team number: _____

Captains Test: Circuit Lab 2019 (Division C)

- You have 50 minutes to complete this test
- All answers-both Multiple Choice and free response-must be recorded on your separate answer packet. No credit will be given for any answers given in the test packet.
- For multiple choice questions, simply write the CAPITAL LETTER that corresponds to your answer Choice on the appropriate line on your separate answer packet.
- For free response, write your answer with proper units, any answer with incorrect units will receive no credit.
- For diagrams that will be graded, draw and label clearly and concisely.
- The number of points awarded for each questions is shown in brackets at the end of each question or set of questions.
- The symbol “^” means “raised to”.

Part 1: Multiple Choice [2 points per question, 40 points total]

- Which of the following the name of $V=IR$?
 - Kirchhoff's voltage law
 - Avagadro's Law
 - Columb's Law
 - Ohm's Law
- Which of the following correctly expresses current in gh of charge and time?
 - $I=Qt$
 - $I=Q/t$
 - $I=t/Q$
 - None of the above
- _____ is based on the flow of positive charges, and _____ is based on the flow of negative charges
 - Proton flow, electron flow
 - Electron flow, proton flow
 - Conventional current flow, election flow
 - Electron Flow, conventional current flow
- In a parallel circuit, _____ is additive and _____ is constant.
 - Voltage, current
 - Resistance, current
 - Power, voltage
 - Current, voltage
- An ammeter measures _____ and is places in a circuit in _____.
 - voltage, parallel
 - current, parallel
 - current, series
 - voltage, series
- A voltmeter is placed in a circuit in _____ and a ohmmeter is placed in a circuit in _____.
 - Parallel, series
 - Parallel, series or parallel
 - Series, series
 - Series, series or parallel
- What is the rate at which energy is transferred or transformed?
 - Current
 - Work
 - Power
 - Voltage
- If the voltage at a point is 3.0 V and the resistance is 10.0 ohms, what is the current?
 - .300 A
 - 3.33 A
 - 30.0 A
 - .333 A
- If current is equal to $3t/5c$, which of the following is equivalent to power?
 - $(9t^2)/5c$
 - $(9t^2)(25c^2)$
 - $(9t^2)(5c)$
 - $(9t^2)/(25c^2)$
- Magnetism is the ability of certain objects to attract _____.
 - Aluminum

- b. Iron
c. All medals
d. Platinum
11. What is the current in a wire that is .30 m away from an electric field which has a magnitude of 18.0 micro-Tesla?
a. 486 A
b. 48.6 A
c. 27.0 A
d. 2.70 A
12. Which of the following is false referring to current in the circuit
- a. $b=d-c$
b. $a=(b+c)$
c. $a=d$
d. $b=c$
- 
13. If it is given that 2 charged particles travel through a circuit in the same amount of time, it can be concluded that they must have the same
a. Charge
b. Mass
c. Ratio of charge and mass
d. Product of charge and mass
e. None of the above
14. By Newton's second law, it can be concluded that acceleration of a particle is _____ proportional to the force on the particle, _____ proportional to the charge on the particle, and _____ proportional to the mass of the particle.
a. Directly, directly, inversely
b. Directly, inversely, inversely
c. Inversely, directly, inversely
d. Inversely, inversely, directly
e. Directly, directly, directly
15. A positive particle moves toward the left through a magnetic field, what is the direction of the force exerted on the particle by the magnetic field?
a. Left
b. Right
c. Out of the page
d. Into the page
e. Toward the top of the page
f. Toward the bottom of the page
16. Compared to conventional electromagnets, superconducting electromagnets
a. Have a stronger force of magnetism
b. Have a weaker force of magnetism
c. Are less expensive to manufacture
d. Use less electrical power
e. Use more electrical power
17. The following diagram means which of the following?
a. AB
b. A+B
c. A-B
d. A/B
e. None of the above
- 
18. The time constant of an RC Circuit is the time it takes for the charge to reach ___% of its initial charge.

- A. 90
- B. 63
- C. 50
- D. 33
- E. 0

19. Which of the following is a classification of a transresistance amplifier
- a. Voltage in and voltage out
 - b. Current in and current out
 - c. Voltage in and current out
 - d. Current in and voltage out
20. Which of the following established the basis for the concepts of electromagnetic field in physics?
- a. Ohm
 - b. Volta
 - c. Faraday
 - d. Tesla
 - e. Hertz

Part 2: Short Answer

21. Name the four factors that affect resistance. [4]

22. What occurs if a magnet is cut in half? [2]

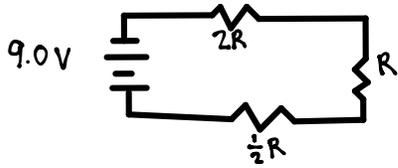
23. What is the difference between AC and DC current? [2]

24. What is the permeability of air in a vacuum? [2]

25. If the voltage drop across R1 is 5 volts, what is the voltage drop across R2? [3]



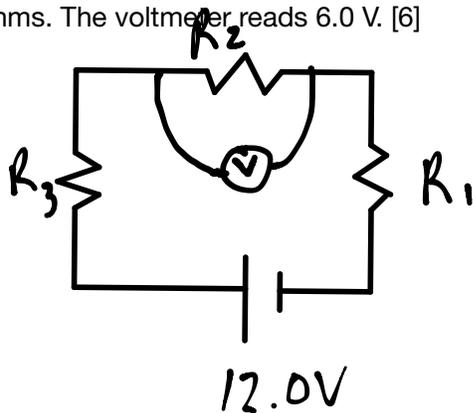
26. A. What is the total resistance in the following circuit given the current is 17 milliamperes? [3]
 B. What is the resistance of the resistor from the diagram below with the greatest resistivity? [3]



27. Calculate the current given power is 8.34 W. [4]



28. Find the resistance of all the resistors below given $R_1=3(R_3)$ and the total resistance is 12.0 ohms. The voltmeter reads 6.0 V. [6]



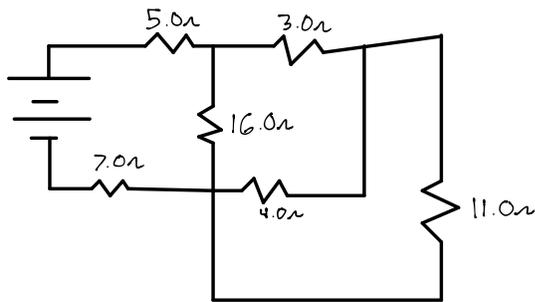
29. A diode lets electricity flow in _____ direction(s). [2]

30. What is the force or repulsion of an electron and a proton that are 8.64×10^9 m apart? [4]

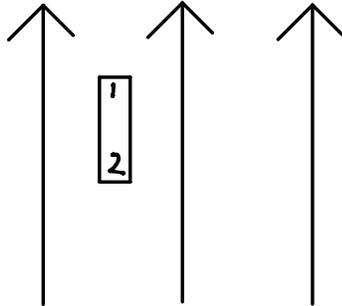
31. What are the maximum and minimum voltages across a 320 V ac power line? [4]

32. Acceptable units for current are _____ and _____. [2]

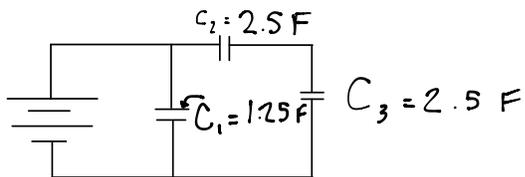
33. Calculate the total resistance [4]



34. In the following magnetic field, a bar of conducting metal moves with a uniform velocity v . Draw the v vector on the bar that will result in electric potential between end 1 and end 2 of the bar. [3]



35. What is the voltage across each of the 3 capacitors if the total charge in the circuit is 6.875C . [6]



b. Draw a new circuit in which there is an equal amount of voltage through each capacitor. [2]

36. How far apart are two capacitor plates if the capacitance is 4.7×10^{-7} pF and the length of each plate is 3 times the distance they are apart. [5]

37. A 4 micro-farad capacitor is being connected to a 5 V battery. The battery is disconnected. If the resistance experienced is 2.32×10^5 ohms, what is the charge remaining after 10 seconds? [5]

38. A negatively charged particle is moving west when entering a magnetic field directed perpendicularly downward. What direction is the force on the charge? [2]

39. Draw a diagram for digital logic of $AB + C + D$ [3]

A

B

C

D

B. Draw another diagram with the same outcome with two inversions. [3]

A

B

C

D

40. What occurs at the point where p-type silicon and n-type silicon make contact with each other? [2]

41. If $V_1=0V$ and $V_2=15V$, what is the value of the output voltage? (Triangle is amplifier) [4]

