Circuit Lab C - Circuit Lab C - SO Practice December 2020 - December 19 SO Practice - 12-19-2020

If a free response question requires a numeric answer, the answer will either be an exact integer (ex: 5, 200, -3, 0) or a terminating decimal (ex: 7.8, 2.25). Answers like 1/3 (0.333...) wi not be on the **short answer** portion of this exam (they can be for multiple choice).

All multiple choice questions are weighted equally. However, not all short answer questions are weighted equally.

Ties will be broken by the score on short answer questions.

1. (2.00 pts) According to one of Kirchhoff's laws, the sum of this quantity entering a node (or junction) is equivalent to the sum leaving a node.

- A) Current
- B) Resistance
- C) Power
- D) Voltage

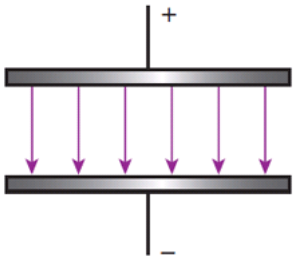
2. (2.00 pts)
This scientist discovered that two parallel wires carrying current in the same direction will experience a magnetic force pushing attracting them together. This phenomenon is a direct consequence of a law named for this scientist.

- A) Ampere
- B) Coulomb
- C) Ohm
- D) Tesla

3. (2.00 pts)
Consider two positive charges each with a charge of 2 coulombs separated 1 meter apart. Doubling the distance between two charges and doubling **both** of their charges will have what effect on the electric force acting on them.

- A) Multiplied by 16
- B) Multiplied by 4
- C) Remains the same
- D) Multiplied by 1/2
- E) Multiplied by 1/8

4. (2.00 pts)
Consider two parallel plates (of infinite area) with a constant DC voltage source applied such that there is a difference in electric potential energy between the plates. Which of the following describes the electric field strength?



- A) Stronger at the positive end and weaker at the negative end
- B) Stronger closer to the plates and weaker in the middle
- C) Stronger in the middle and weaker closer to the plates
- D) Equal field strength everywhere between the plates

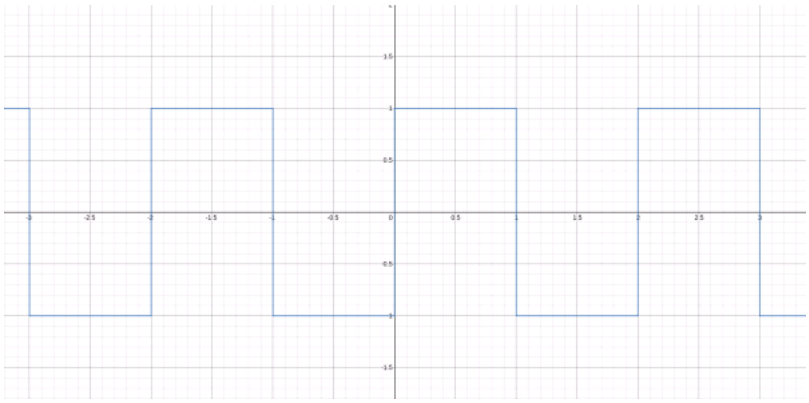
5. (2.00 pts) The truth table below represents what type of digital logic operation performed on A and B? (A is one input, B is the other input.)

A	B	?
0	0	0
0	1	1
1	0	1
1	1	1

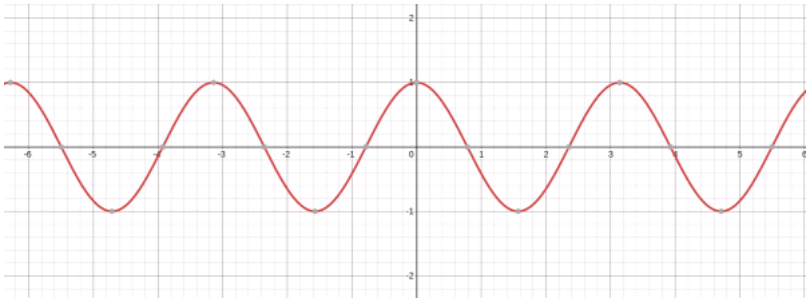
- A) AND
- B) OR
- C) NAND (not AND)
- D) XOR (exclusive OR)

6. (2.00 pts) Which of the following is NOT a graph of alternating current. The x-axis represents time while the y-axis represents current.

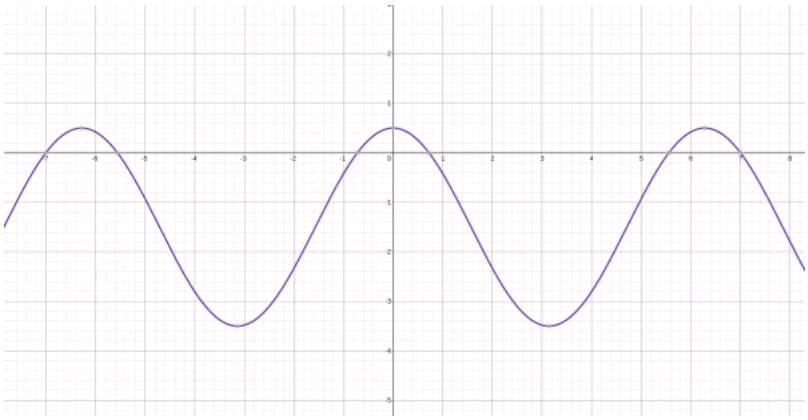
A)



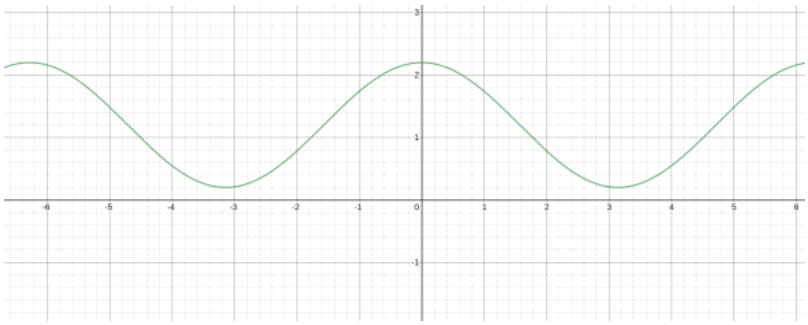
B)



C)



D)



- A) A
- B) B
- C) C
- D) D

7. (2.00 pts) Which of the following is equivalent to the electric potential difference across a resistor?

- A) Current
- B) Charge
- C) Power
- D) Voltage

8. (2.00 pts)
Suppose we want to solve the following circuit with superposition. That is, we will look replace each voltage/current source individually, solve the circuits, and combine the results together. We will start by replacing the voltage source with which of the following choices?

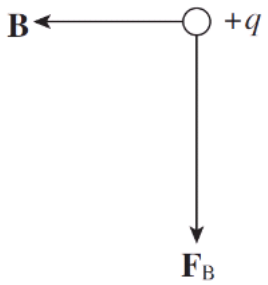
A) Capacitor (with a specific non-zero value)

B) Resistor (with a specific non-zero value)

C) Open circuit

D) Close circuit (wire)

9. (2.00 pts)
At a particular moment in time in this diagram, there is a moving particle with charge +q, in a magnetic field pointing left of strength B. The force observed on the particle is downward In which direction is the particle moving?



A) Up

B) Right

C) Toward the reader (out of the page)

D) Away from the reader (into the page)

10. (2.00 pts)
Assume we have an AC power outlet that is stated to be 50 V (for reference, most home outlets in the United States are 120 V). Which of the following answers is closest to the peak voltage that can be supplied by this outlet?

A) 50 V

B) 80 V

C) 100 V

D) 120 V

11. (2.00 pts) Assume we have an ideal LED with a threshold voltage of 2 V. If the forward voltage on the LED is 1.5 V, which of the following most closely describes the LED?

A) The LED is emits no light.

B) The LED emits light at at 1/2 brightness.

C) The LED emits light at 3/4 brightness.

D) The LED emits light at full brightness.

12. (2.00 pts)
Two parallel wires separated by 1 meter are carrying currents in opposite directions. Wire 1 has a current of 10 amp, while Wire 2 has a current of 20 amps. What is true about the force per unit length acting on Wire 1?

A) The force per unit length on Wire 1 is $20\mu N/m$, which is half that of the force acting on Wire 2.

B) The force per unit length on Wire 1 is $20\mu N/m$ directed toward Wire 2.

C) The force per unit length on Wire 1 is $40\mu N/m$ in a direction perpendicular to the Wire 1 to Wire 2 axis.

D) The force per unit length on Wire 1 is $40 \mu N/m$ directed away from Wire 2.

13. (2.00 pts) Which regions in a PNP transitors are p-type doped?

A) base, collector

B) collector, emitter

C) base, emitter

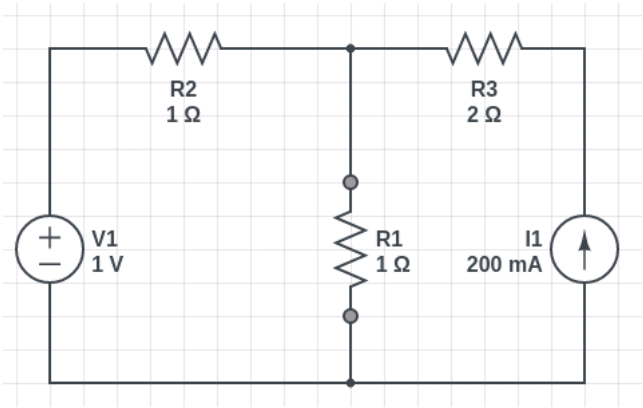
D) none of the above

14. (6.00 pts)

Give the magnitude of the current through each resistor. Make sure to label which is which and to include your units.

(Note: The circuit element labeled I1 with 200mA is a current source, which means it delivers a constant current of 200mA.)

(Note: if the resistor has a current of 1 amp in one direction, then the current is -1 amp is the other direction. Then the magnitude would just be the positive value, which is 1 amp.)

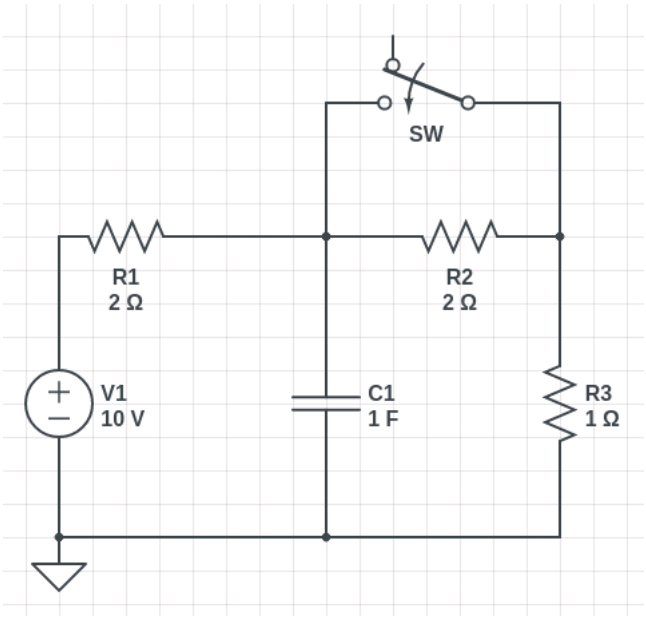


15. (6.00 pts)

The switch in the diagram has been open for a long time such that the circuit is in steady-state. Then, the switch is flipped closed at time 0.

Give the magnitude of the currents flowing through the resistors at the moment the switch is closed. Make sure to label which current matches with each resistor and include the units

Hint: what is the voltage across the capacitor at steady state? What is it directly after the switch closes?

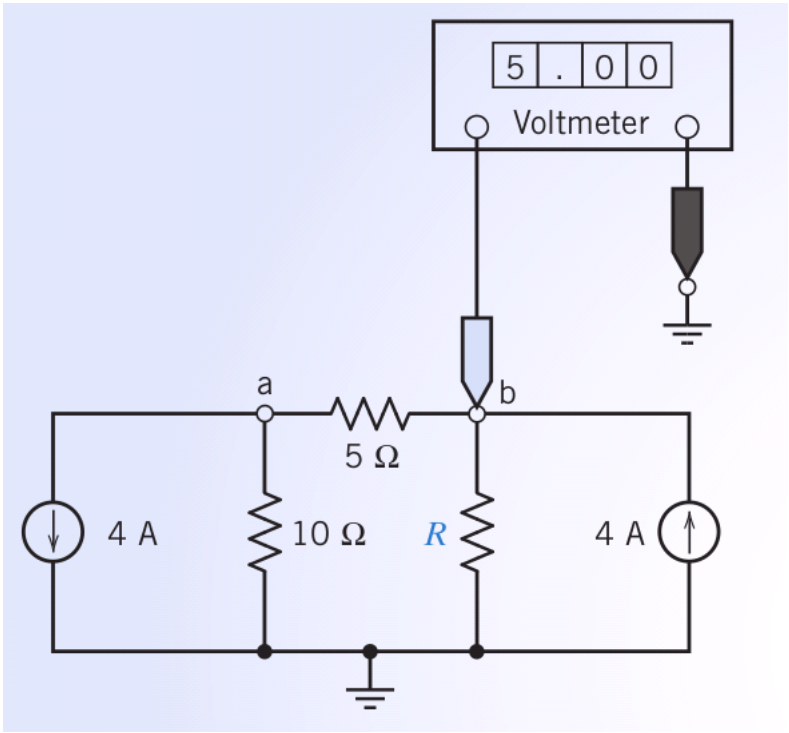


16. (4.00 pts)

In this circuit, two current sources are given, as well as the values of two resistors. We use a voltmeter at point B and measure 5 V (relative to ground). Solve for the voltage at point A (relative to ground) and value of the resistor labeled R. Make sure to label and to include the units (you can use ohm in place of Ω).

Hint: what is the sum of the currents entering or leaving a junction? Apply this at point A and you can directly solve for the voltage.

Hint: the voltage at point A is a negative value.

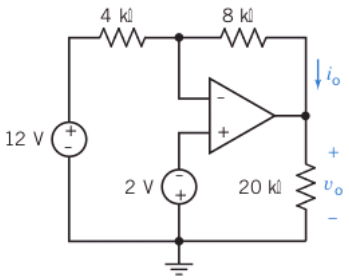


17. (6.00 pts)

The operational amplifier is ideal. Solve for the magnitudes of v_o and i_o. The units for the resistors are in $k\Omega$. Remember to label (you can use v_o and i_o) and include the units.

Hint: for an ideal opamp, you can determine the currents and voltages of the input terminals without any calculations. Given the voltage at the non-inverting input, what is the voltage at the inverting input?

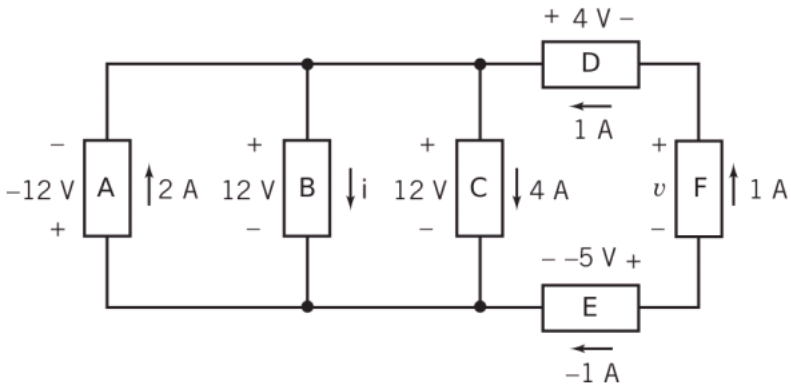
Hint: it is likely easier to solve for the current first.



18. (4.00 pts)

The diagram below shows mystery circuit elements (it does not matter what the elements are, you can pretend they are resistors). The current through element B and the voltage across element F are unknown.

Solve for the magnitude of the **power** supplied by B and by F. Label which power goes with each component and give the units.



End of test.