

Instructions (shown before students start the test)

This workshop is intended to be for Division C Circuit Lab workshop.

This is a timed trial test to take only 30 minutes.

For questions with a blank for units, use the proper abbreviation and capitalization - Kilowatts is kW - not Kw or KW or kw. For Ohms use the word "Ohms". For a number answer engineering units and prefixes - example for 1,000 use 1k, for 10,000 use 10 k, for 100,000 use 100k, do not use 0.1M for 100k.

Introduction (shown after students start the test)

1. (1.00 pts) 1. Historical perspective of the electricity discoveries made by Volta, Ohm, Tesla, Hertz, & Faraday, Ampere, Coulomb, Kirchhoff.

Born in the 1800's this English man developed many of the laws we use today for magnetics. His last name is:

2. (1.00 pts)

2. Properties of electric charge/fields, sources/hazards of static electricity, Coulomb's Law, capacitance

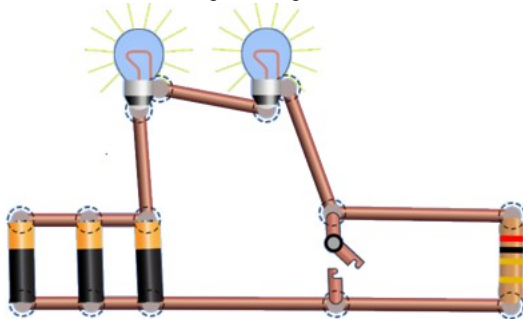
An aluminum electrolytic capacitor is made of two sheets of aluminum foil separated by a paper and dielectric. These sheets are placed on top of each other and rolled up to make the capacitor. For a capacitor with a each sheet 4 m x 20mm and the paper + dielectric thickness of 0.1mm what is the capacitance of the capacitor? The dielectric constant of paper is 3.7.

3. (1.00 pts) Properties of electric charge/fields, sources/hazards of static electricity, Coulomb's Law, capacitance.

For the capacitor in the previous question, what is the charge on the capacitor if it is charged to 100 Volts?

4. (1.00 pts) Direct current (DC) characteristics, sources, uses, simple circuit diagrams, DC hazards.

For the circuit as drawn, the light bulb light?



True False

5. (1.00 pts) Direct current (DC) characteristics, sources, uses, simple circuit diagrams, DC hazards

The unit for measuring energy is:

- A) W's
- B) KWHr
- C) J
- D) All the above
- E) None of the above

6. (1.00 pts) Alternating current (AC) characteristics, sources, uses, AC hazards

The unit used for measuring AC Power is:

- A) Watts
- B) kW RMS
- C) V/s
- D) All the above
- E) None of the above

7. (1.00 pts) Concepts and units of current, voltage, resistance, power, energy, and using Ohm's law

The proper way to write Ohms Law is:

- A) $V = I \cdot R$
- B) $I = V / R$
- C) $R = V / I$
- D) All the above
- E) None of the above

8. (1.00 pts) Concepts and units of current, voltage, resistance, power, energy, and using Ohm's law

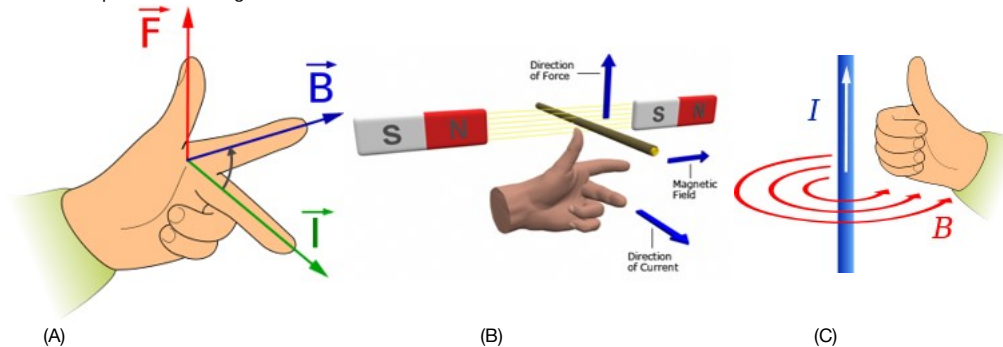
Which of the following statements are true about the combination of 3 parallel resistors? (Check all that apply)

(Mark ALL correct answers)

- A) The current is the same through all the resistors
- B) The total resistance is the sum of the resistors.
- C) The voltage is the same across the resistors.
- D) The power dissipation in each of the resistors is the same.
- E) The total current splits to go through each of the resistors.
- F) You can calculate the current through the resistor using $I = V / R$ where V is the voltage across any one of the parallel resistors.

9. (1.00 pts) Magnetic poles/fields, electromagnets, transformers, motors/generators, right-hand rule

The correct picture for the right hand rule is?



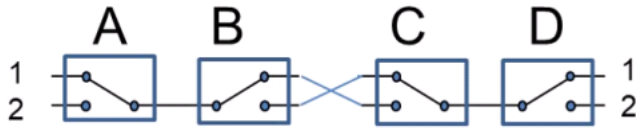
- A) (A)
- B) (B)
- C) (C)

10. (1.00 pts) Magnetic poles/fields, electromagnets, transformers, motors/generators, right-hand rule

The magnetic field in the center of an air core solenoid with 20 turns of 22 AWG wire carrying 0.05 amps is:

- A) There is not enough information to answer this question.
- B) $12.5 \times 10^{-7} \text{ T}$
- C) 100 uT
- D) $28 \times 10^{-6} \text{ T}$

11. (1.00 pts) Electrical control devices including 3-way light switch circuits



All switches are shown in their un activated state. Which switches need to be activated to connect "2" to "2"

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

12. (1.00 pts) Simple measurements, constructions, and configurations of a circuit and individual components



Which of the following are true about this picture?

(Mark **ALL** correct answers)

- A) The multimeter is measuring current.
- B) The multimeter is measuring Voltage
- C) The multimeter is measuring resistance
- D) The probes are connected correctly for the measurement
- E) The probes are not connected correctly for this measurement

13. (1.00 pts) Fundamental characteristics and operation of a light emitting diode (LEDs)

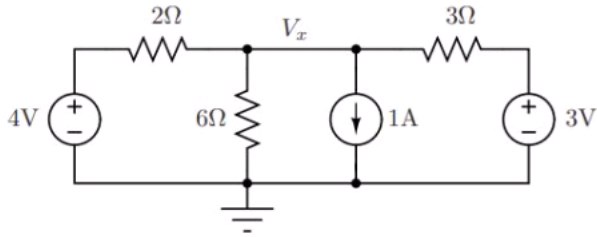
Which of the following statements are true about an LED?

(Mark **ALL** correct answers)

- A) By changing the voltage on an LED, you can change the color of the LED.

- B) For the LED to correctly create light, you connect the positive voltage to the anode and the return to the cathode.
- C) You can connect 2 batteries in series to light an LED.
- D) Different color LED's can be added in parallel and will work better than LED's in series.
- E) The LED voltage is based on the semiconductor bandgap voltage.
- F) A Red, Green and Blue LED can be controlled and combined to create a true white color.

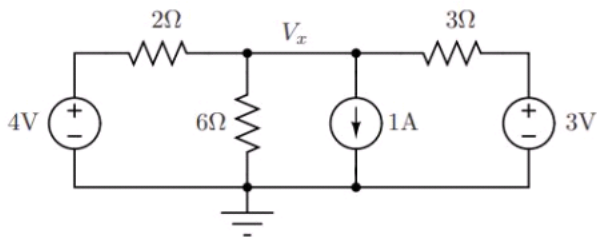
14. (1.00 pts) Simple Circuit Analysis using KCL or KVL



This problem will be easier to solve using KVL?

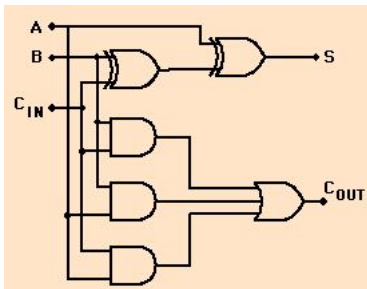
- True False

15. (1.00 pts) Simple Circuit Analysis using KCL or KVL.



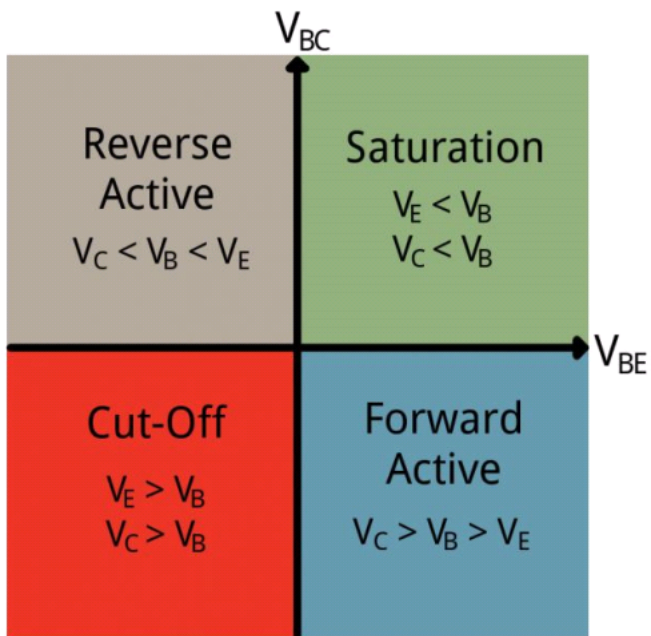
Write the KCL Equations for this circuit

16. (1.00 pts) Basic digital logic and digital logic operations



Write the equation for S based on the inputs. Use ^A for A Not, ^(AB) for (AB) Not

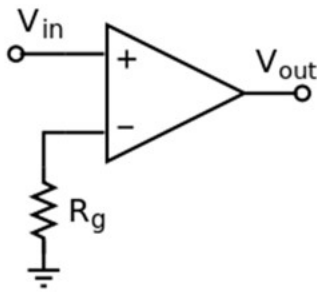
17. (1.00 pts) Electrical characteristics of silicon PN junctions (eg, diodes, PNP, NPN)



The above picture represents the different operating states of an NPN Transistor.

True False

18. (1.00 pts) Basics and application of Operational Amplifiers (OpAmps)



The above picture is of an OpAmp connection to provide a unit gain amplifier ($V_{out} = V_{in}$)?

True False