

Student Name: _____



Electronics & Communications Lab

Student Workbook

ECL-SWB-2001 Revision B
by David Collingham - K3LP
10/27/16



Electronics & Communications Lab – Section 1

Electronic Components & Symbols

Component?:



Symbol?:



What is this electronic component?

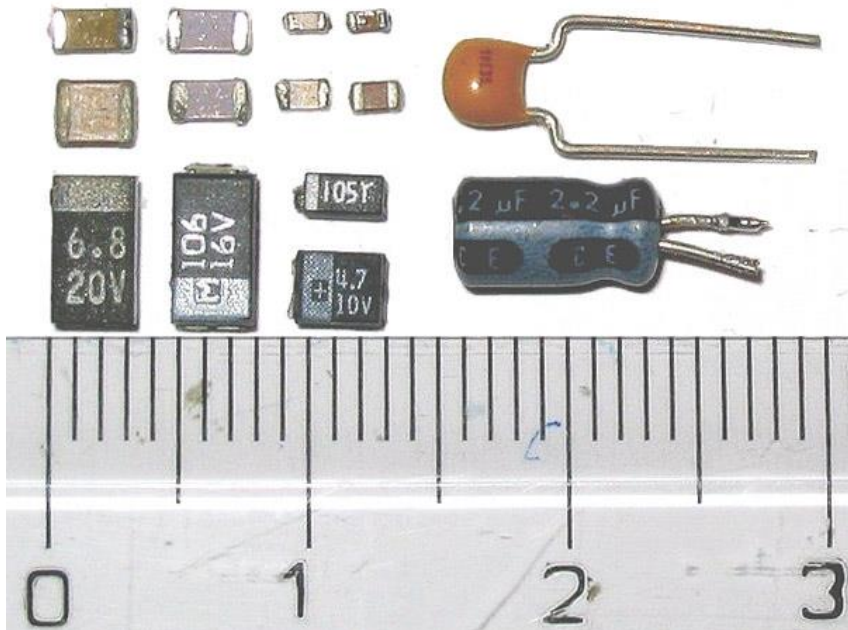
- a) Diode
- b) Capacitor
- c) Resistor
- d) Inductor

Electronics & Communications Lab – Section 1

Electronic Components & Symbols

(continued)

Component?:



Symbols?:



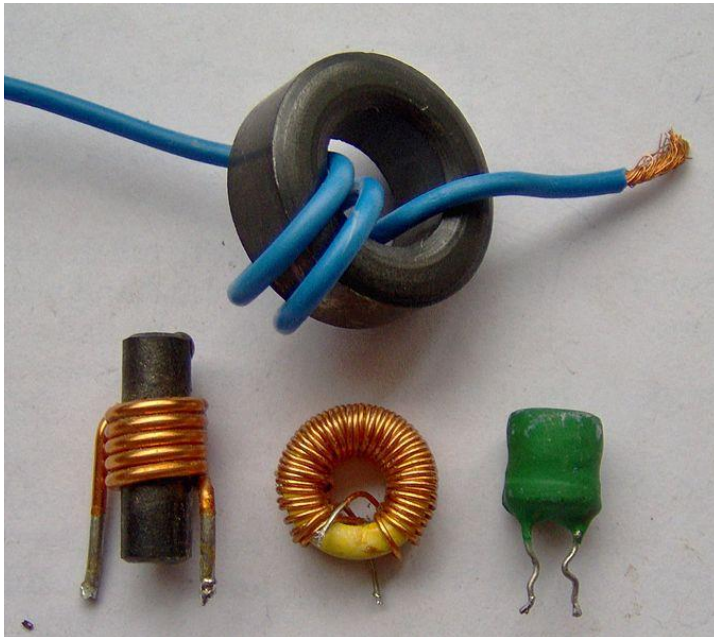
- 1) What is this electronic component?
 - a) Diode
 - b) Capacitor
 - c) Resistor
 - d) Inductor

Electronics & Communications Lab – Section 1

Electronic Components & Symbols

(continued)

Component?:



Symbols?:

Fixed-value



Iron core



Variable



Variac



Tapped

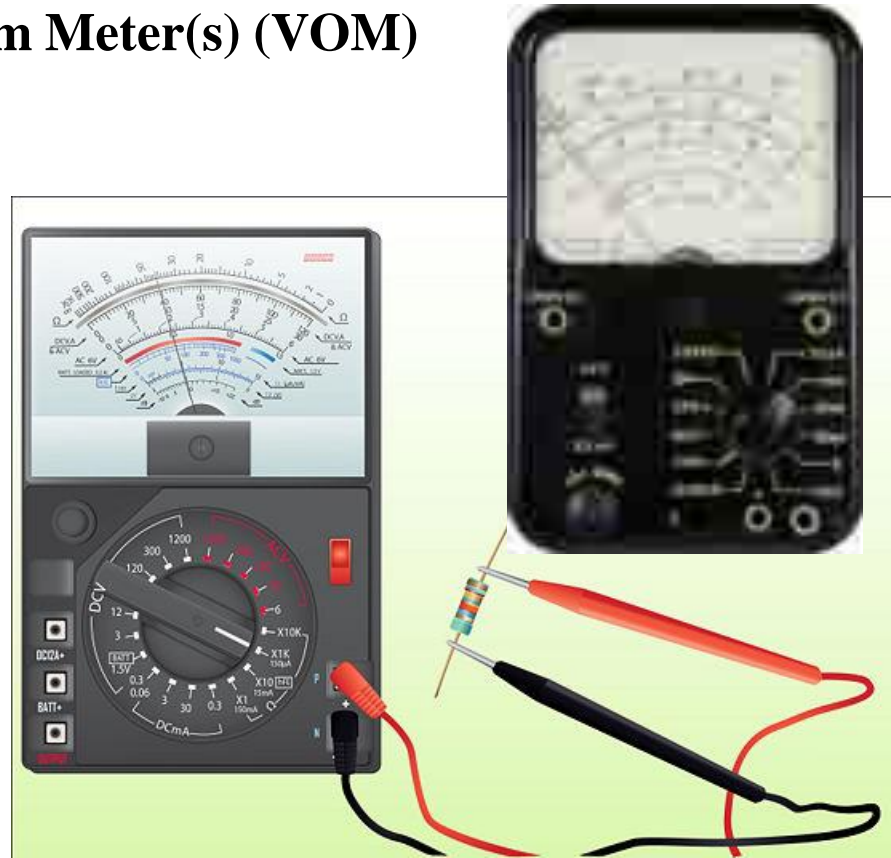


1) What is this electronic component?

- a) Diode
- b) Capacitor
- c) Resistor
- d) Inductor

Electronics & Communications Lab – Section 1

Types of Volt-Ohm Meter(s) (VOM)



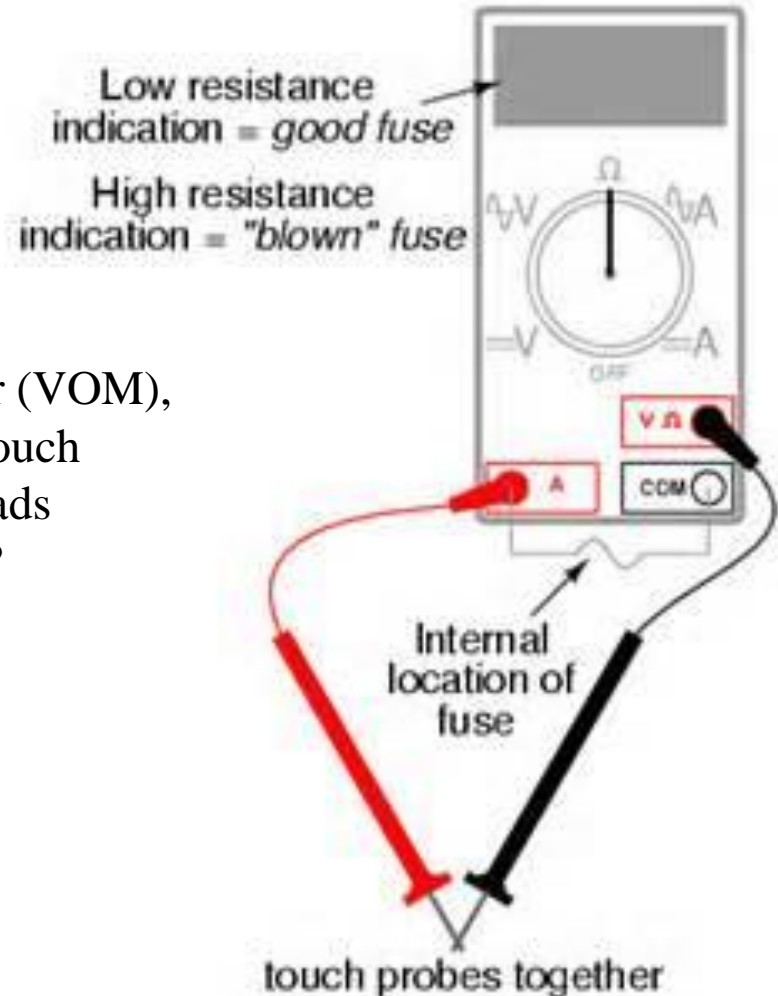
- 1) This type of VOM meter is this?
- a) Digital Volt-Ohm Meter (VOM)
 - b) Analog Volt-Ohm Meter (VOM)

- 2) This type of VOM meter is this?
- a) Digital Volt-Ohm Meter (VOM)
 - b) Analog Volt-Ohm Meter (VOM)

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Using a Volt-Ohm Meter (VOM)

continued



1) When checking your Digital Volt-Ohm Meter (VOM), you place the meter in Ohms (Ω) position and touch meter leads together (short). When the meter reads _____ ohms, the meter is working properly?

- a) Approximately 0.00 Ohms
- b) Greater than 1,000,000. Ohms

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Materials; Non-Conductive and Conductive

1) Circle all Conductive materials:

- Aluminum
- Glass
- Rubber
- Gold
- Insulator (non-metal)
- Wood
- Plastic
- Copper
- Salt water

2) Conductive materials have a _____ Resistance value?

- a) Low (0.00 ohms to 5 ohms)
- b) High (1,000,000 ohms or higher)

3) Non-Conductive materials have a _____ Resistance value?

- a) Low (0.00 ohms to 5 ohms)
- b) High (1,000,000 ohms or higher)

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Voltage; Direct Current (DC) and Alternating Current

1) As viewed on an Oscilloscope, this waveform is for:

- a) Direct Current (DC)
- b) Alternating Current (AC)



2) As viewed on an Oscilloscope, this waveform is for:

- a) Direct Current (DC)
- b) Alternating Current (AC)



Electronics & Communications Lab – Section 1

Electronic Components; Units of Measure

Draw a line from the “Component Type” to the corresponding “Unit of Measure/Inventor Name”:

Component Type:

- Resistor; Resistance

- Capacitor; Capacitance

- Inductor; Inductance

- Frequency

Unit of Measure/Inventor Name:

- Unit of Measure: Henry
Joseph Henry (1797–1878), American Scientist

- Unit of Measure: Hertz
Heinrich Hertz (1887), German Scientist

- Unit of Measure: Ohm or Ohms
Georg Simon Ohm (1827), German Scientist

- Unit of Measure: Farad or Farads
Michael Faraday, (1791-1867), English Inventor

Electronics & Communications Lab – Section 1

Determine the Type of Circuit by apply alphabetic letters to each node (unique connection points):

1) What type of circuit is this?

2) Re-Draw this circuit:

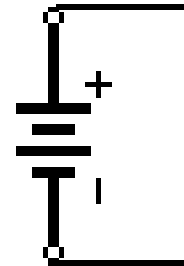
a) Series,

b) Parallel

c) Series & Parallel

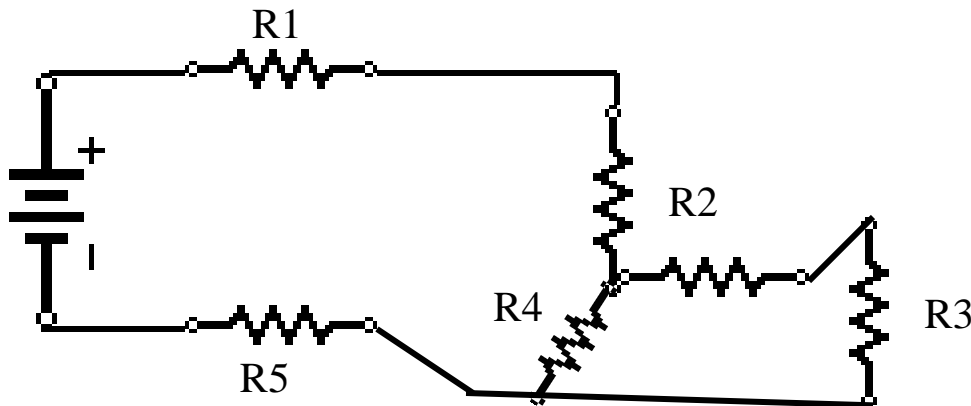
Step 2

12.2 VDC
source



Step 1

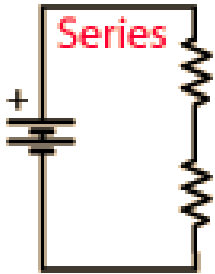
12.2 VDC
source



Electronics & Communications Lab – Section 1

Series Circuits

How to calculate the resistance in a series circuit?



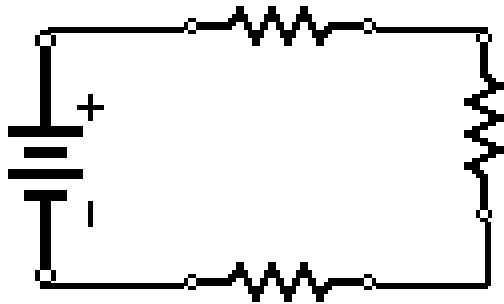
- Series resistance is the total resistance of two or more resistors that are connected end-to-end. In such an arrangement, the resistors are chained together, that is the right lead of the first resistor is connected to the left lead of the second resistor, and the right lead of the second resistor is connected to the left lead of the third and so on.
- The calculation of series resistance is straight-forward. Just sum the resistance values of each resistor in the series chain.

•Formula: $R_{Total} = R1 + R2 + R3 + R4 + \text{etc.}$

$R1 = 5 \text{ K } \Omega \text{ or } 5,000 \Omega$

Step 1

12.2 VDC



$R3 = 4 \text{ M } \Omega \text{ or } 4,000,000 \Omega$

$R2 = 500 \Omega$

Calculate the Series Resistance:

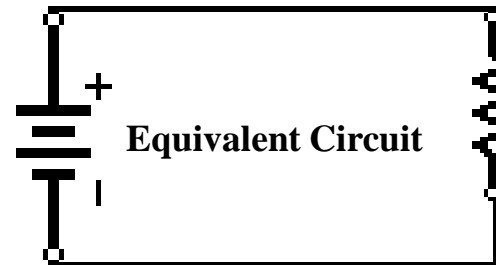
$$R_{Total} = R1 + R2 + R3$$

$$R_{Total} = \underline{\hspace{2cm}} + \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$$

$$R_{Total} = \underline{\hspace{2cm}} \Omega$$

Step 2

12.2 VDC

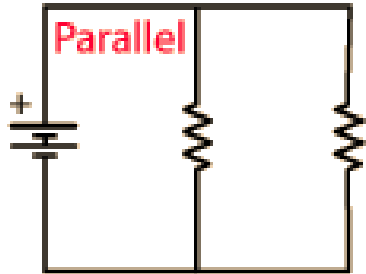


$R_{Total} = \underline{\hspace{2cm}} \Omega$

Electronics & Communications Lab – Section 1

Parallel Circuits

How to calculate the resistance in a parallel circuit?

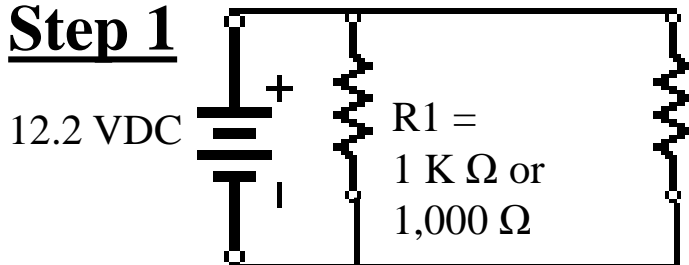


Many networks can be reduced to series-parallel combinations, reducing the complexity in calculating the circuit parameters such as resistance, voltage and current. When several resistors are connected between two points with only a single current path, they are said to be in series. In a parallel circuit, though, the current is divided among each resistor, such that more current goes through the path of least resistance. A parallel circuit has properties that allow both the individual resistances and the equivalent resistance to be calculated with a single formula. The voltage drop is the same across each resistor in parallel

• Formula:

$$R_{\text{Total p}} = \frac{R1 \times R2}{R1 + R2}$$

Step 1



R2 =
1 K Ω or
1,000 Ω

Calculate the Parallel Resistance:

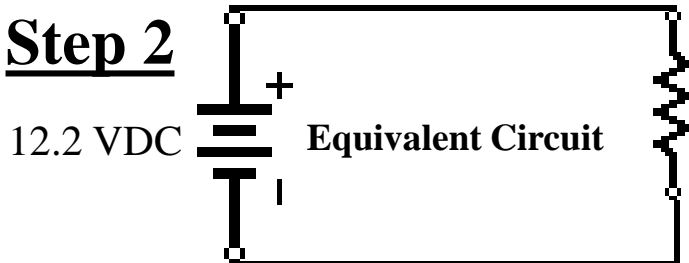
$$R_{\text{Total p}} = \frac{R1 \times R2}{R1 + R2}$$

$$R_{\text{Total p}} = \frac{\quad \times \quad}{\quad + \quad}$$

$$R_{\text{Total p}} = \underline{\quad}$$

$$R_{\text{Total p}} = \underline{\quad} \Omega$$

Step 2



R Total p =
 Ω

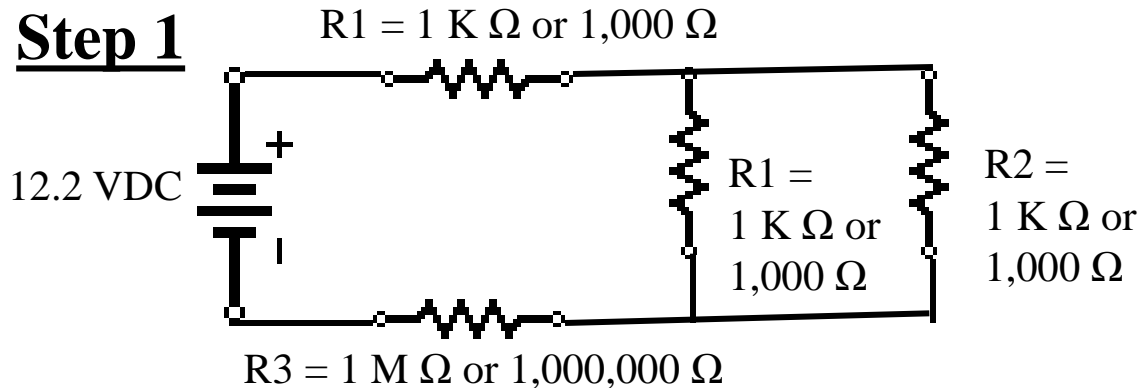
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Series-Parallel Circuits

How to calculate the resistance in a series-parallel circuit?

- First solve the parallel circuit by using the parallel circuit formula, then use the series circuit formula to solve the series circuit as follows:

Step 1



Step 3

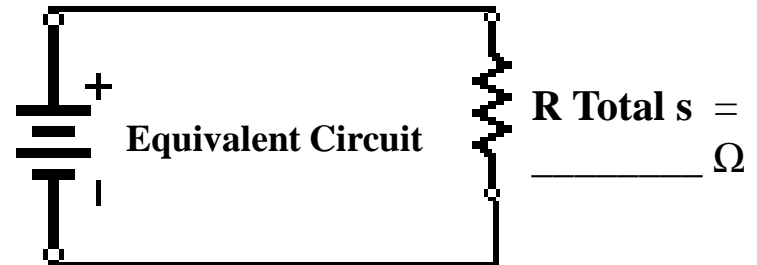
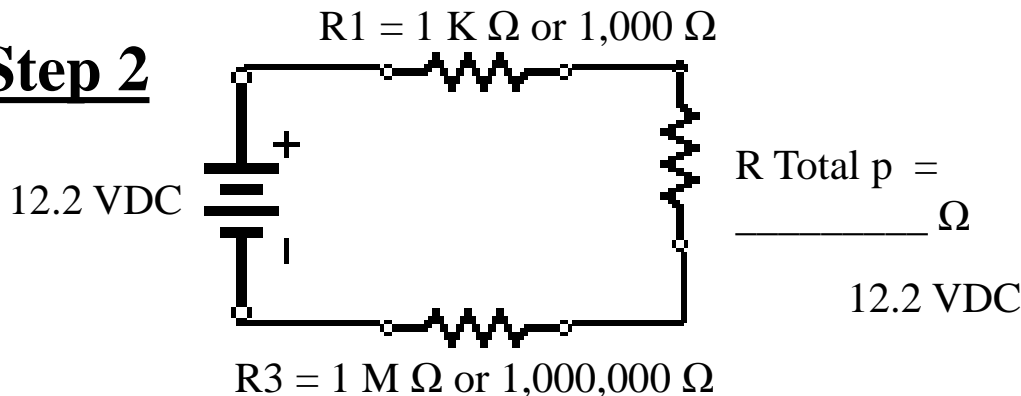
Calculate the Series Resistance:

$$R_{\text{Total s}} = R1 + R_{\text{total p}} + R3$$

$$R_{\text{Total s}} = 1,000 + \underline{\hspace{2cm}} + 1,000,000$$

$$R_{\text{Total s}} = \underline{\hspace{2cm}} \Omega$$

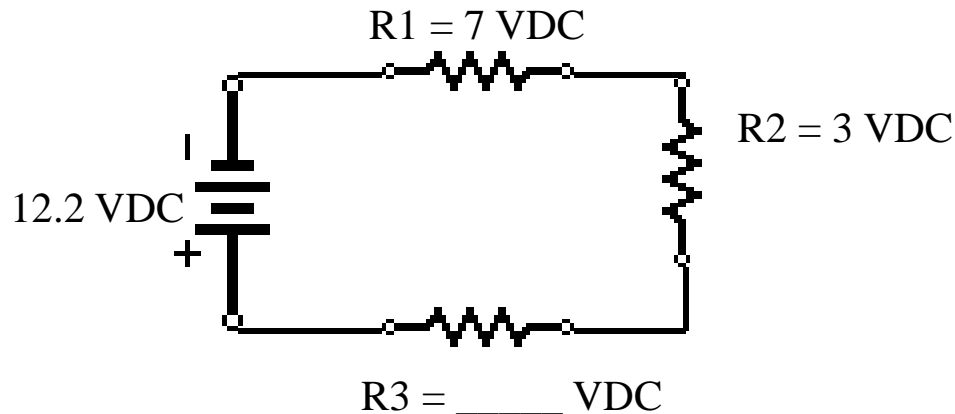
Step 2



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Kirchhoff's Voltage Law

- ❑ Gustav Robert Kirchhoff (1824-1887) - German Physicist
- ❑ Kirchhoff's Voltage Law also follows the principle of conservation of energy and states that the sum of all of the voltages in a complete loop of a circuit must equal zero, or the sum of all voltage drops in a series circuit shall equal its source.



What is the voltage drop across R3?

_____ VDC

Example:

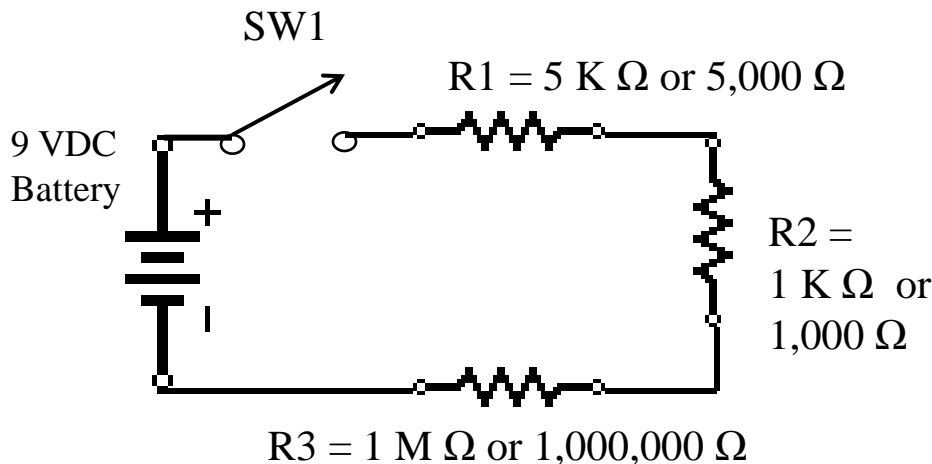
Sum 12.2 VDC = VDC (R1) + VDC (R2) + VDC (R3)

12.2 VDC = 5 VDC + 3 VDC + _____ VDC

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Assemble DC Circuit & Measure Voltages:

1) Assemble this circuit using the components provided and measure the voltages listed with VOM in DC Voltage mode:



a) Measure the Voltage Drop across component with Switch (SW1) Open:

R1 = _____ VDC

R2 = _____ VDC

R3 = _____ VDC

SW1 = _____ VDC

Battery = _____ VDC

b) Measure the Voltage Drop across component with Switch (SW1) Closed:

R1 = _____ VDC

R2 = _____ VDC

R3 = _____ VDC

SW1 = _____ VDC

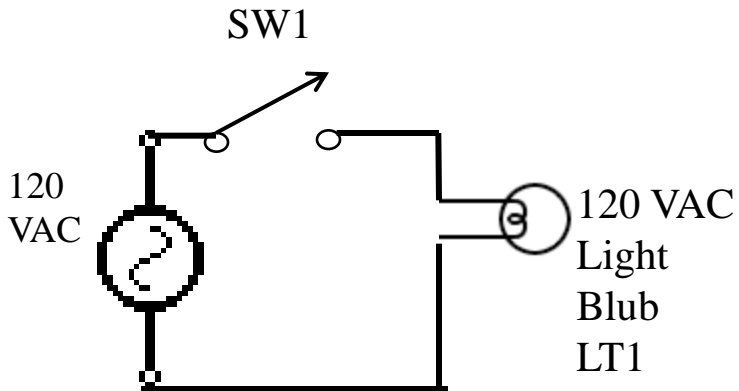
Battery = _____ VDC

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Assemble AC Circuit & Measure Voltages:

CAUTION: HIGH AC VOLTAGE MAY CAUSE SHOCK

- 1) Assemble this circuit using the components provided and measure the voltages listed with VOM in AC Voltage mode:



- a) Measure the Voltage Drop across component with Switch (SW1) Open:

LT1 = _____ VAC

SW1 = _____ VAC

Power Source = _____ VAC

- b) Measure the Voltage Drop across component with Switch (SW1) Closed:

LT1 = _____ VAC

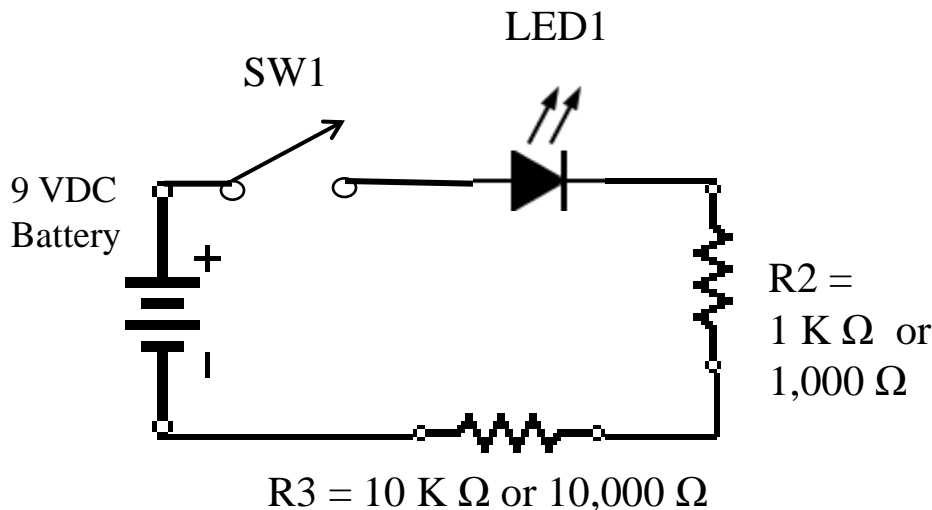
SW1 = _____ VAC

Power Source = _____ VAC

Electronics & Communications Lab – Section 1

Assemble DC Circuit & Measure Voltages:

1) Assemble this circuit using the components provided and measure the voltages listed with VOM in DC Voltage mode:



a) Measure the Voltage Drop across component with Switch (SW1) Open:

LED1 = _____ VDC

R2 = _____ VDC

R3 = _____ VDC

SW1 = _____ VDC

Battery = _____ VDC

b) Measure the Voltage Drop across component with Switch (SW1) Closed:

LED1 = _____ VDC

R2 = _____ VDC

R3 = _____ VDC

SW1 = _____ VDC

Battery = _____ VDC