Group	1192	Task	3	Date	26/10/2018	Pair #	**12**
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Analysis and measurement tools - Basic Concepts

Instructions

In order to do this task we need:

- Mounting plate
- 5 resistors
- 2 LED

Exercise 1

Fill in the following table indicating the resistance value of each resistor, as well as the colour code given. Order resistors from smaller to bigger resistance ($R_1 < R_2 < \ldots < R_5$).

Resistor #	Measured Val. (Ω)	Colour Code	Theoretical Val. (Ω)	Theoretical Tolerance
1	468	Ye,Pur,Br,Gold	470	5%
2	552	Gr,Blu,Br,Gold	560	5%
3	991	Br,Bla,Red,Gold	1000	5%
4	1345	Br,Or,Or,Br,Br	1330	1%
5	1505	Br,Gr,Bl,Br,Br	1500	1%

Notes: Explain briefly whether the results obtained are reasonable or not.

The change among Theoretical Value and Measured Value is pretty close, according to the tolerance.

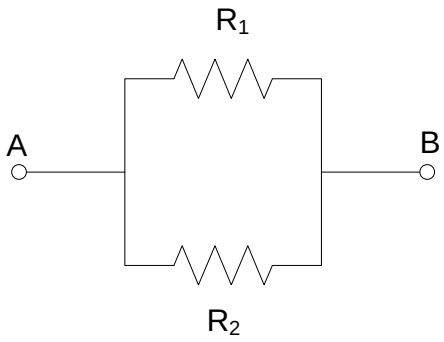
Exercise 2

Now, several assemblies with resistors are shown. For each of them, you should theoretically compute the value that you will measure, and after that, perform the assembly and check the measured value.

The resistor number should match the position in the previous table so that R_1 indicates resistor 1 in the previous table.

Assembly 1

Measure the resistance between points A and B.



Explanation:

We calculate the total resistance (Rt):

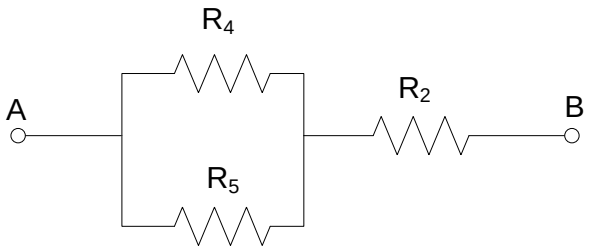
Rt = 1/((1/468)+(1/552))=253 Ohms

R1 R2

Measured value: 253 Ohms_____

Assembly 2

Measure the resistance between points A and B.



Explanation:

We calculate the total resistance (Rt):

Rt = (1/((1/1345)+(1/1505))) + 552=1262 Ohms

R4 R5 R2

Measured value: 1262 Ohms_____

Assembly 3

Voltage measurement

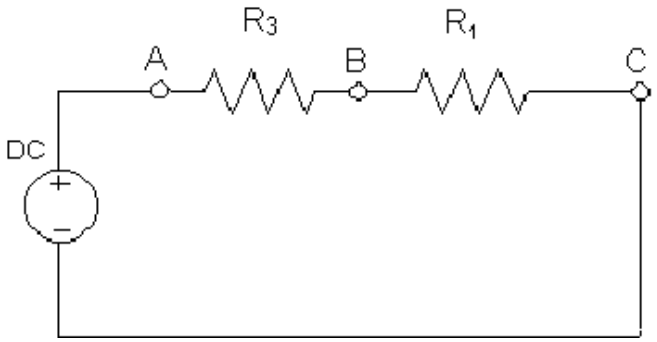
Measure the voltage between points A and B, and between points B and C, when the source provides 5 Volts. Explain the calculations and the relationship between these values.

Explanation:

Applying Ohm's law we get the total current (It):

It = 5/(468+991) = 0.0034 A

R1 R3



Applying Ohm's law we get the voltage between A and B:

991*0.0034 = 3.39 V

R3

Applying Ohm's law we get the voltage between B and C:

468*0.0034 = 1.61 V

R1

Finally we check that the sums of voltages is equal to the total voltage, to ensure that everything has been well calculated:

3.39 + 1.61 = 5 V

Measured Value A and B: 3.39 V_____

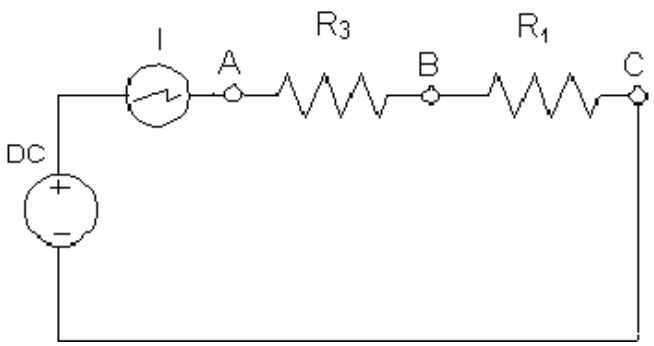
Measured Value B and C: 1.61 V_____

Current measurement

Put the multi-meter in series as it is shown in the figure. Measure the current in R3 when the source provides 5 Volts. How do you measure the current in R1? Explain the calculations and relationship between these values.

Explanation:

As we calculated in the last exercise, the current of this circuit is 0.0034 A when the source provides 5 Volts and the total resistance is (R3 +R1 = 1459 Ohms). As it is a circuits in series, the current is constant.

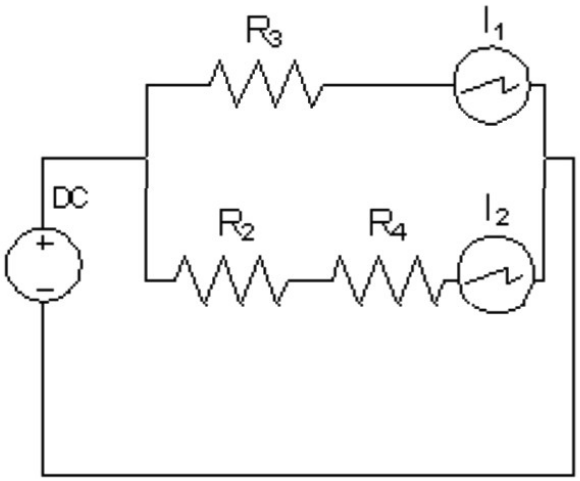


Measured Value: 0.0034 A_____

Assembly 4

Measure the intensities I_1 and I_2 when the source provides 12 Volts.

Note: You only have one multi-meter so you must do one measurement after the other. When you remove the multi-meter remember to connect the circuit again.



Explanation:

We calculate the total resistance (Rt):

Rt = 1/((1/991)+(1/(552+1345))) = 650.94 Ohms

R3 R2 R4

Applying Ohm's law we get the total current (It):

It = 12/650.94 = 0.018 A

Applying Ohm's law we get I1:

I1 = 12/991 = 0.012 A

R3

Applying Ohm's law we get I2:

I2 = 12/(552+1345) = 0.006 A

R2 R4

Finally we check that the sums of currents is equal to the total current, to ensure that everything has been well calculated:

It = I1+I2 =0.018 A

Measured value I_1: 0.012 A_____

Measured value I_2: 0.006 A_____

Exercise 3

In the following circuit, it is necessary to fix the current to 20 mA. Choose the right value of the resistor in table 1 and modify the voltage in the source in order to ensure the current in the resistor is 20 mA.

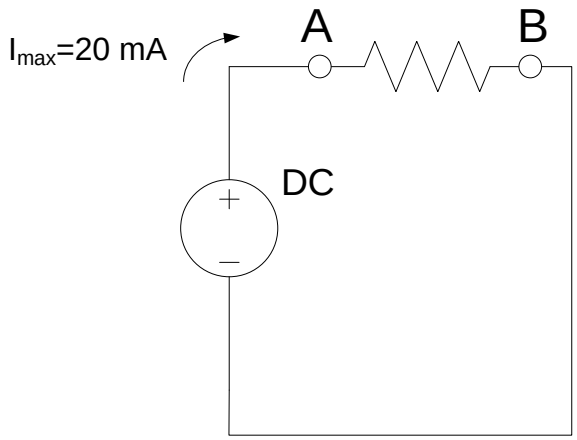
Note: Choose the correct resistor to avoid increasing the voltage more than 12 V.

Explanation:

Applying Ohm's law we get the source voltage:

468*0.02 = 9.36 V

R1



Resistor value: 468 Ohms_____

Source value: 9.36 V_____

Exercise 4

Use the resistor and voltage from previous exercise and assembly the following circuit to power a LED. Remember the information in the slides about the voltage and resistance necessary to power a LED.

Measure the current of the circuit and voltages between A and B (V_{AC}) and B and C (V_{BC}).

Explicación:

From the previous exercise we got that the source voltage was 9.36 V and the resistance R = 468 Ohms. As we know from the slides, Applying the formula of the slides (R = (Vs-Vled) / Iled) we get the current of the circuit:

It = (9.36-1.7) / 468= 0.016 A

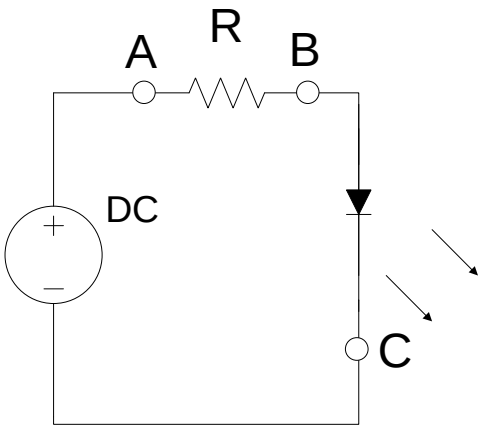
Vs VLed R

With the value of the current we can obtain the voltages between A and B, and B and C:

V_{AB} = 0.016 * 468 = 7.66 V

It R

V_{BC} = 1.7 V (Voltage drop that is caused by the LED)



We can see that V_{AB} + V_{BC} = Vt = 9.36 V

Resistance value: 468 Ohms_____

Source value: 9.36 V_____

Voltage V_{AB}: 7.66 V_____

Voltage V_{BC}: 1.7 V_____

Exercise 5

If the source in the following circuit is 5 V, calculate the values for resistances R and R' to power both LEDs. In addition, one LED should shine twice the other. Measure the current and voltage for both LEDs.

Remember the information in the slides about the voltage and resistance necessary to power a LED.

Explanation:

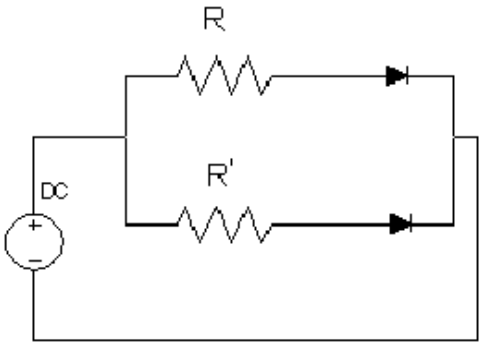
As one led has to shine twice the other, and the amount of current needed to light up a led is between 0.01 A and 0.02 A, the upper path will have 0.01 A and the lower 0.02 A. Then the total current will be 0.03 A.

Applying the formula of the slides (R = (Vs-Vled) / Iled) we get the resistance that each led needs:

R = (5 – 1.7) / 0.01 = 330 Ohms

R' = (5 – 1.7) / 0.02 = 165 Ohms

Because is a parallel circuit, the voltage in both branches is the same, 5 V.



Upper path: Current value: 0.01 A_____ and voltage value (LED leads): 1.7 V_____

Lower path: Current value: 0.02 A_____ and voltage value (LED leads): 1.7 V_____

Exercise 6 – No mandatory (2 points)

This exercise is optional. Perform the assembly of a continuity tester whose correct working order will be verified with a LED. The goal is to have a personal device to detect continuity. The student should purchase the material. Given the complexity of the task (buy components and mount (or solder) them on a mounting plate, etc.), 3 weeks are given starting from the day of the lecture for presenting the assembly to the professor.