2022/23
EE101 Laboratory Book
Department of Electronic Engineering

Lab 2 : Resistance, Current and Voltage

Handout and Answer Sheet

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EQUIPMENT

A voltage source, voltmeters, ammeters, a laboratory lead kit. Pick three different resistors from the available resistors.

OBJECTIVE

The objectives of this laboratory are for the student to calculate, implement and measure resistance, current and voltage. In doing so the student will for the first time gain experience using the test and measuring equipment provided for the laboratory.

INFORMATION

1. Always use the measured value of resistance for all calculations.
2. Always adjust the power supply voltage with the circuit connected.
3. When measuring voltage, the voltmeter must be connected across the circuit.
4. When measuring current, you must break the circuit and the current meter must be inserted into the circuit (in series).
5. Remember the resistor colour-code!

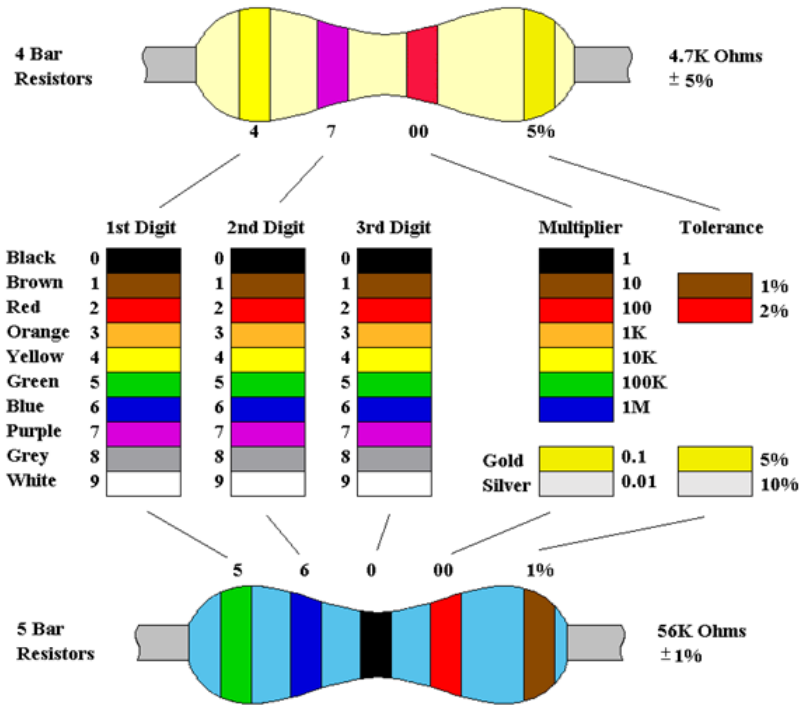


Figure 1: Resistance and related color codes

PROCEDURE

Part 1: Ohm's Law

You need to calculate the value of all the three resistors supplied using their color-code and fill in Table 1 accordingly. Ensure, the values of the resistors are high enough so that R gets very hot!! When reading resistors there is a figure for tolerance (the percentage error that this device is allowed to have). You can get the max and the min resistance values by taking the nominal "official" value and adding/subtracting the tolerance percentage.

Table 1: Answers for Part 1

	Resistor Colour-Code	Colour-Coded Resistance	Colour-Coded Tolerance	Max Coded Resistance	Min Coded Resistance	Measured Resistance	Is the resistor within Tolerance
R_1							
R_2							
R_3							

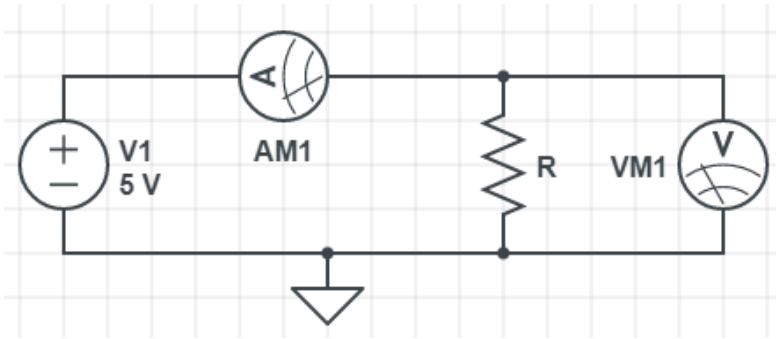


Figure 2

You may measure the resistance by constructing a circuit with a supplied voltage of 5 Volt, a voltmeter and an ammeter. The circuit you need is shown below (Fig. 2). Using ohm's law, calculate the real resistance (measured resistance) of the device and fill in Table 1. You must use an ammeter and a voltmeter to take your measurements. *DO NOT USE AN OHMMETER.*

Part 2: Resistors in Series

Part 2.1

- On your bread-board connect the circuit shown in Fig. 3.
- Calculate and then measure the total resistance. You may measure the individual resistances using the color codes. You may measure the total resistance R_{Total} using a multi-meter.

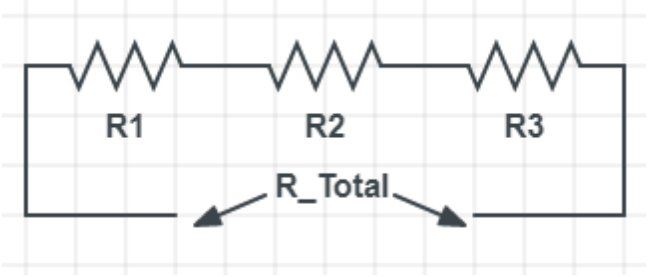


Figure 3

Table 2: Answers for Part 2.1

R_1	1 kΩ
R_2	2.2 kΩ
R_3	10 kΩ
Calculated R_{Total}	13.2 kΩ
Measured R_{Total}	13.2 kΩ

- Show your calculation.

Add all of the resistances in the form R1 + R2 + R3 = Rt. As they are in parallel this will work.
1 kΩ+2.2 kΩ+ 10kΩ = 13.2 kΩ

Part 2.2

- Connect the circuit in Fig. 4. Note that this circuit is the same as in Fig. 3, except that there is now a DC supply voltage connected. Set the voltage source to 5.0 volts. Break the circuit between the **POSITIVE side of the battery and resistor** R_1. Insert the ammeter and measure and record the current flow through this point. Now do the same for the points between the other resistors and the **resistor** R_3 **and the negative side of the battery**. Record the currents in Table 5.
- What conclusions can be made from these results?

The current coming out of the power supply is exactly the same as the current going in.

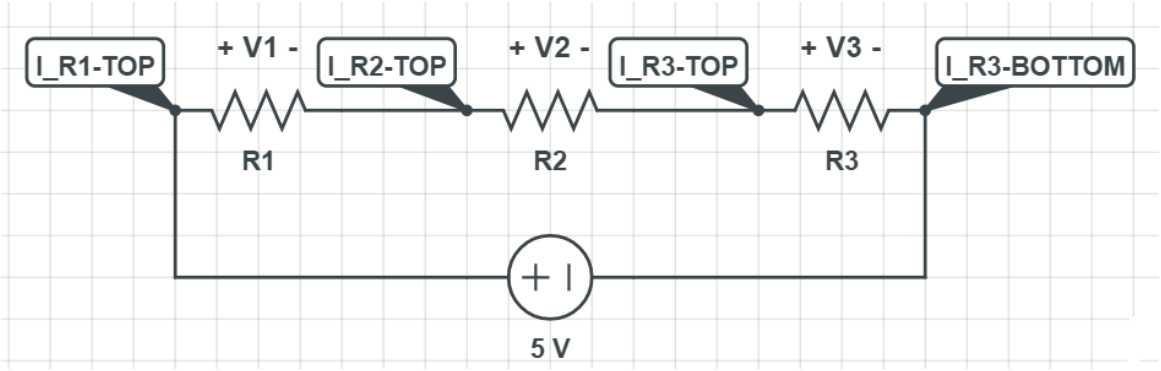


Figure 4

Table 3: Answers for Part 2.2

I_{R1-TOP}	379 mA
I_{R2-TOP}	379 mA
I_{R3-TOP}	379 mA
$I_{R3-BOTTOM}$	379 mA

The current coming out of the power supply is exactly the same as the current going in.

Part 2.3

- Connect the circuit of Fig. 4. Set the DC supply voltage to 5.0 volts. Measure the voltage drop across each resistor. Record in Table 4. Add the voltage drops together and record.

Table 4: Answers for Part 2.3

V_1	0.379 V
V_2	0.833 V
V_3	3.790 V
Total of Voltage Drops	5.002 V

- What conclusions can be made from these results?

The voltage that comes out is the same as the voltage that goes in.

Part 3: Resistors in Parallel

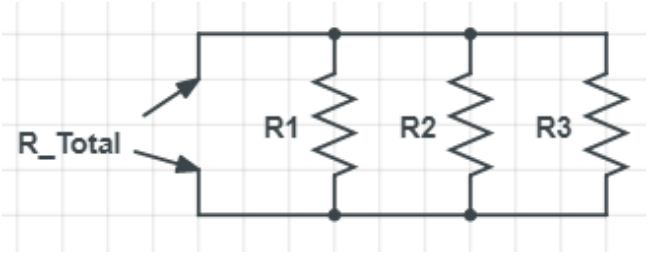


Figure 5

Part 3.1

- On your bread-board connect the circuit shown in Fig. 5. Calculate and then measure the total resistance. Show your calculation. For the measurement you may use the same technique as done in Part 1. You may measure the individual resistances using the color codes. You may measure the total resistance R_{Total} using a multi-meter.

Table 5: Answers for Part 3.1

Calculated R_{Total}	643Ω
Measured R_{Total}	643Ω

- Show your calculation.

1
---------- = 643 mΩ
1/1 + 1/2.2 + 1/10
5/7.77 = 643 mΩ

Part 3.2

- Connect the circuit in Fig. 6. Make sure that the source voltage is properly set to 5 volts with the circuit connected. Measure the current through each resistor and the total current. Record in Table 6.

- Add the measured currents through R_1, R_2, and R_3 together and compare with the measured total current. Record the sum of measured currents.

Table 6: Answers for Part 3.2

I_{R1}	5 mA
I_{R2}	2.27 mA
I_{R3}	0.500 mA
I_{Total}	7.77 .A

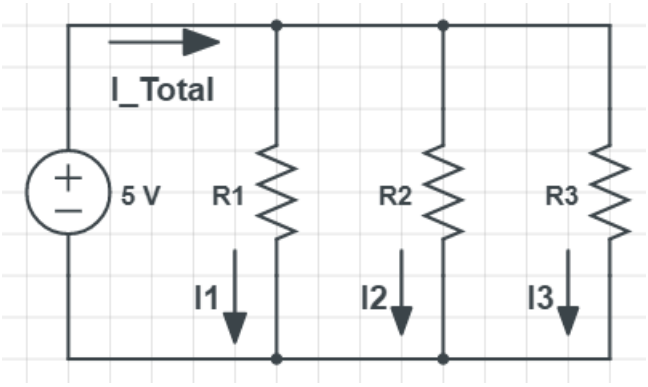


Figure 6

- What conclusions can be made from these results?

The amperes throughout the circuit add up to the total amperes. This means that the Amps going in is equal to the amps going out

Part 3.3

- Connect the circuit in Fig.7. Adjust the voltage source to a value of 5 volts (with the circuit connected). Using the voltmeter, measure the voltage across each resistor. Record in Table 7. Add the voltage drops together and record.

- What conclusions can be made from these results?

The voltage stays the same thorughout the circuit which means that the all resistors see the voltage as the same.

Table 7: Answers for Part 3.3

V_1	5 V
V_2	5 V
V_3	5 V

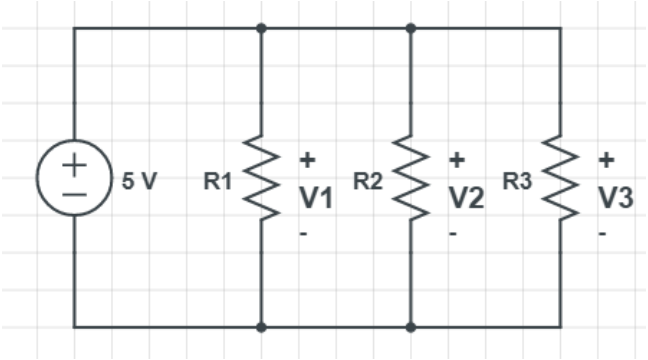
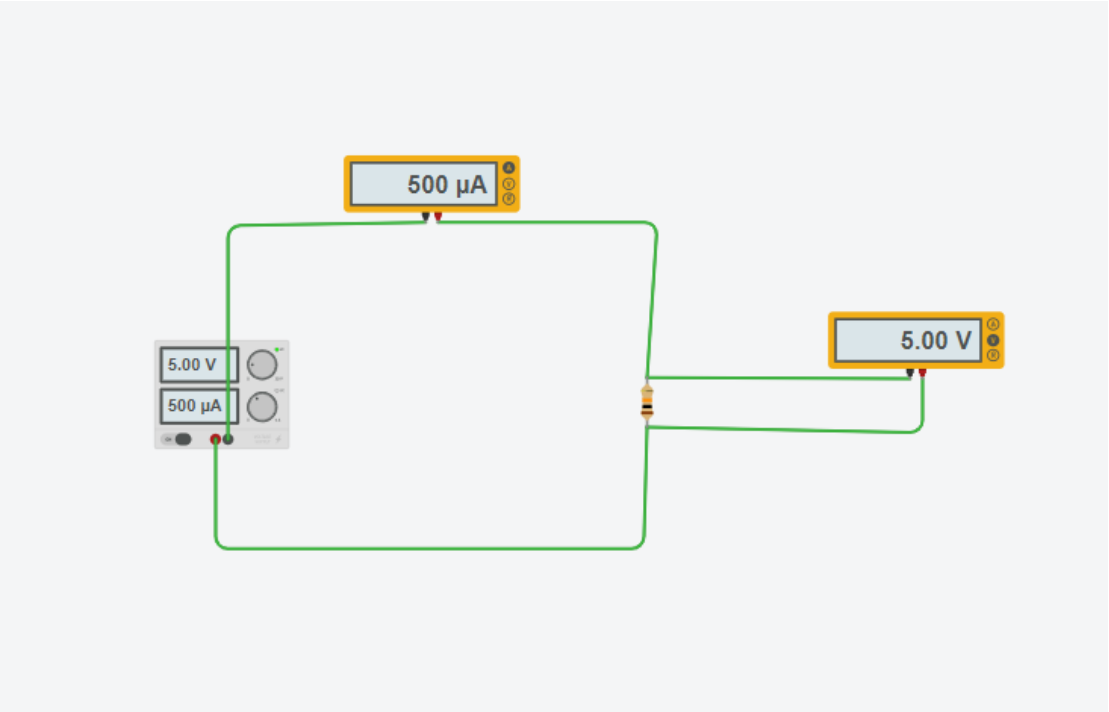
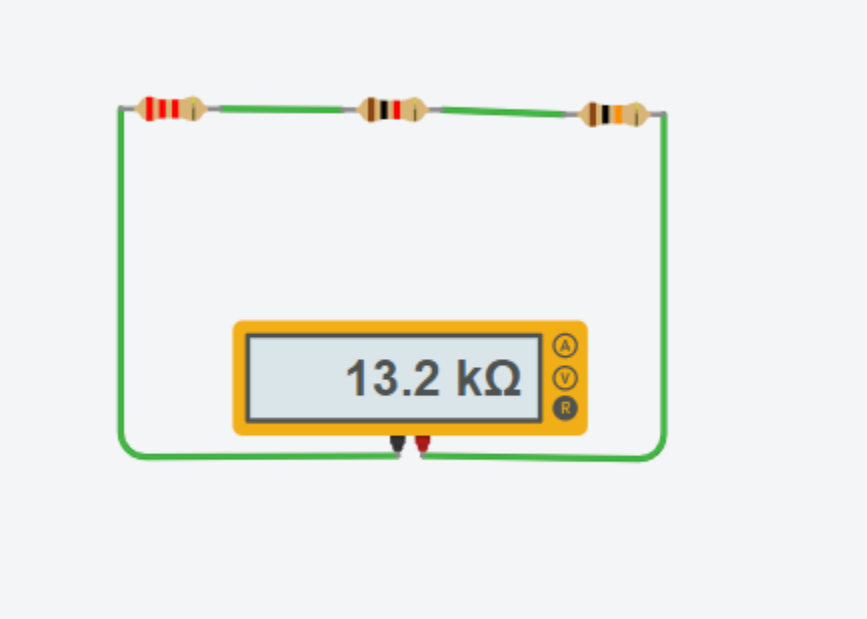


Figure 7

Part 1:



Part 2.1:



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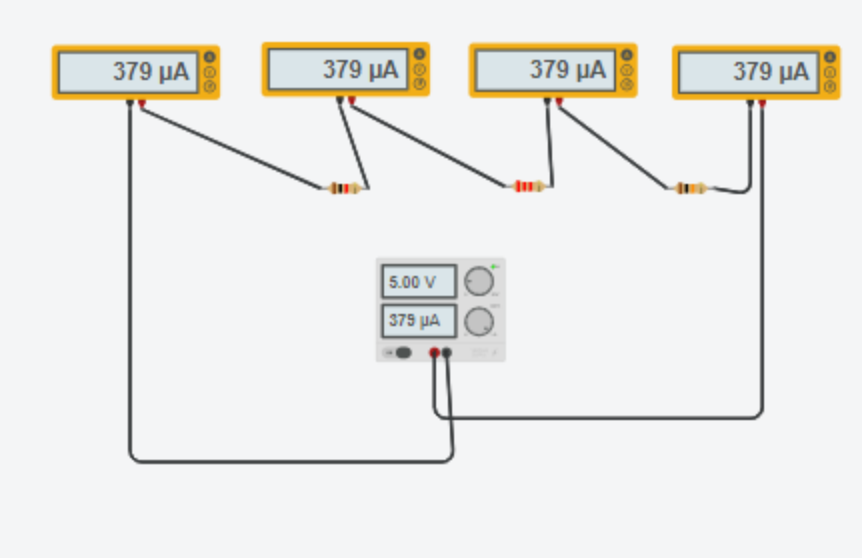

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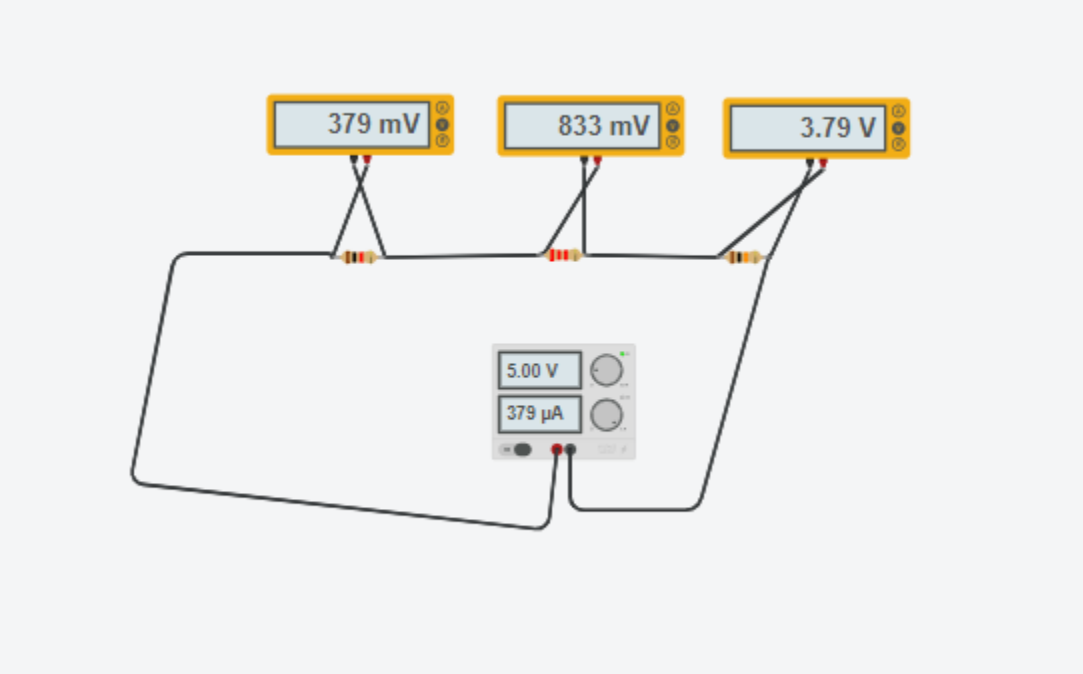
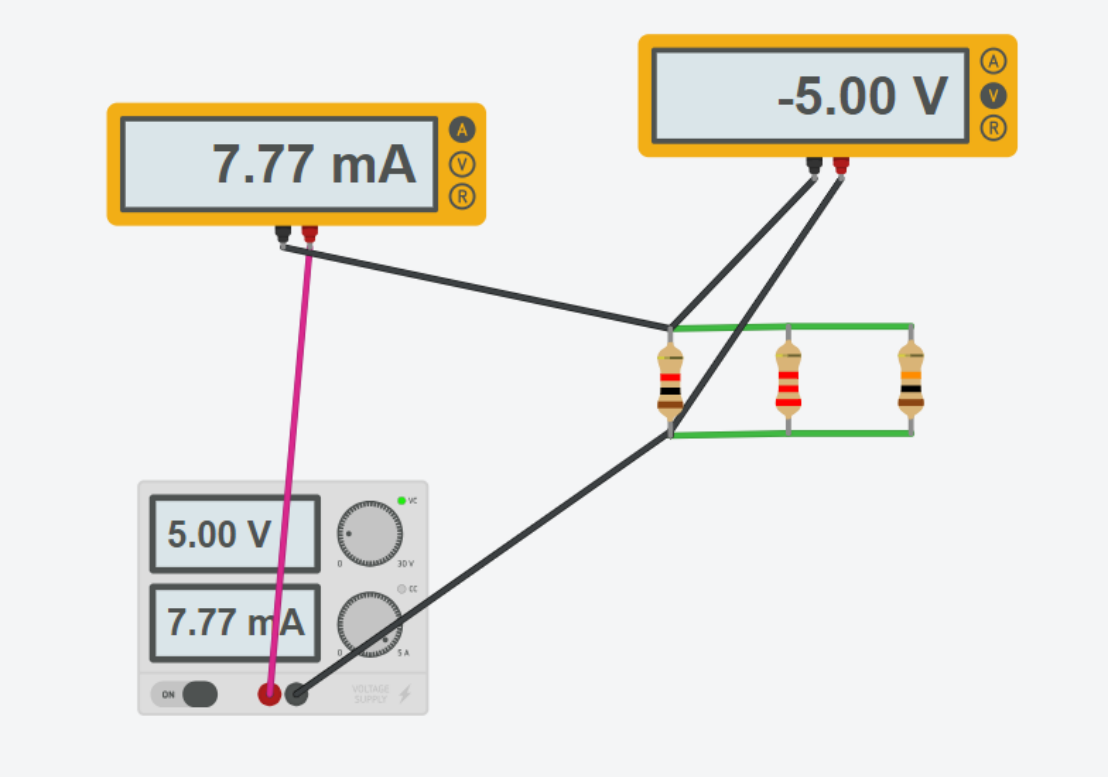


Part 3.1:



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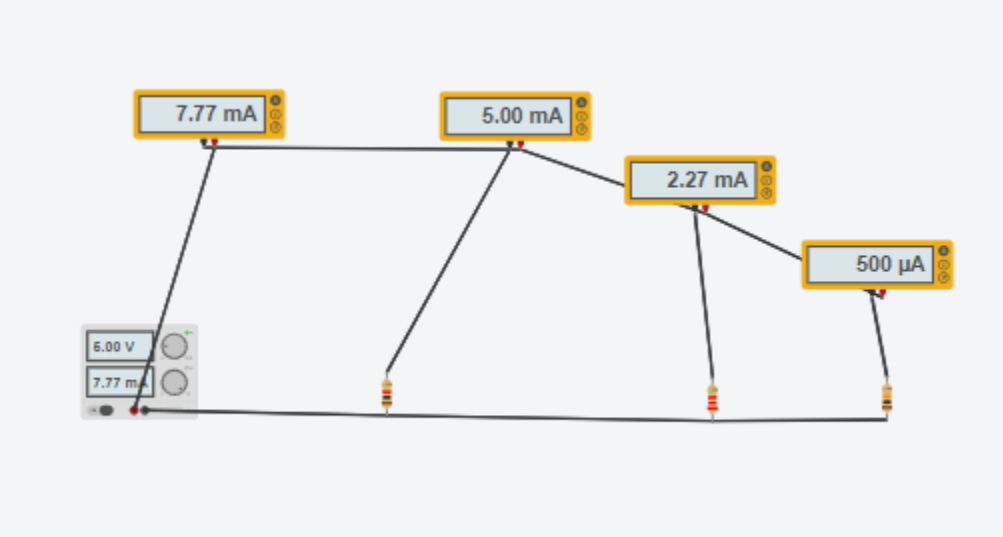
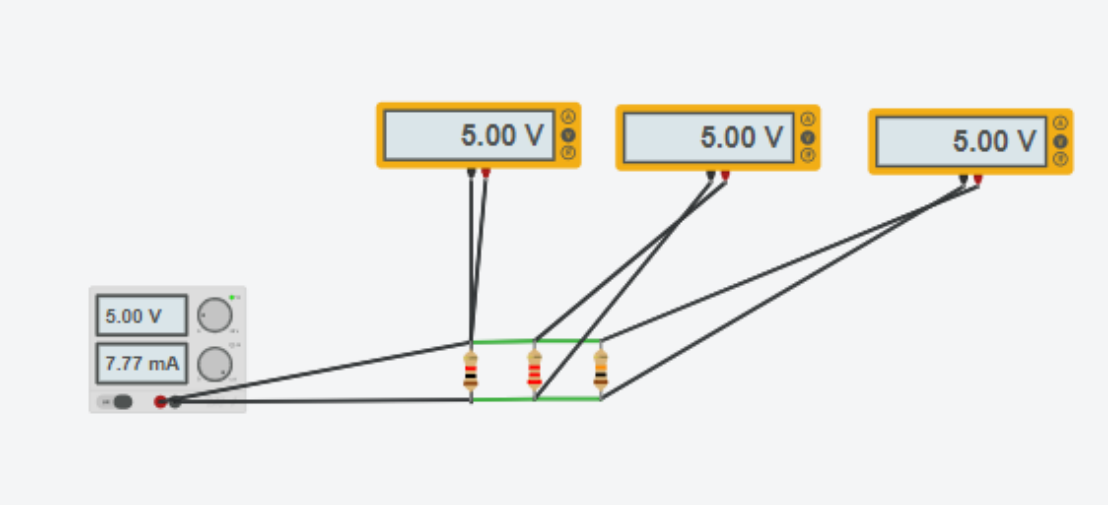


Part 3.3:


5.00 V
5.00 V
5.00 V
5.00 V
7.77 mA