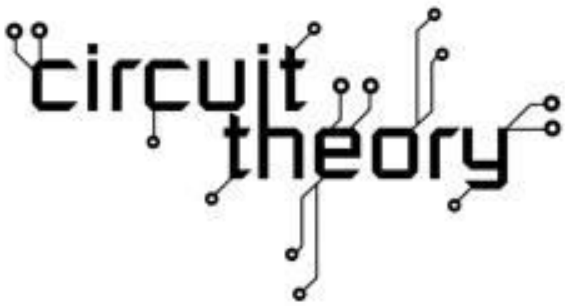
**University of Western Attica**
**Faculty of Engineering**
**Department of Informatics and Computer Engineering**

**Circuit Theory Lab Exercises**

**1st EXERCISE**




**Notes 2020, Voutsinas Stylianos**
**Material revision, Editor 2021, Christos Kampouris**

**ATHENS**
**2021**

## 1.1 Laboratory part

## 1.2 Circuits - theorems - basic laws

- As a circuit, the set of electrical sources and passive or active elements, which are connected to each other, is characterized.
- A branch is any part of the circuit that has its elements connected in series.
- A loop is any closed path of a circuit, designed so that the path does not pass through the same point twice.
- A node is the point where two or more branches join.

### *Kirchhoff's first law*

The algebraic sum of all the intensities of the currents flowing into and out of the node is zero

### *Kirchhoff's second law*

The sum of all potential differences across the individual branches of a loop is zero

### *Ohm's Law*

The intensity of the current I is proportional to the potential difference with a ratio factor of 1/R

**1. 3.1 : Kirchoff 's 1st law .**

You experimentally verified through Figure 1 Kirchhoff's 1st law (the algebraic sum of all intensities of the currents flowing into and out of the node equals zero). Record your measurements and reasoning.

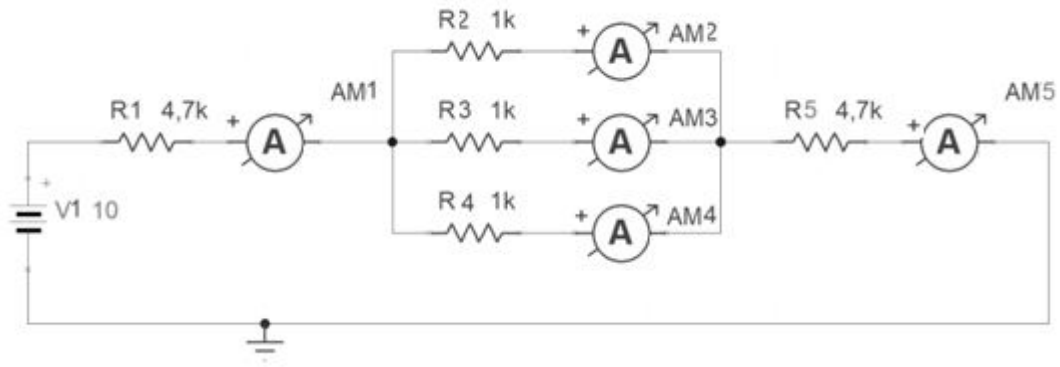



***Figure 1***

## 1.3.2 : Kirchoff 's 2nd law .

You experimentally verified through figure 2 Kirchhoff's 2nd law ( T the sum of all potential differences in the individual branches of a loop is equal to zero). Record your measurements and reasoning. Prove the simulation part based on the trend calculation formulas.

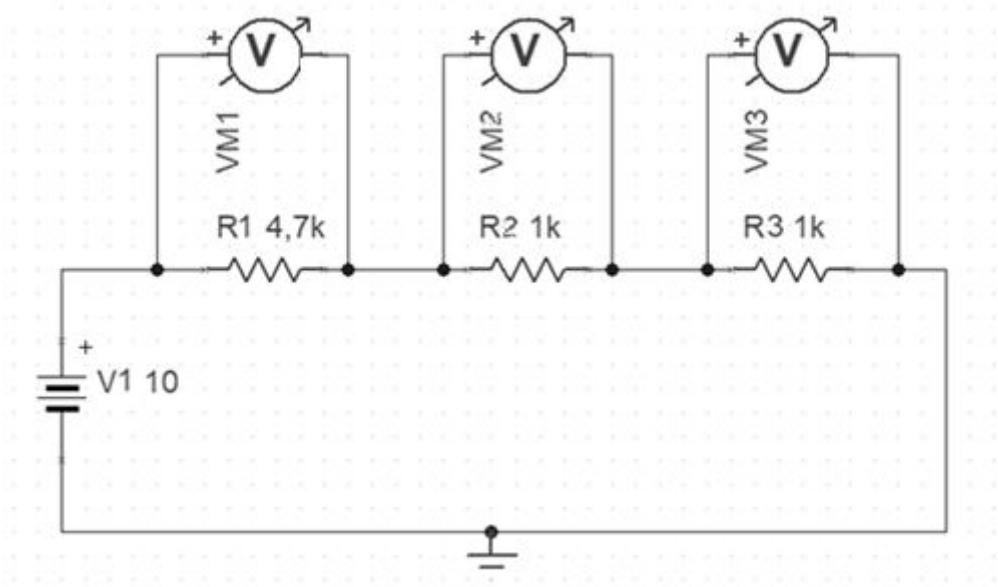



***Figure 2***

## 1. 3.3 : Ohm's law .

Make the circuit of figure 3. complete the following Table and graphically represent the relationship between voltage and current. What do you notice?

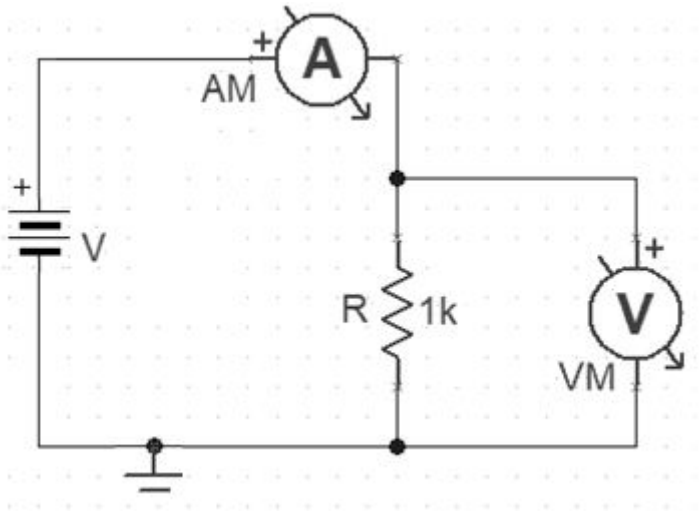



***Figure 3***

With a fixed resistance value of 1K, change your source voltage and complete the following table:

| **A distance R = 1K** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Source Voltage ( V )** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **Intensity (I)** | | | | | | | | | | | |
| **Voltage Drop across R ( V )** | | | | | | | | | | | |

For a constant source voltage value of 10 V , change the resistor values and complete the following table:

| **Source voltage V = 10 V** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Resistance ( KOhm )** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **Intensity (I)** | | | | | | | | | | | |
| **Voltage Drop across R ( V )** | | | | | | | | | | | |

## 1. 3.4 : Connecting a resistor as a potentiometer.

Implement the circuit of Figure 4. Change the value of the variable resistor and complete the table below. Comment.

Helpful Note: The circuit below uses voltage divider circuitry.

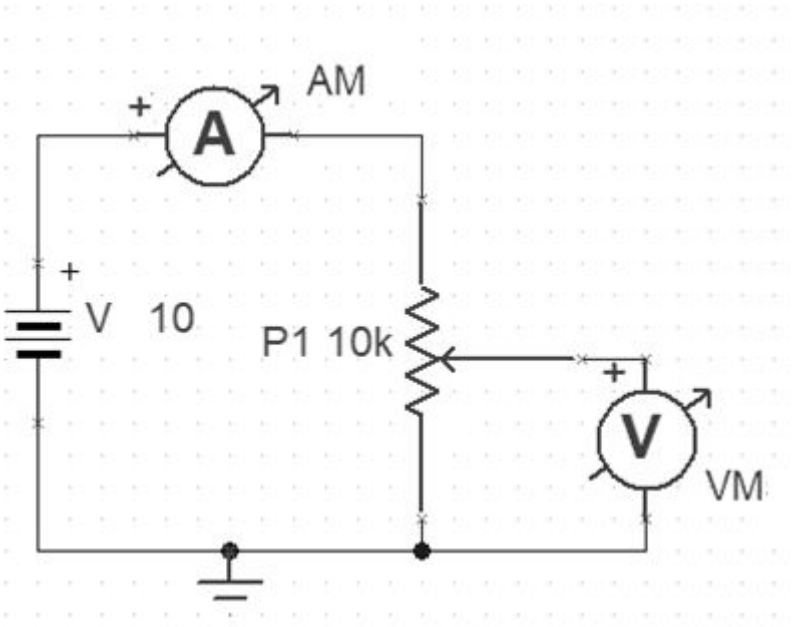



***Figure 4***

| **Resistance (R) %** | **10** | **20** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Voltage ( V )** | | | | | | | | | | |

## 1.5. 5 : Connecting a resistor as a dimmer.

Implement the circuit of Figure 5. Change the value of the variable resistor and complete the table below.

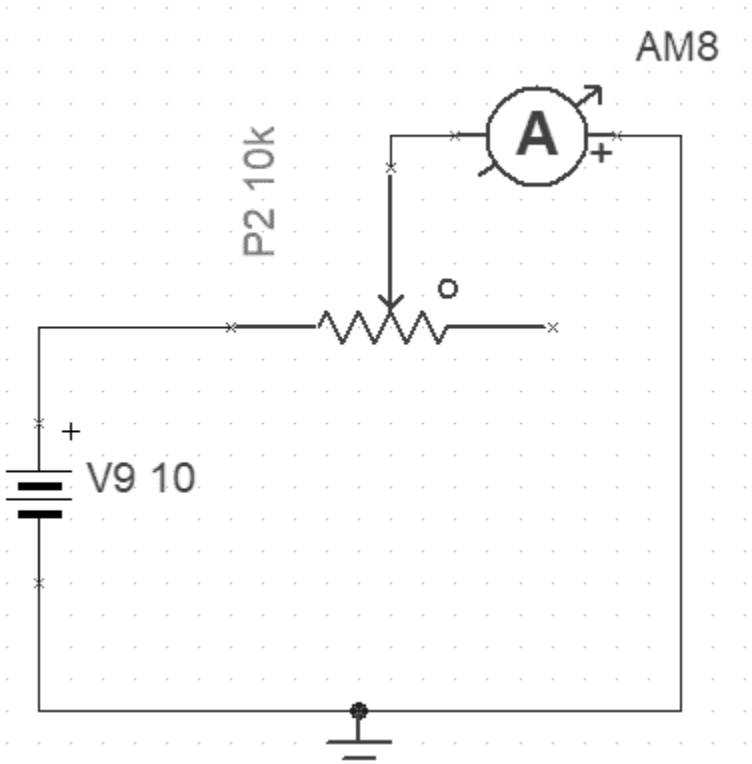



***Figure 5***

| **Resistance (R) %** | **10** | **20** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Intensity (I)** | | | | | | | | | | |

## 1.6 Questions

- What will happen in Figure 5 if the variable resistor goes to 0%? You calculated the current that will flow through the resistor. Is there a way to fix this particular problem?

- The voltage measurement in figure 3, would it be better to include the voltage drop across the resistor R 4 and the ammeter? Justify.
- Consider a voltage divider with R 1 = R 2 = 1 K Ω. We connect a load RL = 10Ω. What will happen? Suggest a way to solve it.