Elektronika pro informační technologie (IEL)

First lab

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2017/2018

Obsah

- Basic info
- What you need to know to not die here
- Introduction to the lab equipment
- Simple measurements (Ohms law, Kirchoffs law)

Basic information, safety briefing

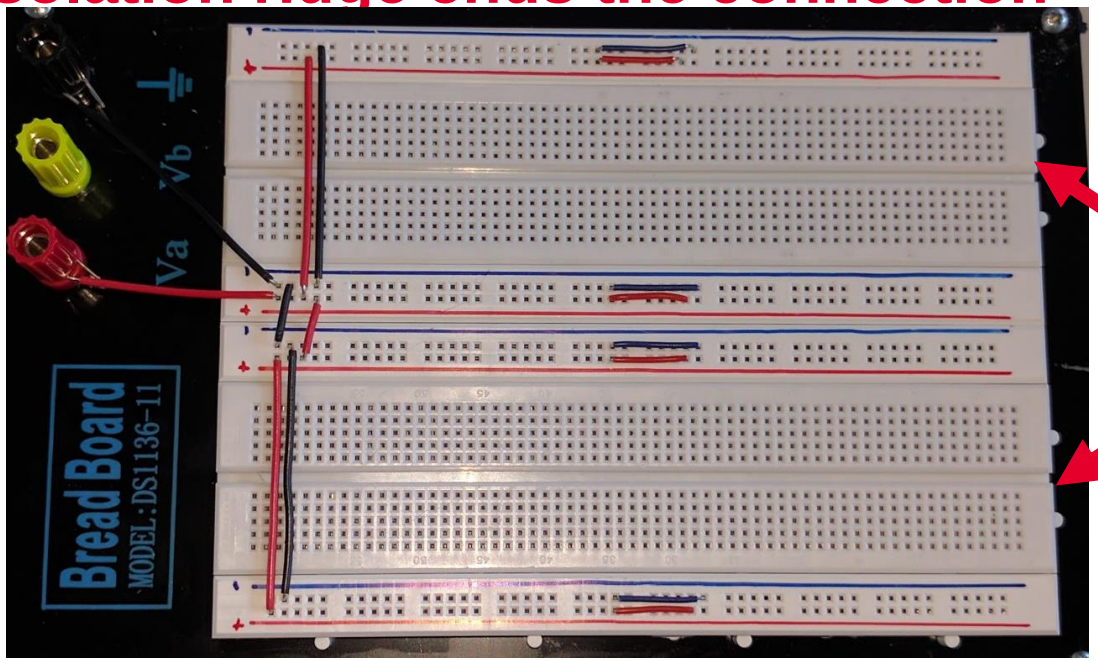
- Hi, my name is Petr
- You don’t have to work alone, you can cooperate
  - **The important thing is to learn something new, understand something, etc.**

- Basically don’t eat, drink, behave responsibly
- We are going to work with electricity and you all know that it harm you

LAB EQUIPMENT

Solderless board

- You will connect the parts using the solderless board and measure the voltages (or currents) using the multimeter
- Solderless board **– columns are conductively connected**
  - **Isolation ridge ends the connection**



Isolation ridge

Set before the measurement

DCV
direct voltage

Ω
resistanc

Ground
(GND)

DCA
direct current

Test wire

Measure
(U, I, R)

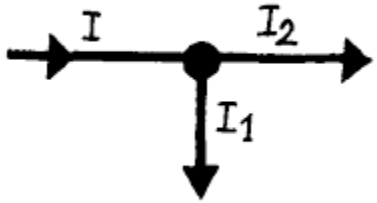
- **Ohms Law**

$$U = R * I$$

  - **U – voltage [V, Volt]**
  - **R – resistence [Ω, Ohm]**
  - **I – current [A, Ampér]**

- **Kirchhoffs laws (KL)**
  - **1.st KL**: Algebraic sum of the currents in the node is equal to 0.

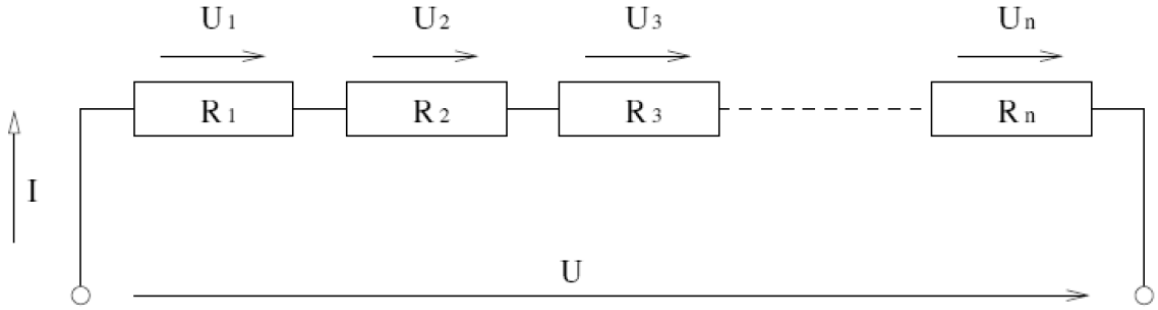
$$\sum_{k=1}^{n} I_k = 0$$



$$I - I_1 - I_2 = 0$$

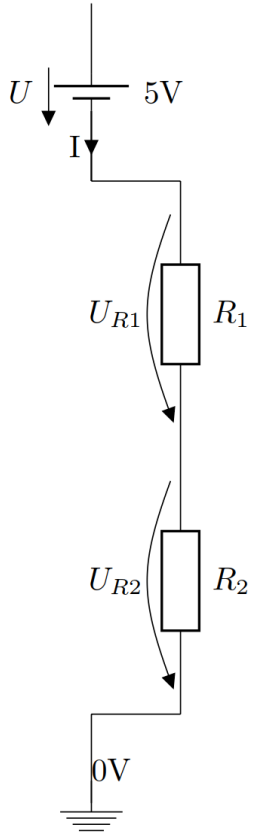
  - **2. KZ**: Algebraic sum of the voltage in the closed loop is equal to 0.

$$\sum_{k=1}^{n} U_k = 0$$



$$U_1 + U_2 + U_3 + \cdots + U_n - U = 0$$

- Voltage divider (input voltage U=5V, 2 resistors R1, R2)

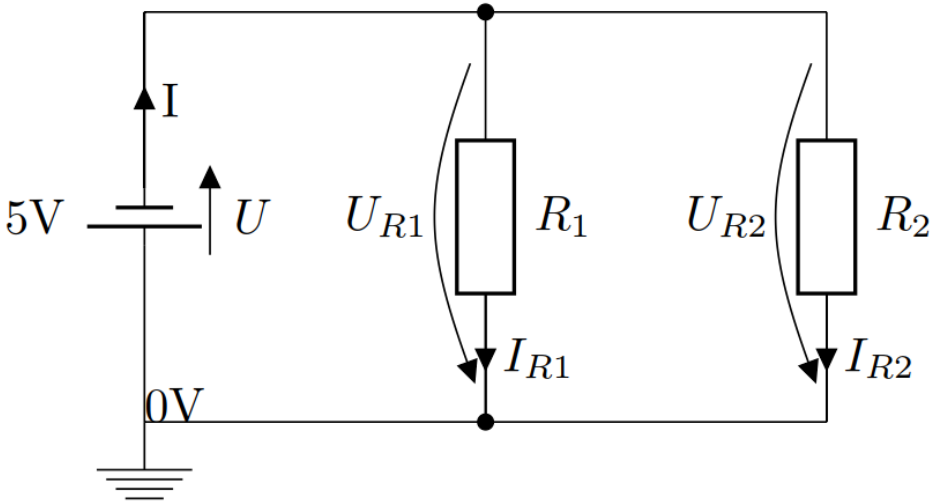


Voltage on individual resistors (using Ohms Law)

$$U_{R1} = I \cdot R_1$$
$$U_{R2} = I \cdot R_2$$

Voltage (2.nd KL):

$$U - U_{R1} - U_{R2} = 0$$
$$U_{R1} + U_{R2} = U$$



Current (1st. KL):

$$I - I_{R1} - I_{R2} = 0$$

$$I_{R1} + I_{R2} = I$$

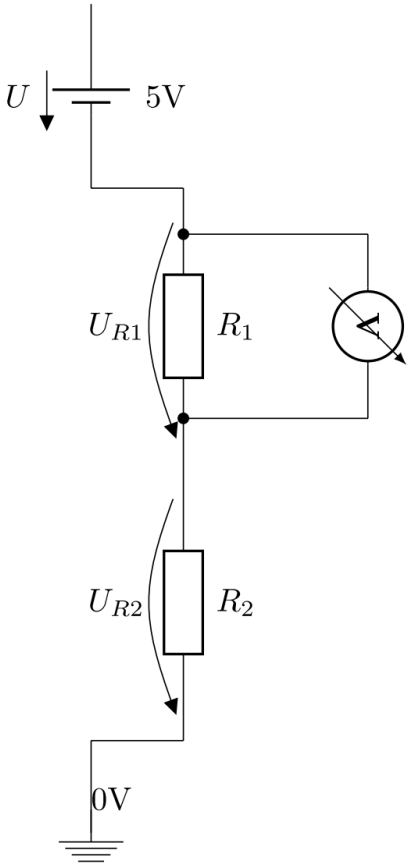
Voltage (OL)

$$U_{R1} = I_{R1} \cdot R_1 \Rightarrow I_{R1} = \frac{U_{R1}}{R_1}$$

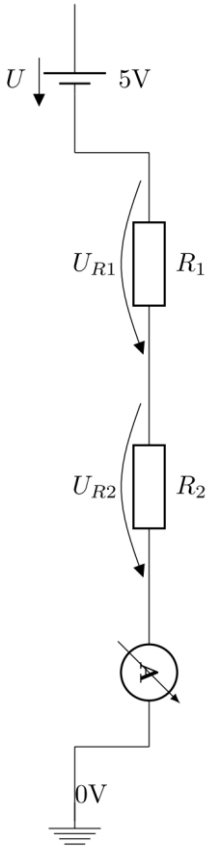
$$U_{R2} = I_{R2} \cdot R_2 \Rightarrow I_{R2} = \frac{U_{R2}}{R_2}$$

$$U_{R1} = U_{R2} = U$$

Measuring **voltage** (in parallel)



Measuring **current** (in series)

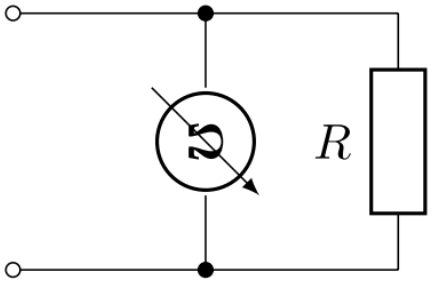


1ST EXPERIMENT

First experiment

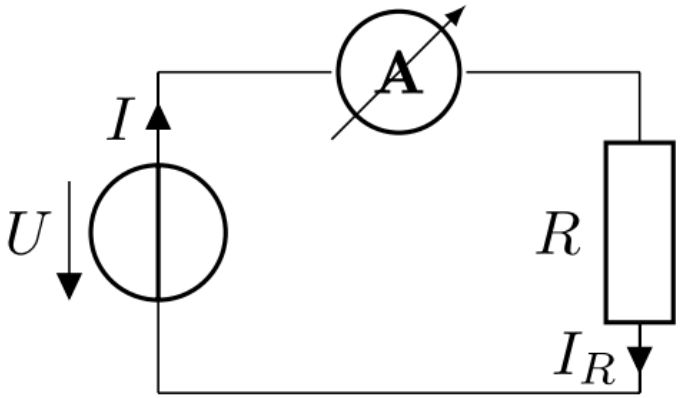
- Prepare a resistor, measure its **resistance (R)**
- Connect the following circuit, including the input voltage
- Measure the voltage **(U)** on the resistor
- Measure the current **(I),** that flows through the resistor

- Connect the resistor into the solderless board and measure its resistance



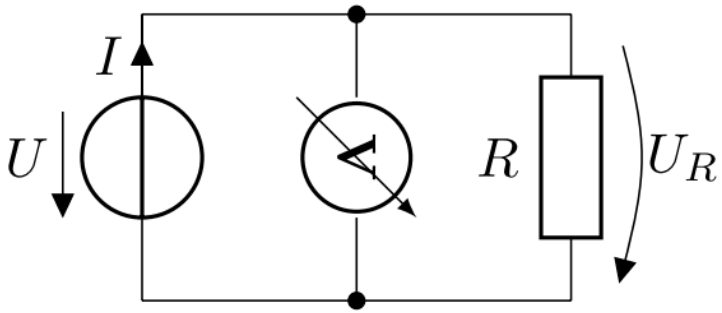
- **Multimeter**: **Ω**, **20k**
- Just connect the resistor to the different rows of the board and connect multimeter in **parallel**
  - 1st wire: VΩmA → resistor (same column)
  - 2nd wire COM → resistor (same column)
- Do not connect input voltage

- Connect the input voltage
- Connect the ampermeter into the circuit in the **series**



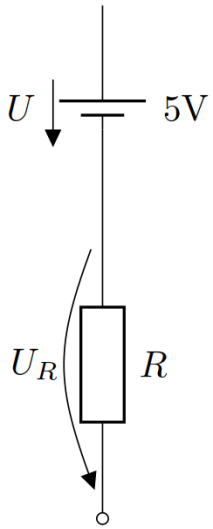
- **Measurement**
  - **Multimeter**: **A**, **200mA**, set before connecting the input voltage
  - On one terminal of R: **5V, +**
  - On the second one: **0V, -**

- Connect the voltmeter in **parallel**



- **Measurement**
  - **Multimeter**: **V**, **20V**, set before connecting the input
  - One terminal of R: **5V**
  - Other terminal of R: **0V**
  - **VΩmA**: same column as 5V
  - **COM:** same column as **0V**

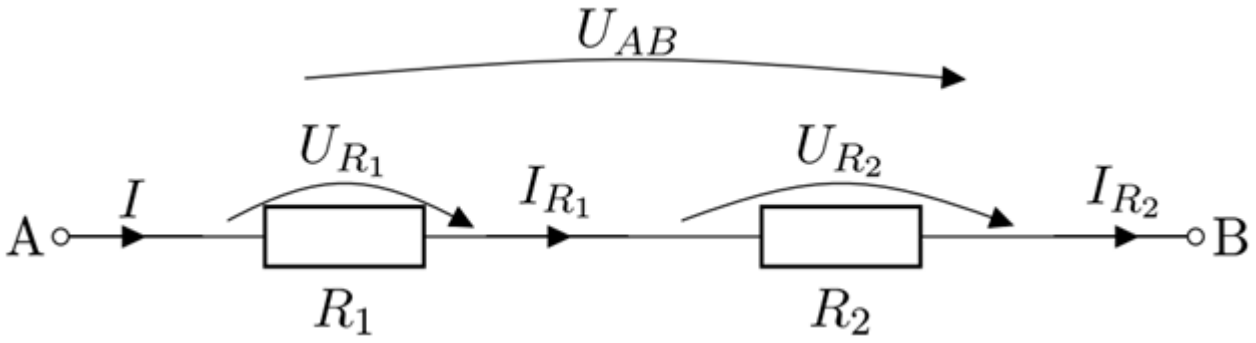
2ND EXPERIMENT



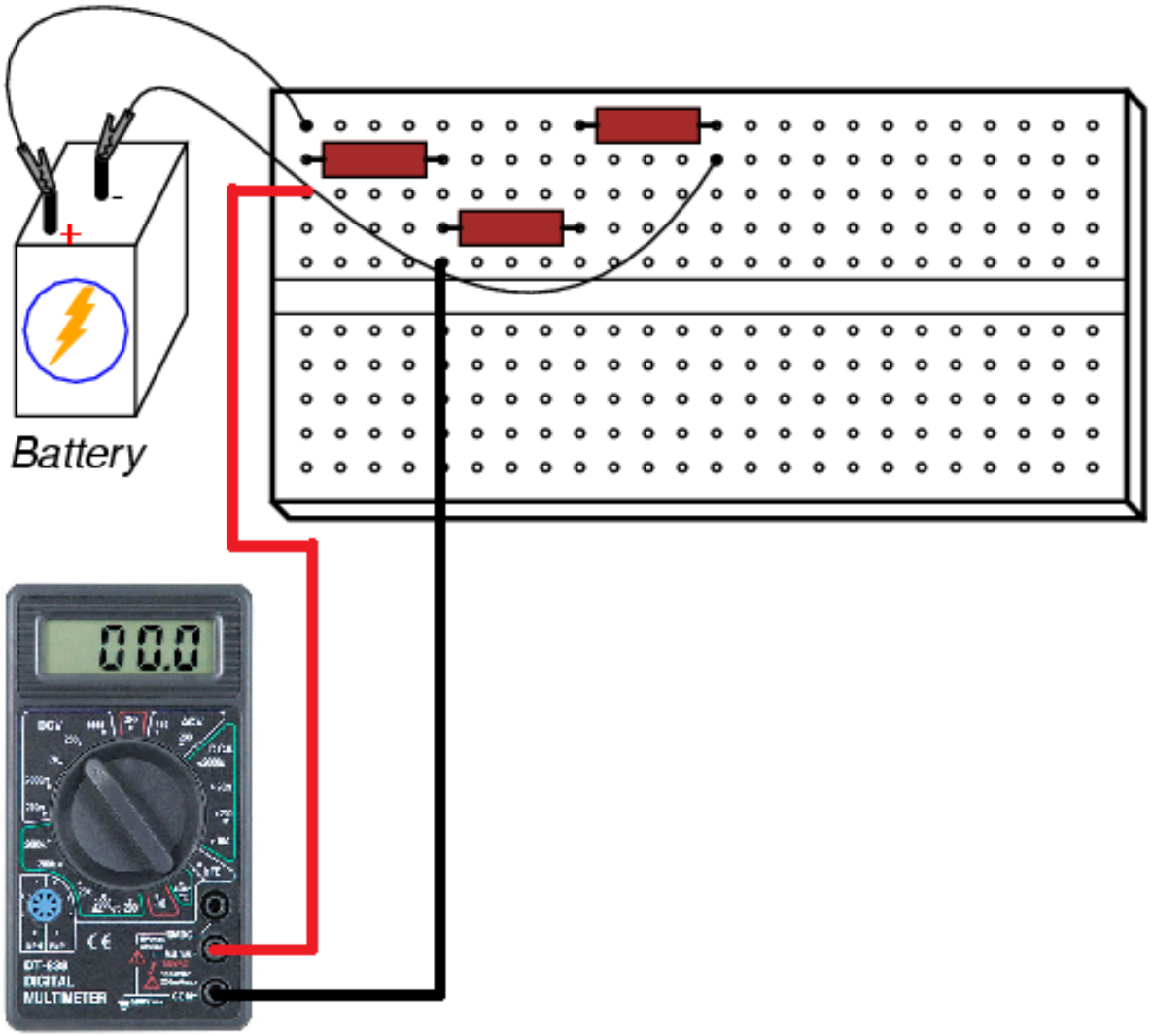
- **What is going to be the value of the voltage on the resistor? Why?**

3RD EXPERIMENT

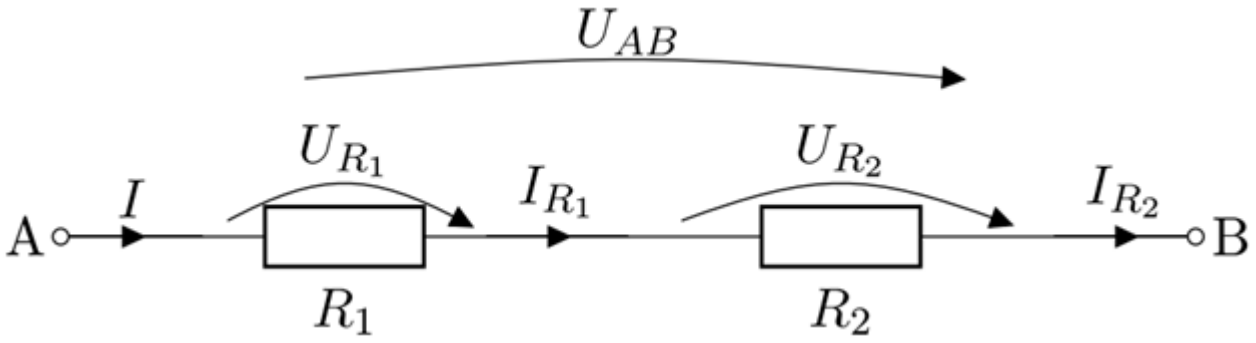
- Connect the following circuit
  - Prepare two resistors (find out their resistances, if you don’t know them already)
  - Connect the input voltage $U_{AB} = 5V$ and measure the voltages U_{R1}, U_{R2} and currents I_{R1}, I_{R2}



Third experiment



- Connect the following circuit
  - Prepare two resistors (find out their resistances, if you don’t know them already)
  - Connect the input voltage $U_{AB} = 5V$ and measure the voltages U_{R1}, U_{R2} and currents I_{R1}, I_{R2}



Thank you for your attention!