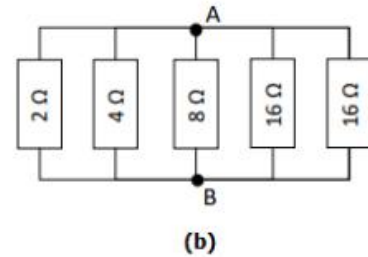
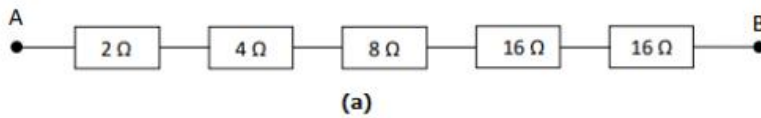


EXERCISES ON FUNDAMENTAL LAWS OF ELECTRICITY

Part I Equivalent resistor

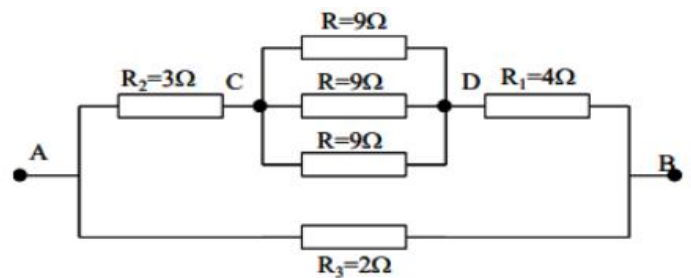
Exercise 1

Calculate the equivalent resistance of the following 2 circuits



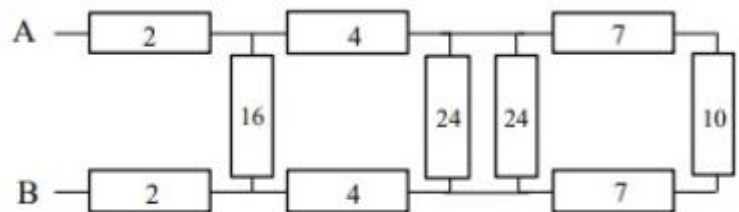
Exercise 2

Considering the following circuit, find the equivalent resistance between points C and D and then the one between A and B.



Exercise 3

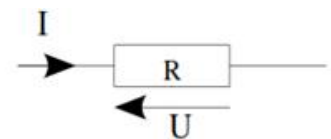
Considering the following circuit, find the equivalent resistance between A and B. (the values of resistances are indicated in ohms)



Part II Ohm's law

Exercise 1

A resistance $R = 6.3 \text{ k}\Omega$ is crossed by a current of intensity $I = 3.81 \text{ mA}$. Calculate the voltage U at its terminals.



Exercise 2

We measure the voltage $U = 25 \text{ V}$ at the terminals of an unknown resistance R as well as the intensity that crosses it $I = 5.3 \text{ mA}$. Calculate the value of the resistance R .

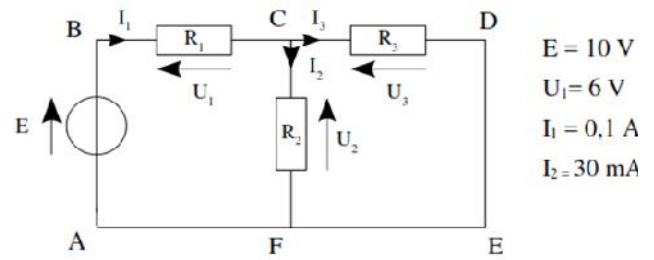
Exercise 3

Calculate the intensity I that crosses a resistance $R = 10 \text{ k}\Omega$ if the voltage $U = 10 \text{ V}$

Part III Node and Mesh laws

Exercise 1

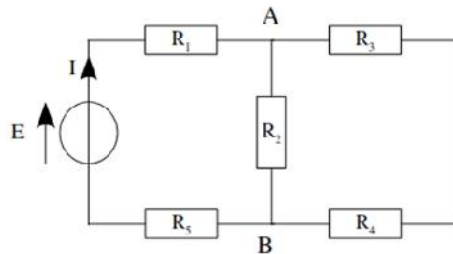
Let us have the following circuit



- 1- Establish the equation of the node C
- 2- Deduce the expression of I_3 function of I_1 and I_2
- 3- Calculate I_3 .
- 4- Establish the equation of the mesh (ABCFA).
- 5- Deduce the expression of the voltage U_2 .
- 6- Calculate U_2 .
- 7- Establish the equation of the mesh (CDEFC).
- 8- Checking the mesh law : establish the expression of the mesh (ABDEA) and show that $E = U_1 + U_2$.
- 9- Do the numerical application. Is the mesh law verified ?

Exercise 2

- 1- Show the orientations (arrows) of the voltages and currents and annotate in the circuit. (for example, at R_1 terminates the voltage is U_1 and the current crossing it is I_1).
- 2- What is the value of the current that crosses R_5
- 3- The current that crosses R_4 has a value of $I_4 = 6\text{mA}$, calculate the value of the current I_2 that crosses R_2 .
- 4- The voltage U_1 . Calculate U_5 the voltage at R_5 terminals.
- 5- Deduce the value of I_3 .
- 6- Establish the expression of U_2 function of U_3 and U_4 . Calculate U_3 when $U_4 = 1.2\text{V}$.



We have :

$$E = 12\text{ V}, U_{AB} = 4\text{ V}$$

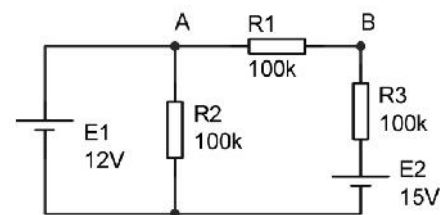
$$I = 10\text{ mA}$$

$$R_1 = 470\ \Omega, R_2 = 1\text{ k}\Omega.$$

Part IV- Fundamental theorems (superposition, Thevenin and Norton)

Exercise 1 :

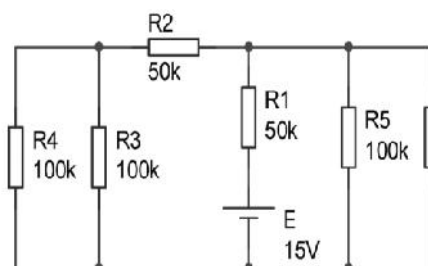
Using the superposition method, calculate the voltage U_{AB} .



Exercise 2

Soit le circuit ci-contre

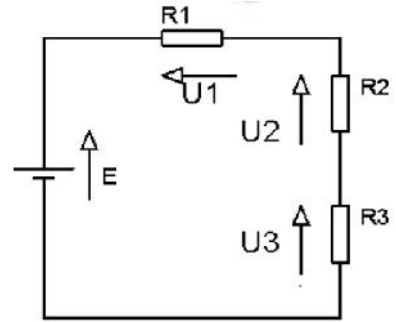
- 1- Determinate the characteristics E_{Th} et R_{Th} of the equivalent Thevenin generator
- 2- Calculate the voltage at R terminals for $R = 10\text{ k}\Omega$



Exercise 3 :

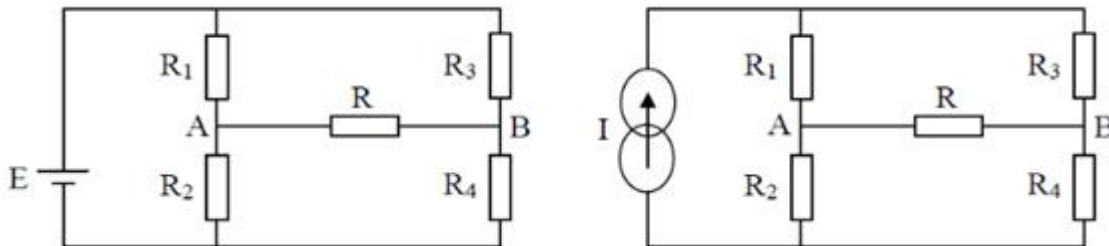
We have the circuit as shown (using the voltage divider law)

- 1- Express U_1 , U_2 et U_3 as function of E , R_1 , R_2 et R_3 .
- 2- what is the sum of $U_1 + U_2 + U_3$



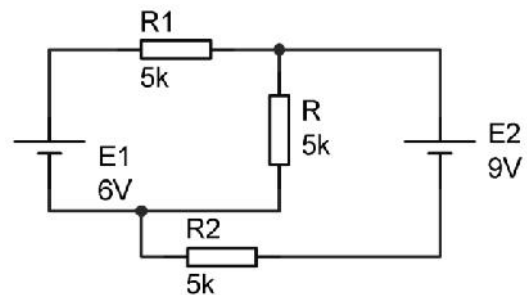
Exercise 4

Give the equivalent Thévenin diagrams to the two circuits below between points A and B



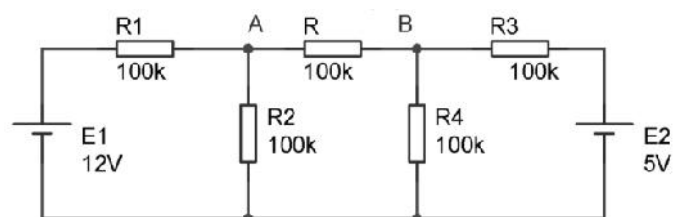
Exercise 5

Using the superposition theorem, calculate the Voltages at the terminals of R_1 , R_2 and R_3 .



Exercise 6

- 1- Draw the Thevenin generator of the following circuit without taking into account the resistor R .
- 2- Calculate the voltage U_R and the power supplied to the resistor R



Exercise 7

The circuit shown has the following characteristics

$$E_1 = 10V \quad E_2 = 5V \quad E_3 = 12V$$

$$R_1 = R_2 = R_3 = R_5 = R_6 = 1k\Omega \quad R_4 = 0,5k\Omega$$

Calculate U_4

