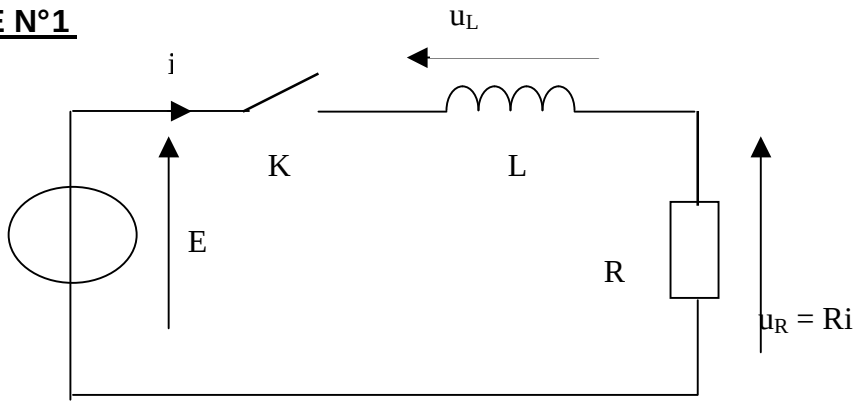
ORAL WORK ON R-L CIRCUIT

EXERCISE N°1

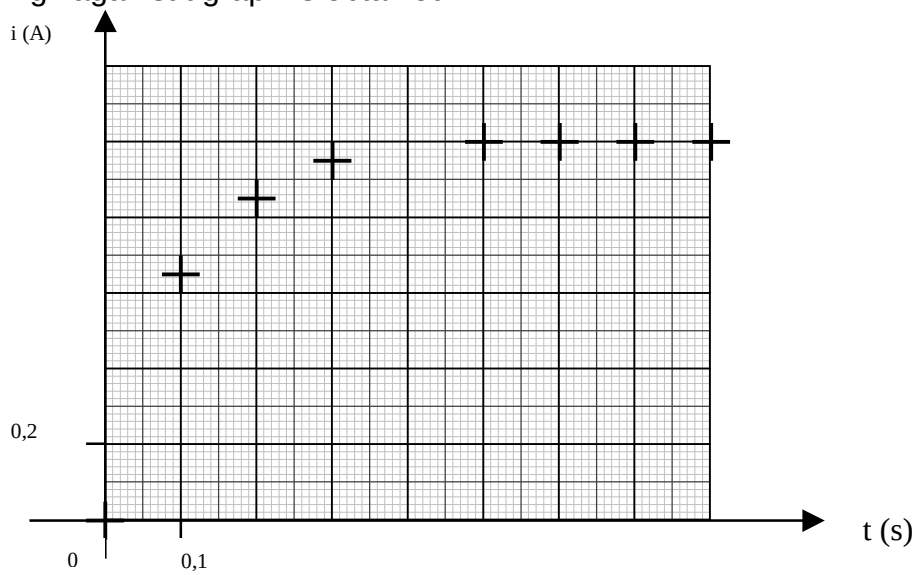


E = DC voltage = 10 V, L = 1 H and R = 10 Ω.

A t = 0, we close K.

a) Give the value of i when K is open.

The following i against t graph is obtained :



b) The value of i is still equal to 0 just after K is closed ($t = 0^+$). Why ?
c) Calculate time constant τ of the circuit.
d) Give the value of i at $t = \tau$ and $t = 3\tau$.
e) Write the relationship between E, u_L and u_R.
f) By writing Ohm"s law for L and R. Show that the following equation is obtained :

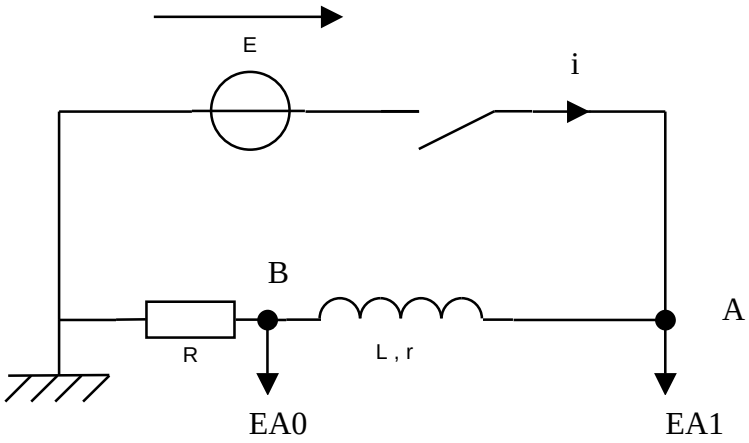
$$\frac{di}{dt} + \frac{R}{L} i = \frac{E}{L}$$

g) Give the name of the equation.
h) We can show that the solution of the above equation is :

$$i = A + Be^{-\frac{t}{\tau}} \text{ where } \tau = \frac{L}{R}$$

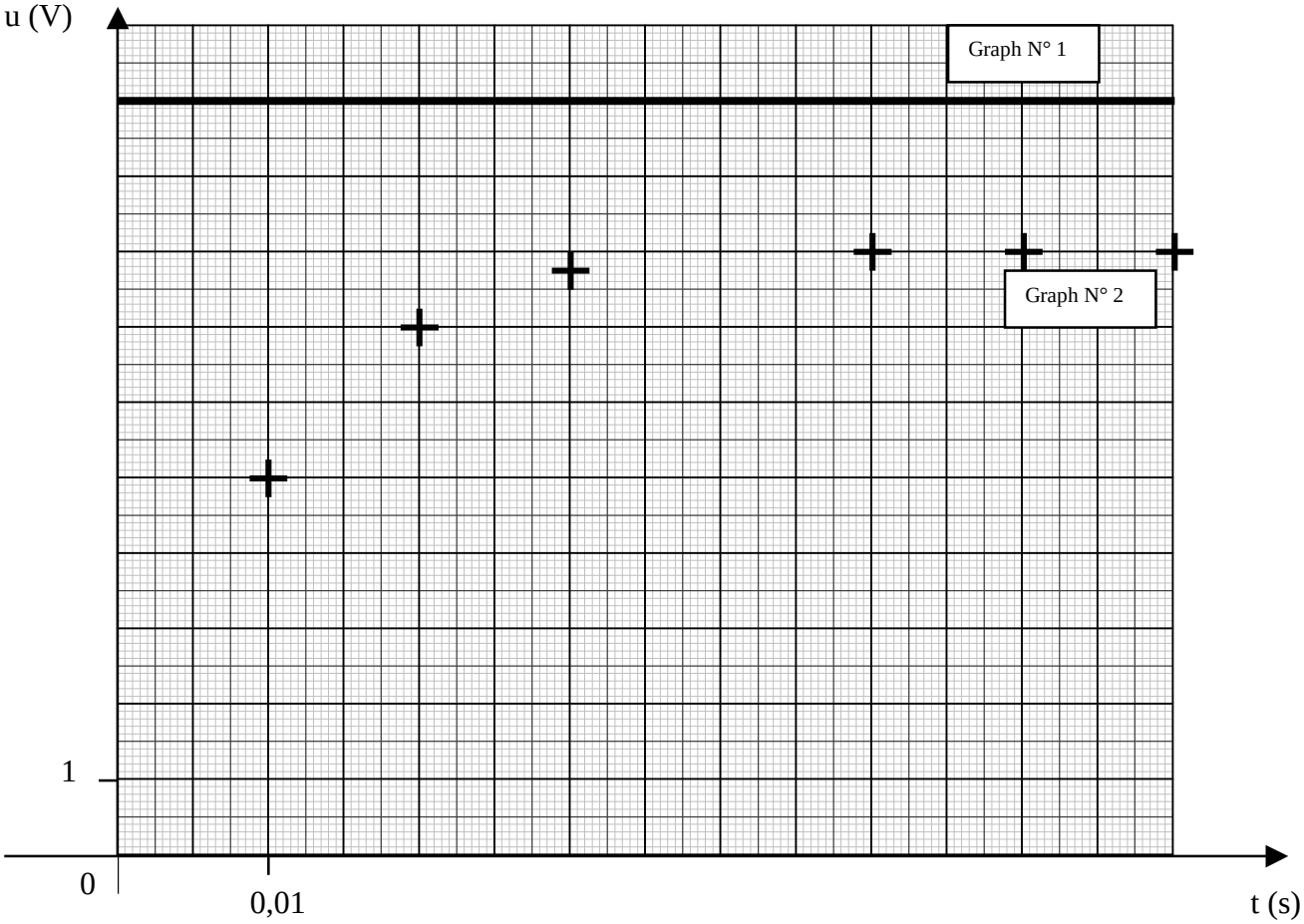
Calculate A and B.

EXERCISE N°2 (Extract from a baccalauréat subject)



An electric circuit is composed of an ideal voltage source E = 10 V, a switch K , an inductor L with a resitance r (real inductor) and a resistance R = 80 Ω.

At t = 0 s, K is closed.
A computer connected to the circuit with an appropropriate interface gives the following graphs at channels EA0 and EA1.



a) Give the names of voltages at EA0 and EA1.
b) Associate each graph to each voltage.
c) One of the voltage give the image of current i. Which one? Justify your answer;
d) What influence has the inductor on current i ?

e) Give the value of i at steady state. (that is when i reaches its maximum value)
f) By applying KVL calculate voltage v_{AB} across the inductor at steady state.
g) Give v_{AB} in terms of r, L and i and hence calculate the value of r at steady state knowing that $L\frac{di}{dt} = 0$ at steady state.
h) Express time constant τ of the circuit and determine graphically its value.
i) Determine the value of L.