Building Physics

LEVEL: **1 YEAR BACHELOR**

SPECIALTY: **COP**

COURS 06

ELECTRICITY

University of Biskra

2024-2025

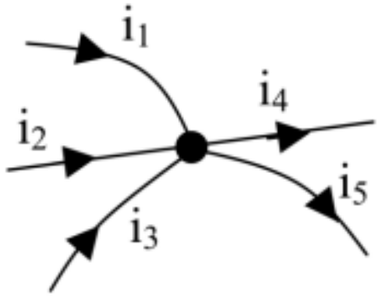
Ohm's law :

$U = R.\ I$ **is an equation that relates voltage (*U*), resistance (*R*), and current (*I*).**

Kirchhoff's laws :

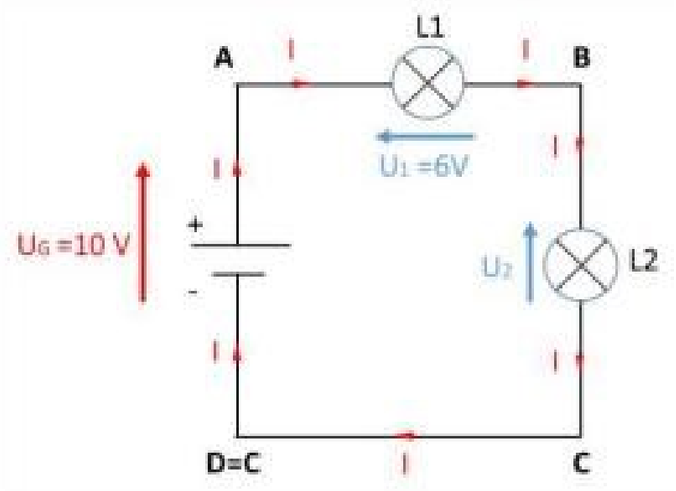
Kirchhoff's laws refer to two fundamental laws in electrical circuit analysis:

Kirchhoff's current law (KCL) states that the total current entering a **junction** in an electrical circuit **must be equal** to the total current **leaving the junction**.



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

Kirchhoff's voltage law (KVL) states that the total voltage around any **closed loop** in an electrical circuit **must be zero**.

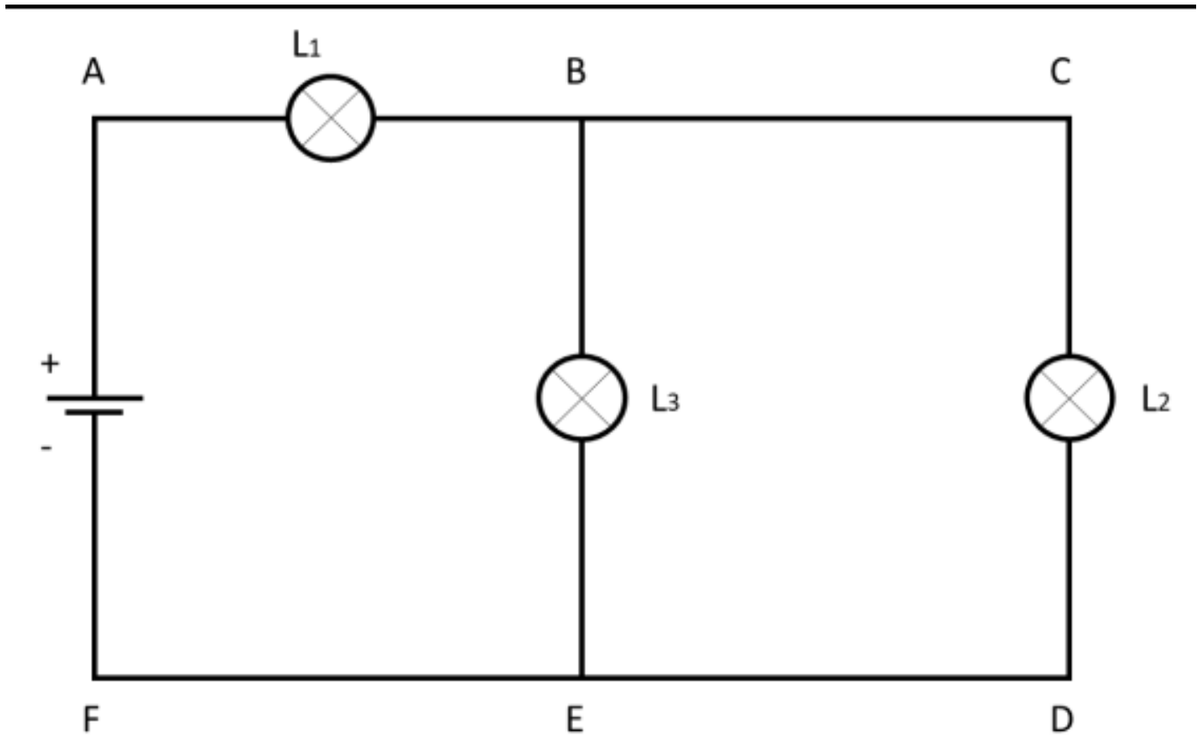


UG-UL1-UL2=0

Exercice n°1:

Given that the voltage across lamp L1 is equal to 4V and UG= 10V.

Calculate the voltages across lamps L2 and L3.



Solution :

Exercice n°1:

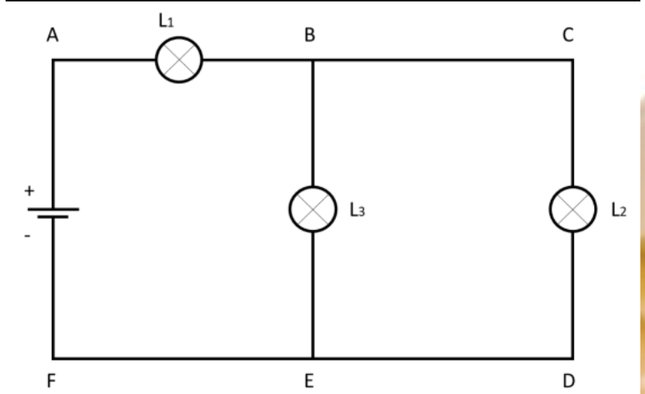
We apply the conservation of potential (the second Kirchhoff law KVL) to the circuit loop **ABCDEFA**.

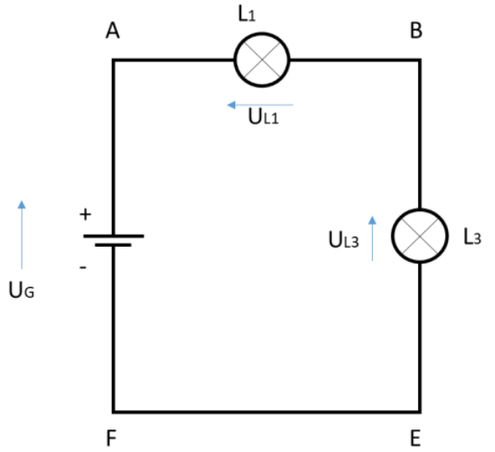
For the first loop **ABEF**:

the first **Kirchhoff law** implies that:

$$UG - UL1 - UL3 = 0$$

So: $UL3 = 10 - 4 = 6V$





For the second loop BCDE:

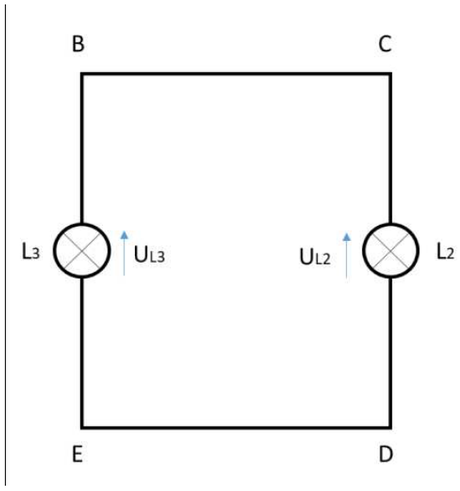
The first Kirchhoff law implies that:

$UL3 - UL2 = 0$

This implies that:

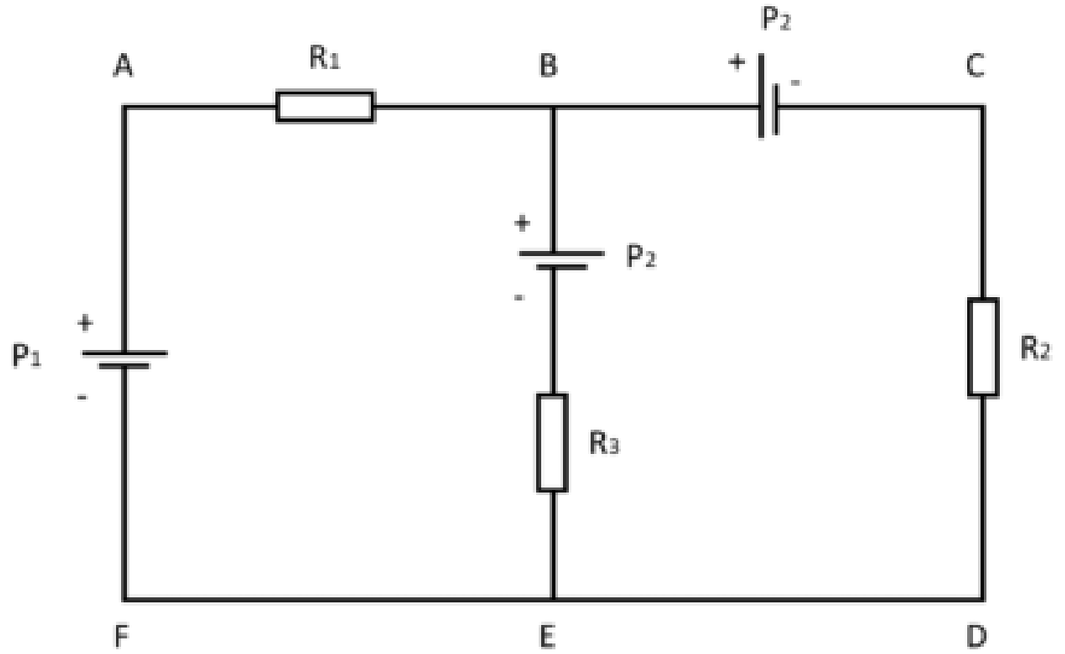
$$UL3 = UL2$$

So: $UL2 = 6V$



Exercice n°2:

we have the following circuit:

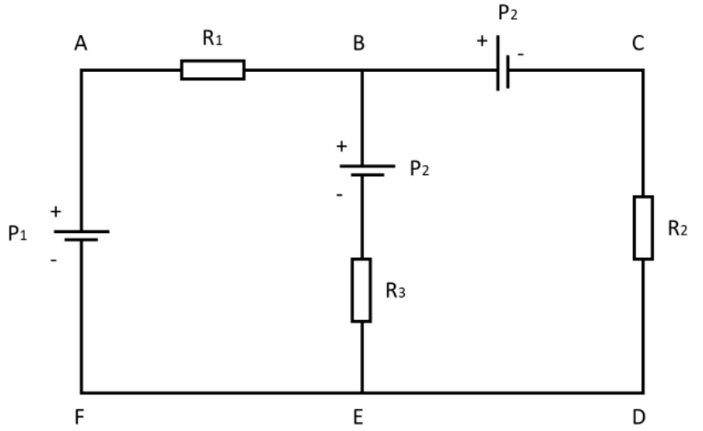


- From F to A, we have a battery P1 of 10 V, with an internal resistance of 0.5 Ω, in the direction of current i1.
- From A to B, there is a resistance R1 of 2.5 Ω through which current i1 flows.
- From B to C, there is a battery P2 causing a voltage drop of 1 V, with an internal resistance of 0.5 Ω, in the direction of current i2.
- From C to D, there is a resistance R2 of 1.5 Ω.
- From B to E, there is a battery P3 of 3 V with an internal resistance of 0.5 Ω. Additionally, there is a resistance R3 of 1.5 Ω through which current i3 flows.

Find the values of the two currents i1 and i2, knowing that the current intensity i3 is equal to 0.5 A.

Solution :

Exercice n°2:



According to the first Kirchhoff law (node law), we have: $\sum Is = \sum Ie$ Where:

- Is: currents leaving the node in amperes (A)
- Ie: currents entering the node in amperes (A)

This law implies: $i1 = i2 + i3$

According to **Ohm's law**, we also have: $U = R \cdot I$ Where:

- U: voltage or potential in volts (V)
- R: resistance in ohms (Ω)
- I: current intensity in amperes (A)

Then, we apply the conservation of potential in the circuit **loop ABCDA** according to the second Kirchhoff law (loop law),

In this example, we observe two loops: **ABEFA** and **BCDEB**.

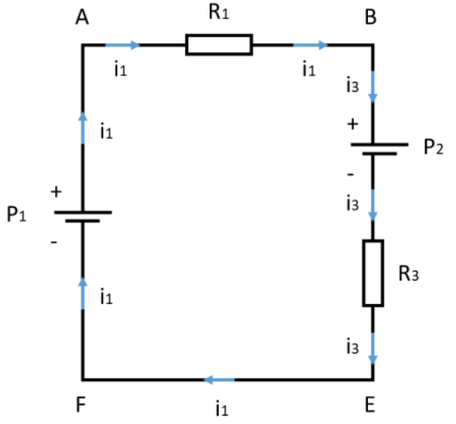
From reading the data of the first loop **ABEF**, we have:

$$UG - 0.5i1 - 2.5i1 - 0.5i3 - 3 - 1.5i3 = 0$$

$$UG - (3i1) - (2i3) - 3 = 0$$

Substituting UG with 10V and $i3$ *with 0.5A, we obtain:*

$$-3i1 = -6 \quad \text{So: } i1 = 2A$$

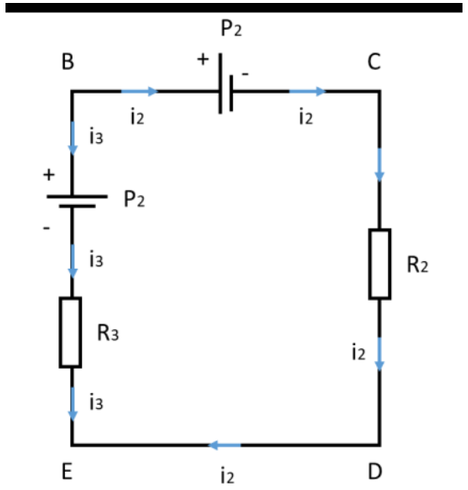


From reading the data of the second loop **BCDE**, we can deduce that:

$$1.5i3 + 3 + 0.5i3 - 1 - 0.5i2 - 1.5i2 = 0$$

$$\text{Thus: } 2i3 - 2i2 + 2 = 0$$

Substituting $i3$ with 0.5A, we get: $i2 = 1.5A$



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Merci pour votre Attention