

Exercise 1: MCQ

Among the following choices, only one is correct.

Choose the correct answer, without explanation.

1- The circuit, shown in document 1, is:

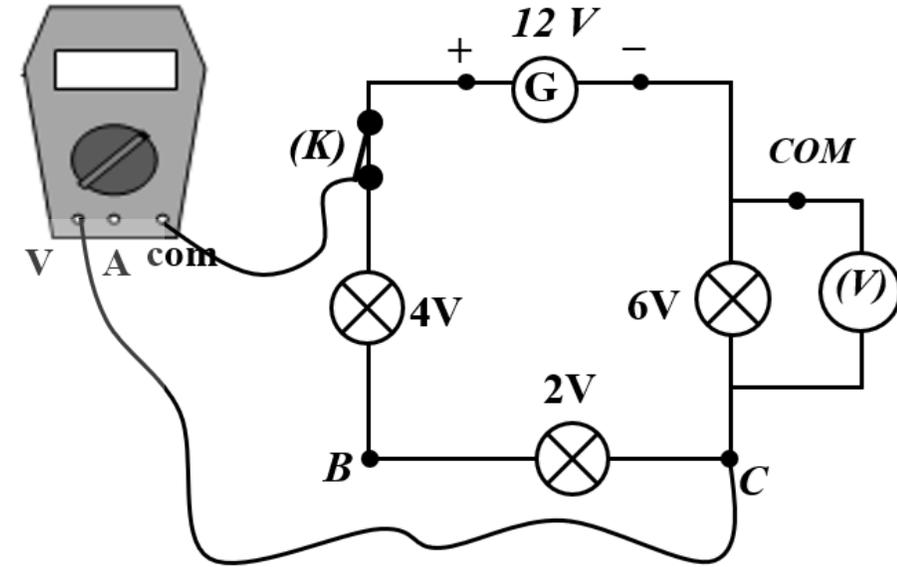
a- a series connection.

b- a parallel connection.

c- a complex connection.

d- an open circuit.

Multi-meter



Document 1

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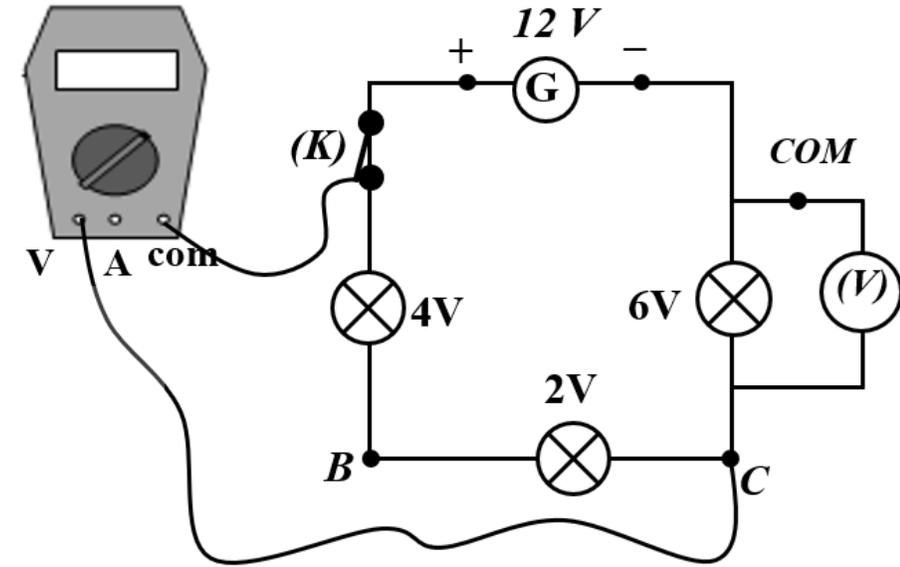
2- The reading of voltmeter (V) in document 1 is:

a- (+6V); **b-** (-6V) **c-** (+12V) **d-** (-12V)

3- The reading of the multimeter in document 1 is:

a- (+4V); **b-** (-6V) **c-** (-2V) **d-** (-4V)

Multi-meter

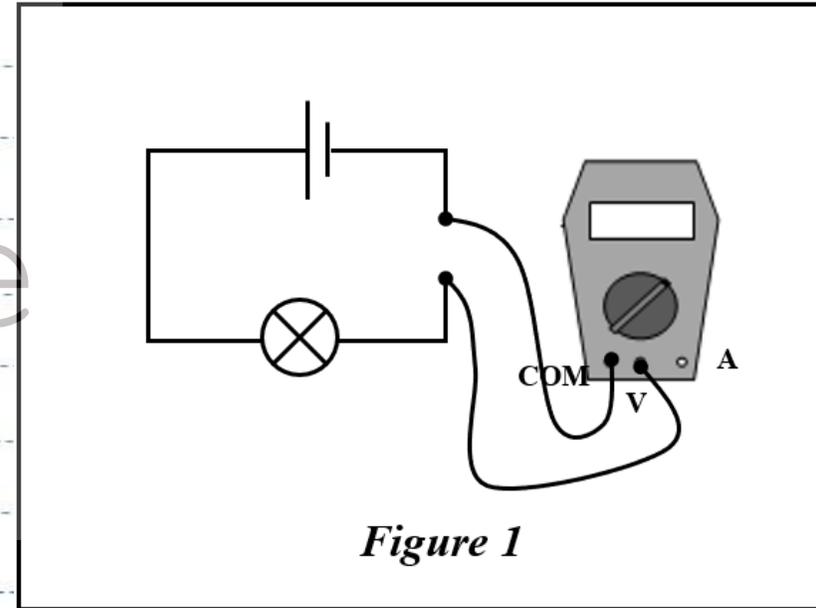


Document 1

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Exercise 2: **Connecting a Multi-meter**

In each figure in document 4, a multimeter is used to measure the voltage or the current in the simple circuit shown. For each figure, state whether the connection of the multimeter is correct or not. If the connection is correct, specify the characteristic it reads; and in case it is connected in a wrong way, state what the error is.



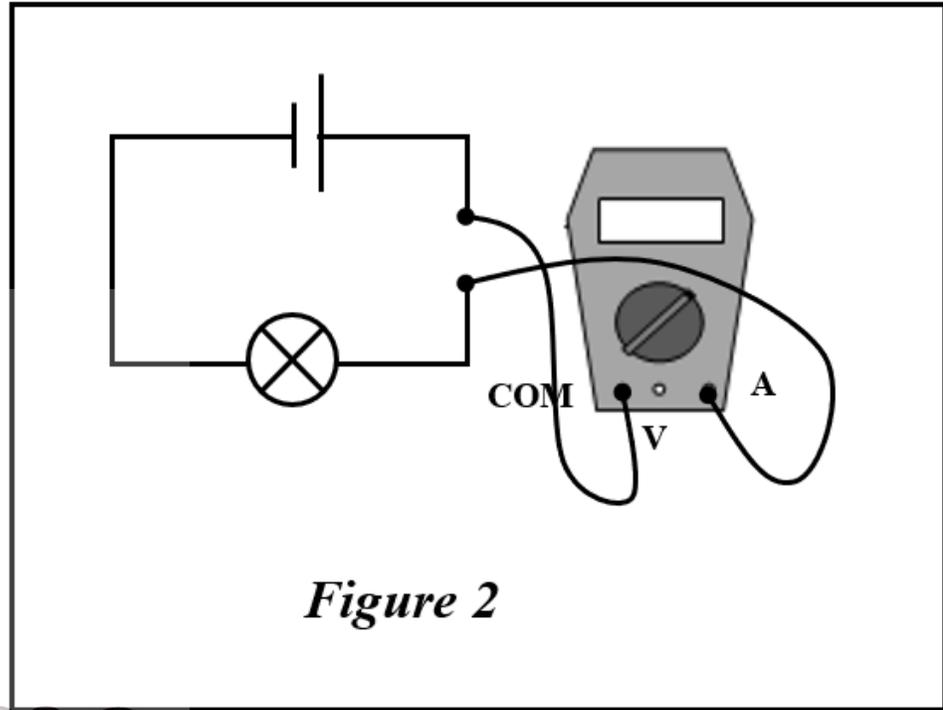


Figure 2

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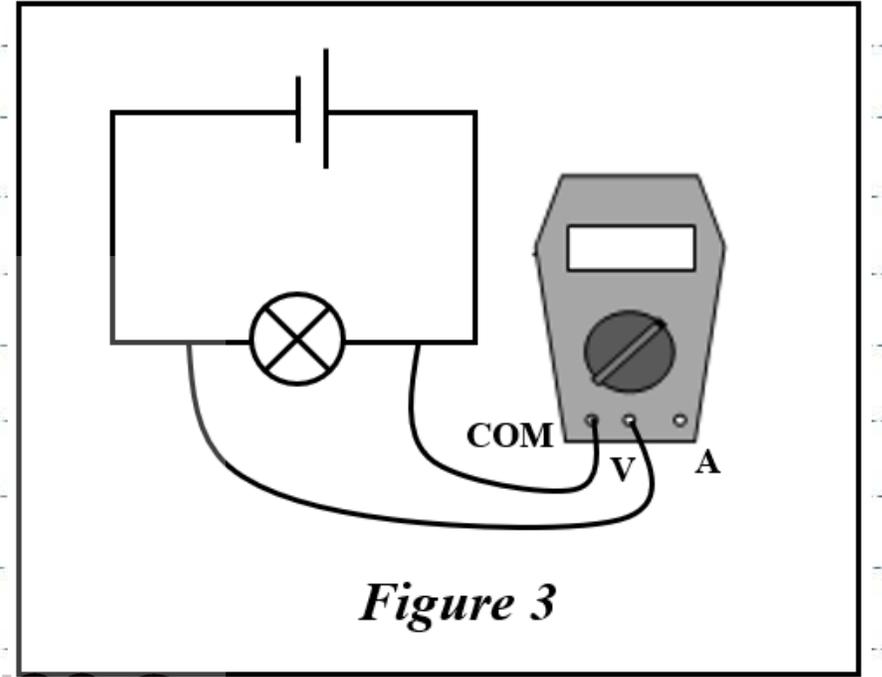


Figure 3

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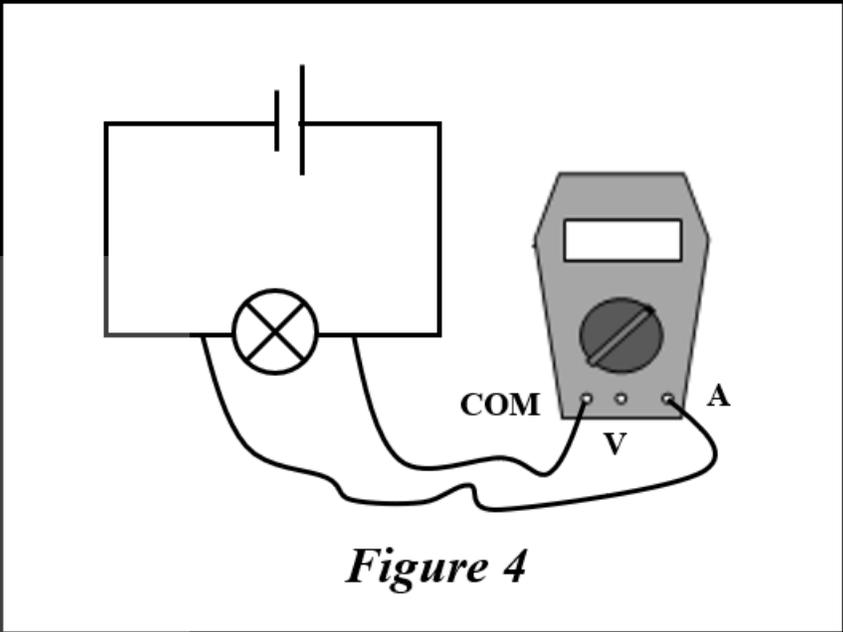
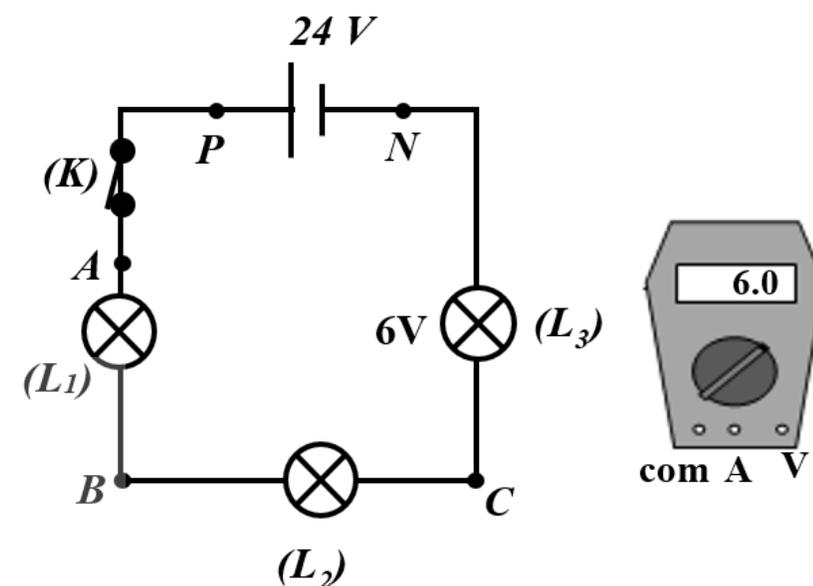


Figure 4

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Exercise 3: **Lamps in Series**

A circuit consists of three lamps (L_1), (L_2) and (L_3) are connected in series across the terminals of a dry cell of voltage $E = 24V$. The circuit is protected by a switch (K). A multimeter is used to measure the voltage of lamp (L_3) and it displays the value $6.0V$ (document 2). Lamps (L_1) and (L_2) are identical.



1. Switch (K) is closed, the current flowing in the circuit is given to be $0.3A$.

1.1. Give the value of the current intensity across each of the three lamps.

1.2. The voltage across the switch is 0; why?

1.3. Explain how it is possible to obtain the reading given by the multimeter.

State the mode used, the outlets, and the connection of the terminals of the multimeter.

1.4. Determine the voltages across lamps (L_1) and (L_2) giving the necessary explanations.

1.5. The multimeter has the ranges $2V$, $10V$, $12V$, $20V$ and $100V$. Which range is the most convenient one to obtain the reading on the multimeter?

2. Switch (K) is opened.

2.1- What is the intensity of the current in the circuit?

2.2- Give the values of the voltages of the switch and the lamps.

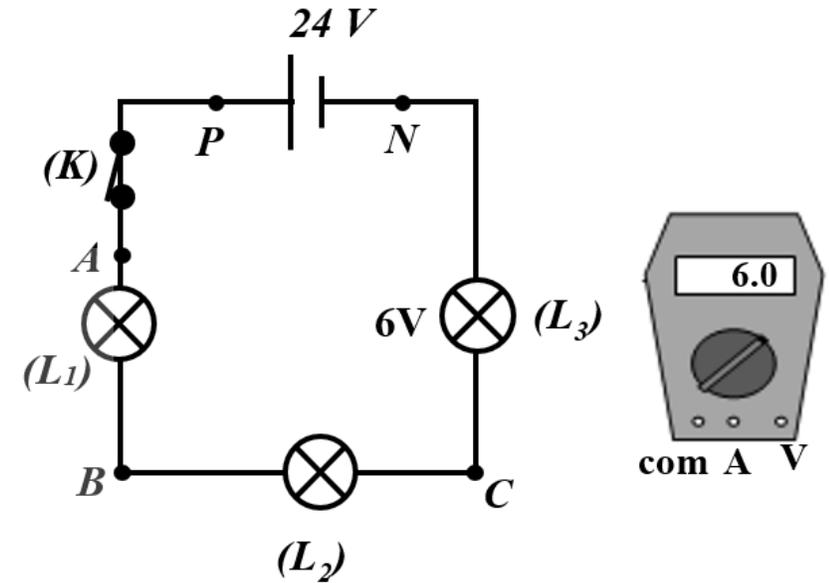
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1. Switch (K) is closed, the current flowing in the circuit is given to be **0.3A**.

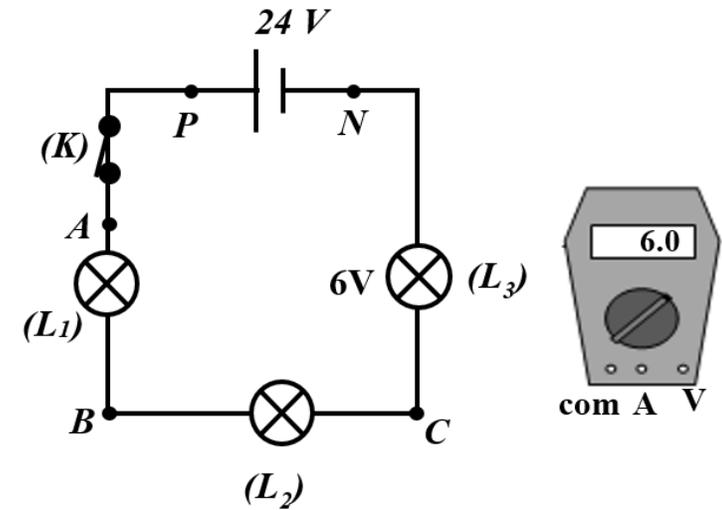
1.1. Give the value of the current intensity across each of the three lamps.

1.2. The voltage across the switch is 0; why?



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- 1.3.** Explain how it is possible to obtain the reading given by the multimeter. State the mode used, the outlets, and the connection of the terminals of the multimeter.
- 1.4.** Determine the voltages across lamps (L_1) and (L_2) giving the necessary explanations.
- 1.5.** The multimeter has the ranges **2V**, **10V**, **12V**, **20V** and **100V**. Which range is the most convenient one to obtain the reading on the multimeter?

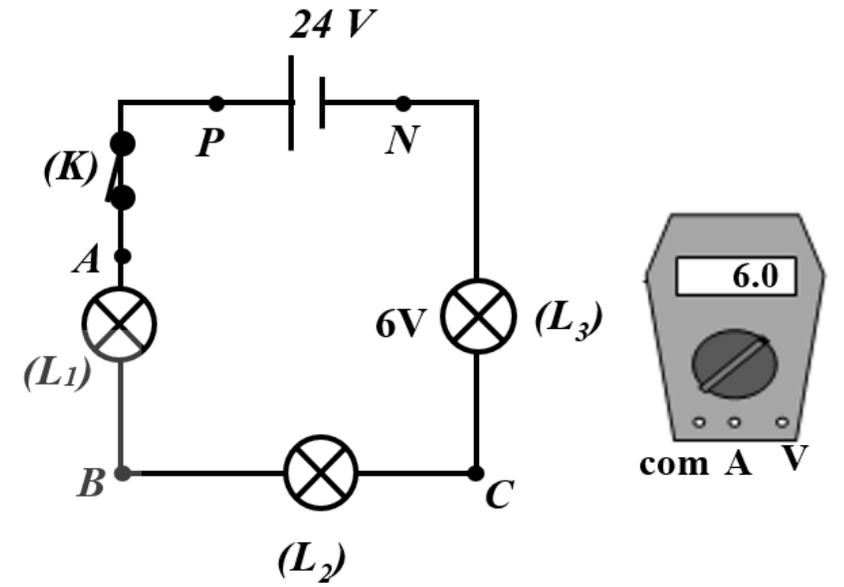


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2. Switch **(K)** is opened.

2.1- What is the intensity of the current in the circuit?

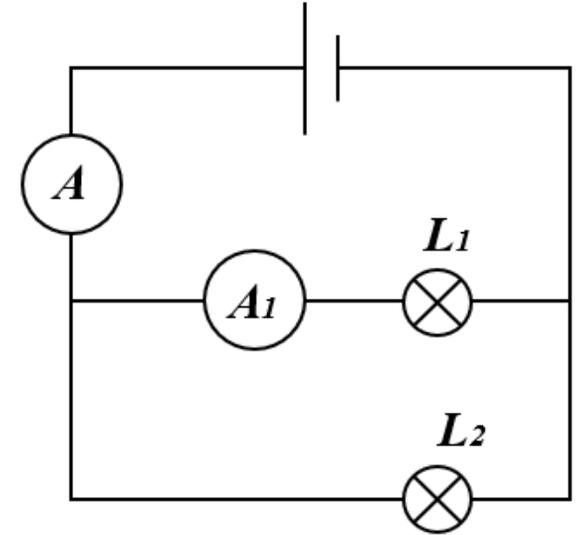
2.2- Give the values of the voltages of the switch and the lamps.



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Exercise 4: **Lamps in Parallel**

The generator in the circuit shown in the adjacent figure delivers a voltage of **6V**. The ammeters **(A)** and **(A₁)** indicate **600 mA** and **280 mA** respectively.



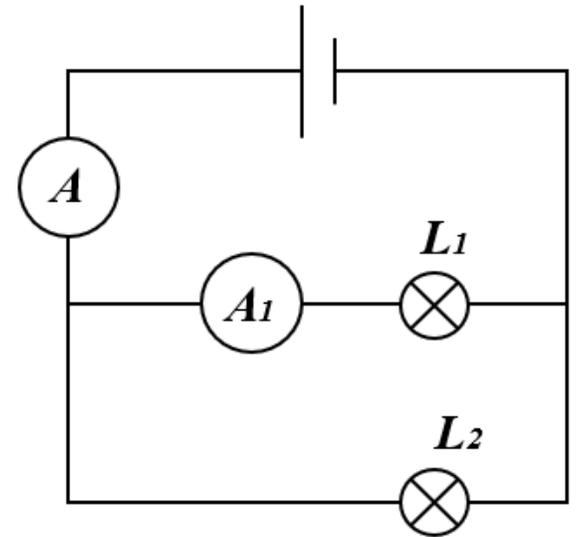
1. Redraw the figure and add to it the directions of the electric current in all branches, the **COM** terminal of each ammeter and another ammeter (A_2) to measure the current through lamp (L_2).
2. Determine the reading of (A_2).
3. What are, listing the laws used, the voltages across the terminals of each lamp?
4. What happens to lamp (L_1) in each of the following cases?

Answer by mentioning whether it remains lit or not.

- 4.1. The filament of (L_2) breaks out and it turns off.
- 4.2. (L_2) is short circuited by a wire and turns off.

Exercise 4: *Lamps in Parallel*

The generator in the circuit shown in the adjacent figure delivers a voltage of **6V**. The ammeters (**A**) and (**A₁**) indicate **600 mA** and **280 mA** respectively.

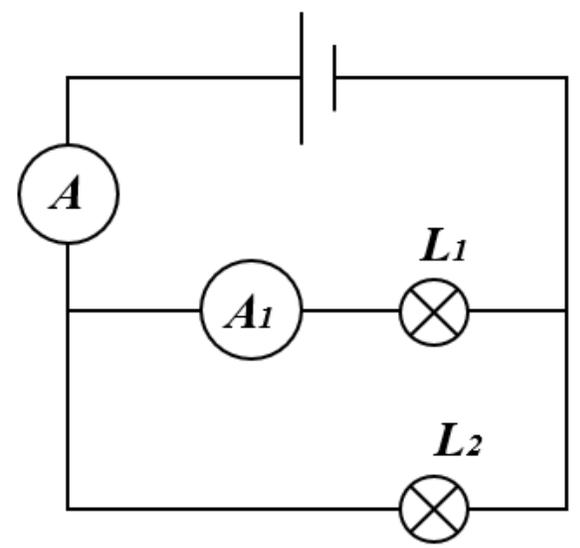


1. Redraw the figure and add to it the directions of the electric current in all branches, the **COM** terminal of each ammeter and another ammeter (**A₂**) to measure the current through lamp (**L₂**).

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2. Determine the reading of (A_2).

3. What are, listing the laws used, the voltages across the terminals of each lamp?



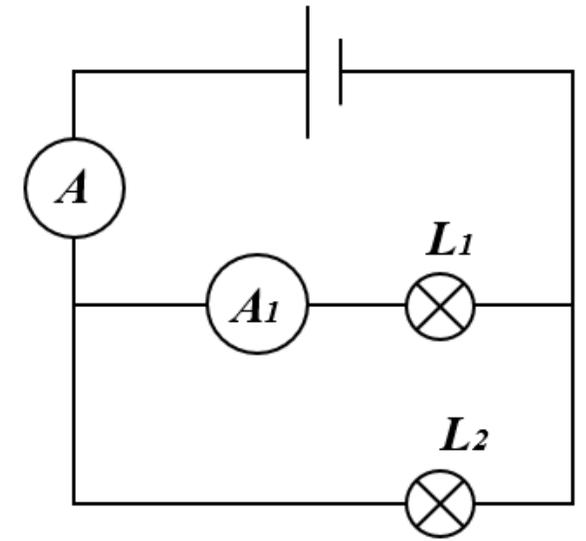
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4. What happens to lamp (L_1) in each of the following cases?

Answer by mentioning whether it remains lit or not.

4.1. The filament of (L_2) breaks out and it turns off.

4.2. (L_2) is short circuited by a wire and turns off.



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Exercise 5: **Normal Functioning of a Lamp**

The circuit of document 1 consists of:

- a generator (G) delivering across its terminals a constant voltage $U_{AC} = 12 \text{ V}$;
- Resistor (D) of resistance R and lamp (L) carries the inscriptions (9 V; 30 mA);
- a closed switch (K);
- an oscilloscope connected across the terminals of (D).

I – Role of (D)

- 1) What do the inscriptions 9 V and 30 mA of (L) represent?
- 2) If (L) is connected directly across the terminals of (G), it burns out. Justify.
- 3) Deduce the role of (D) in this circuit.

II – Exploitation of the waveform

Document 2 shows the waveform displayed by the oscilloscope.

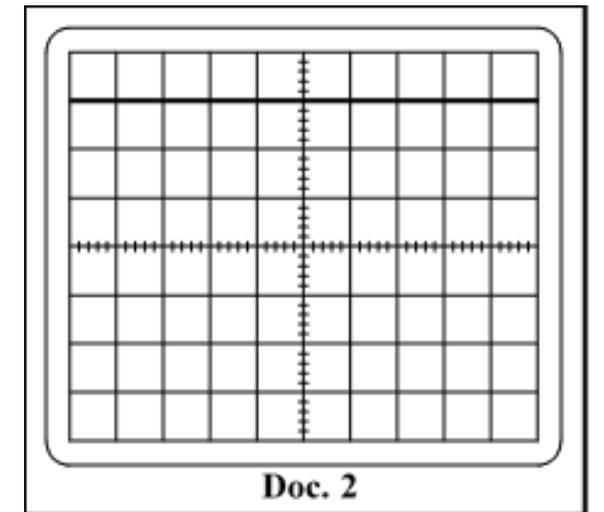
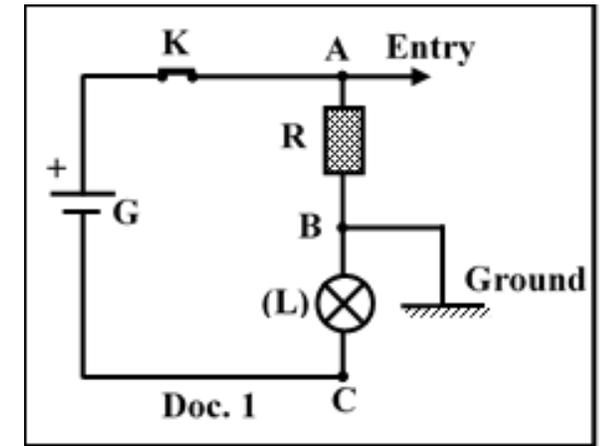
Given: vertical sensitivity: $S_v = 1 \text{ V/div}$.

- 1) **a)** Does the oscilloscope measure U_{AB} or U_{BA} ? Justify.
b) Calculate the value of U_{AB} .
c) Deduce the value of the voltage U_{BC} and name the used law.

- 2) (L) functions normally. Justify.

III – Determination of the value of R

- 1) Specify the value of the intensity I of the current traversing the circuit.
- 2) Deduce the value of R .



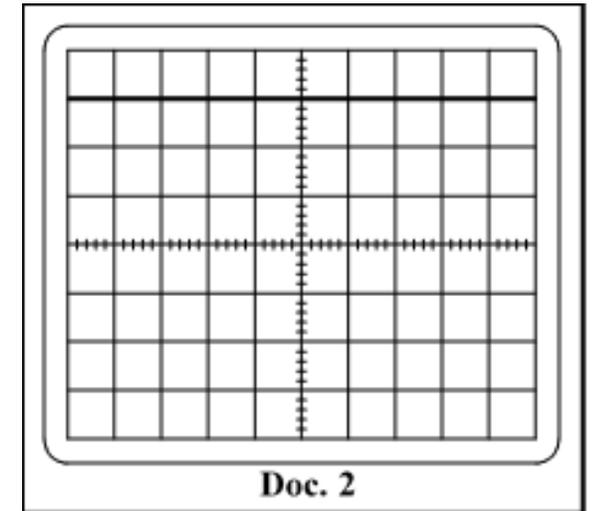
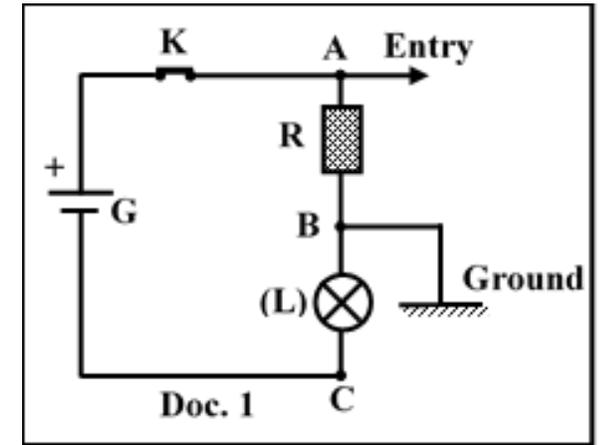
Normal functioning of a lamp

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II – Exploitation of the waveform

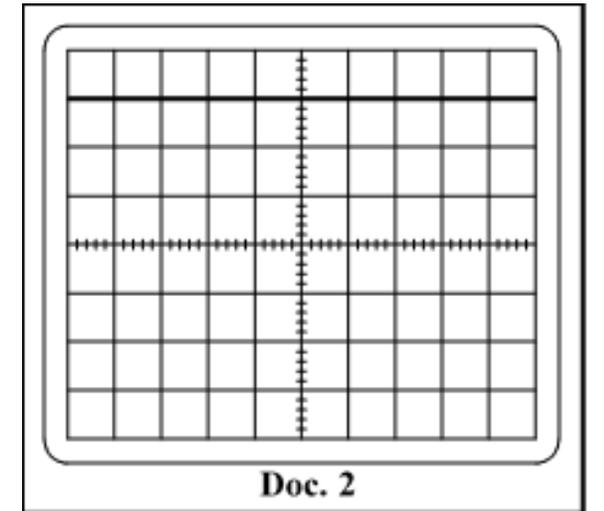
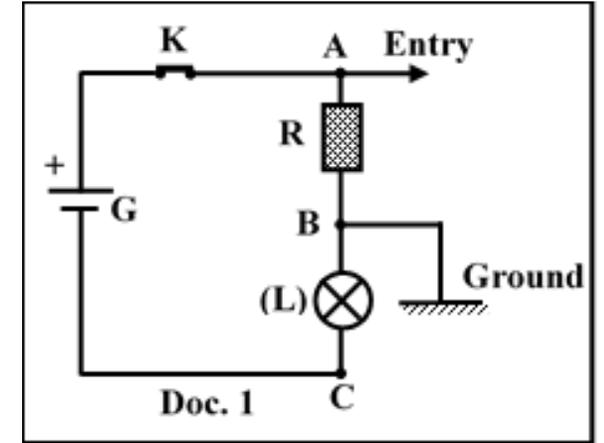
Document 2 shows the waveform displayed by the oscilloscope.

Given: vertical sensitivity: $S_v = 1 \text{ V/div}$.

- 1) **a)** Does the oscilloscope measure U_{AB} or U_{BA} ? Justify.
 - b)** Calculate the value of U_{AB} .
 - c)** Deduce the value of the voltage U_{BC} and name the used law.
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- 1) Specify the value of the intensity I of the current traversing the circuit.
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II – Exploitation of the waveform

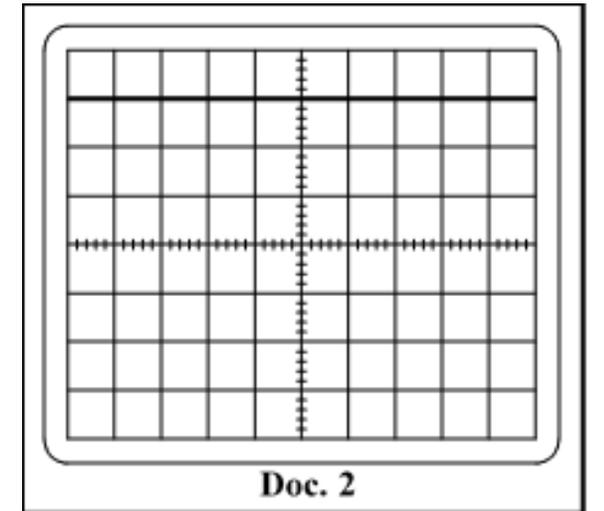
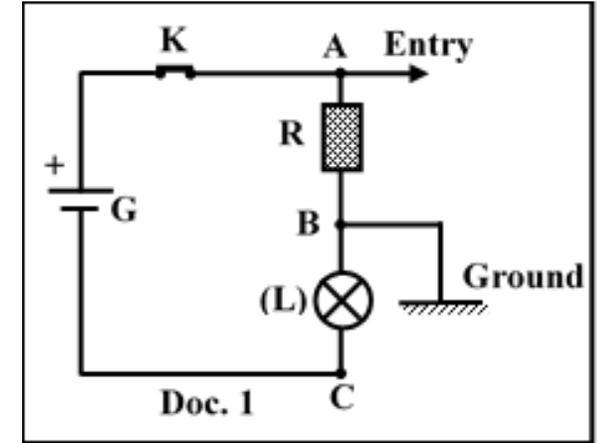
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