This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lebanon Evangelical School
for Boys and Girls Loueizeh - Baabda

Stage Exam 02

08DEC2023

Do NOT write in this box. Your MARK will be placed here.

Subject :	Physics
Class :	9B, 9C and 9E
Teacher :	Mr. Ali Moukalled
Duration :	1 hour

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

EXERCISE 1 (4 points)

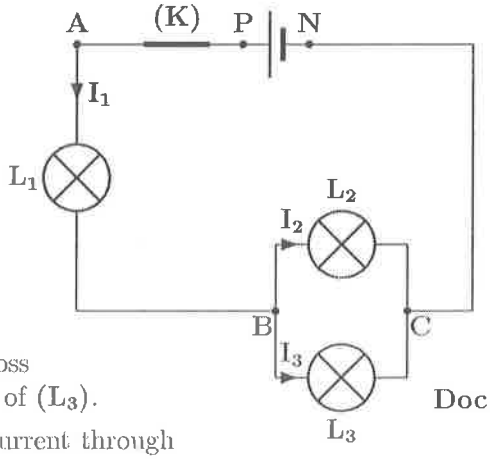
For each of the following statements, answer by true or false and rewrite the false statements correctly.

1. The resistance R_{eq} of the resistor equivalent to two resistors of resistances R_1 and R_2 connected in parallel is: $R_{eq} = R_1 + R_2$.
2. The resistance of a resistor is measured by a voltmeter.
3. The voltage across a closed switch is equal to that of the dry cell.
4. The characteristic current voltage curve of a resistor is a curve passing through the origin.

EXERCISE 2 (4 points)

The electric circuit of document 1 is formed of:

- a generator (G) that maintains across its terminals a constant voltage $U_{PN} = 9V$;
- three lamps (L_1), (L_2) and (L_3);
- a switch (K);
- connecting wires.



Doc.1

1. The switch (K) is closed.
   The voltage across (L_1) is $U_{AB} = 3V$.
   (a) Knowing that $U_{PA} = 0V$ and $U_{CN} = 0V$, determine the voltage U_{BC}.
   (b) Deduce, by indicating the law used, the voltage across the terminals of (L_2) and that across the terminals of (L_3).
   (c) The generator sends a current $I_1 = 500mA$. The current through (L_2) is $I_2 = 300mA$.
   Determine the current I_3 through (L_3).
2. The switch (K) is open.
   Give the new values of U_{PA} and U_{BC}.

EXERCISE 3 (6 points)

The circuit of document 2 consists of :

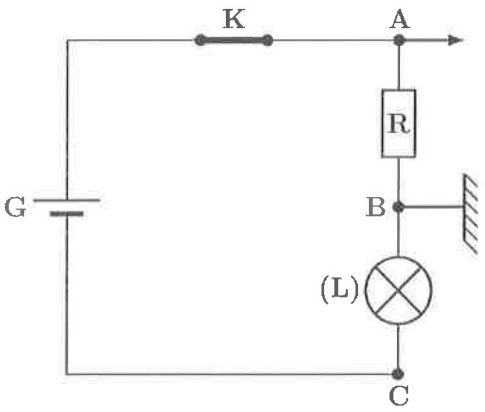
- a generator (G) delivering across its terminals a constant voltage $U_{AC} = 12V$;
- resistor (D) of resistance R;
- a lamp (L) carries the inscriptions $(9V; 30mA)$;
- a closed switch (K);
- an oscilloscope connected across the terminals of (D).

The aim of this exercise is to determine the value of R of (D) in order to let the lamp function normally.

I- Role of (D)

1. What do the inscriptions 9V and 30mA 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.



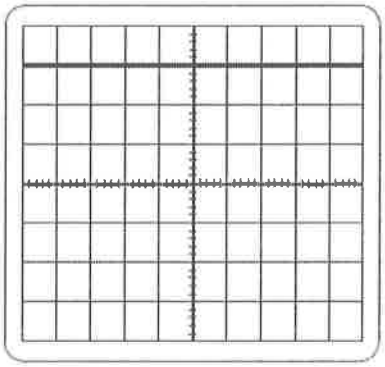
Doc.2

II- Exploitation of the waveform

Document-3 shows the waveform displayed by the oscilloscope.

Given: vertical sensitivity : $S_V = 1V/div$.

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.


Doc.3

III-Determination of the value of R

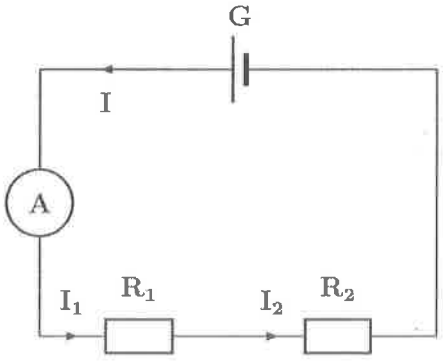
1. Specify the value of the intensity I of the current traversing the circuit.
2. Deduce the value of R.

EXERCISE 4 (6 points)

During a laboratory session, a circuit is constructed as shown in document 4, where:

- (G) is a generator that maintains across its terminals a constant voltage U.
- (R_1) is a resistor of resistance $R_1 = 20\Omega$.
- (R_2) is a resistor of resistance $R_2 = 40\Omega$.
- (A) is an ammeter of negligible resistance.

We designate by I the current sent by (G), I_1 the current traversing (R_1) and I_2 the current traversing (R_2). The ammeter indicates 100mA.



Doc.4

1. $I = I_1 = I_2$. Justify.
2. Calculate the resistance R_e of the resistor equivalent to (R_1) and (R_2).
3. Calculate, by applying Ohm's law, the values of the voltages U_1 and U_2 across the terminals of (R_1) and (R_2) respectively.
4. The voltage across the terminals of (A) is zero. Why ?
5. Deduce the value of U.

SL:02/Physics/20232024/Solution/9BCE

Exercise 1

1) False. The resistance R_{eq} of the resistors equivalent to two resistors of resistances R_1 and R_2 connected in parallel is: $R_{eq} = \frac{R_1 \times R_2}{R_1 + R_2}$ (1)

2) False. The resistance of a resistor is measured by an Ohmmeter. (1)

3) False. The voltage across a closed switch is equal to 0V. (1)

4) False. The characteristic current voltage curve of a resistor is a straight line passing through the origin. (1)

Exercise 2

$U_{PN} = 9V$

1) $U_{AB} = 3V$

a) $U_{PN} = U_{PA} + U_{AB} + U_{BC} + U_{CN}$ (law of addition of voltages in series connection)

$9 = 0 + 3 + U_{BC} + 0$

$U_{BC} = 9 - 3$

$\boxed{U_{BC} = 6V}$ (1)

b) $U_{BC} = U_{L2} = U_{L3} = 6V$ (law of addition of voltages in parallel connection) (1)

c) $I_1 = 0.5A$

$I_2 = 0.3A$

$I_1 = I_2 + I_3$ (law of addition of current in parallel connection)

$0.5 = 0.3 + I_3$

$I_3 = 0.5 - 0.3$

$\boxed{I_3 = 0.2A}$ (1)

2) $U_{PA} = U_{PN} = 9V$ (opened switch) (0.5)

$U_{BC} = 0V$ (opened circuit) (0.5)

Exercise 3

$U_{AC} = 12V$

L (9V; 30mA = 0.03A)

1) 9V: rated voltage
30mA: rated current (0.5)

2) $U_{AC} = U_G = 12V > U_L = 9V$
so the lamp burns out (0.5)

3) To reduce the voltage (0.5)

II - Exploitation of the wave form

1. (a) U_{AB}. The oscilloscope measures from its phase to its ground. (0.5)

(b) $U_{AB} = Y \times Sv$
$= 3 \text{ div} \times 1V/\text{div}$
$= 3V$ (0.5)

c) $U_G = U_R + U_L$ (law of addition of voltages in series connection)
$U_G = U_{AB} + U_{BC}$
$12 = 3 + U_{BC}$ (1)
$U_{BC} = 12 - 3$
$\boxed{U_{BC} = 9V}$

2. $U_{BC} = U_{rated\ (L)} = 9V$ (0.5)

III - (1) Determination of the value of R

1. $I = 0.03A$ since the lamp is functioning normally (1)
2. (1) Due to ohm's law
$U_{AB} = R \times I$ (1)
$R = \frac{U_{AB}}{I} = \frac{3}{0.03} = 100\Omega$
$\boxed{R = 100\Omega}$

(2)

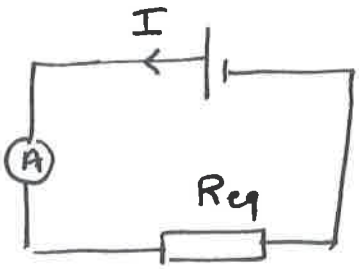
Exercise 4

$R_1 = 20\,\Omega$, $R_2 = 40\,\Omega$. $I = 100\,mA = 0.1\,A$ (1)

1. $I = I_1 = I_2$ (law of uniqueness of current in series connection)
2. R_1 and R_2 are connected in series

$$R_{eq} = R_1 + R_2$$
$$= 20 + 40$$
$$= 60\,\Omega$$

$\boxed{R_{eq} = 60\,\Omega}$ (1)



3. Due to Ohm's law

$$U_1 = R_1 \times I_1$$
$$= 20 \times 0.1$$
$$= 2V$$

$\boxed{U_1 = 2V}$ (1)

$$U_2 = R_2 \times I_2$$
$$= 40 \times 0.1$$
$$= 4V$$

$\boxed{U_2 = 4V}$ (1)

4. The ammeter has negligible resistance (1)
5. $U = U_1 + U_2$ (law of addition of voltages in series connection)

$$= 2 + 4$$

$\boxed{U = 6V}$ (1)