مسابقة في مادة الفيزياء
المدة: ساعة واحدة

الاسم:
الرقم:

This exam is formed of four obligatory exercises in two pages.
Non programmable calculators are allowed

Exercise 1: (4 points) True or False

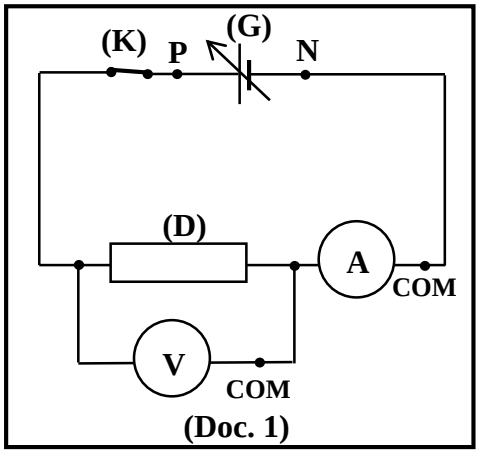
For each of the following statements, answer by true or false and rewrite the false statements correctly.

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) Joule's effect is the transformation of electric energy into heat.
4) The effective voltage between the live line and the neutral of the wall outlet is about 220 V.

Exercise 2: (6 points) Energy consumed by an electric component

Consider the circuit of document 1 that consists of the following components:

- a DC generator (G) of adjustable voltage;
- an electric component (D);
- an ammeter (A);
- a voltmeter (V);
- connecting wires;
- a switch (K).



(Doc. 1)

1) We vary the voltage delivered by (G) from 0 to 10 V.
We record the values of U and I displayed respectively by (V) and (A). The results are shown in the table below:

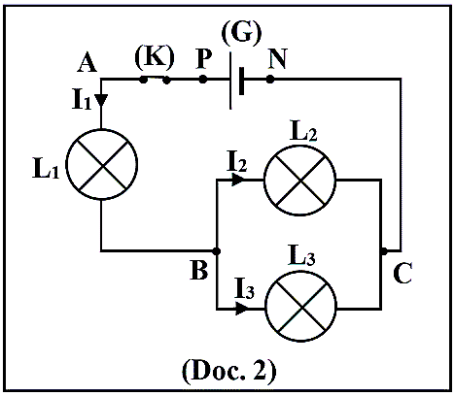
U (V)	0	2	4	6	10
I (mA)	0	10	20	30	50

1.1) Draw the characteristic current-voltage curve of (D).
Scale: on the horizontal axis: 1 cm for 10 mA;
on the vertical axis: 1 cm for 2 V.
1.2) (D) is a resistor. Justify.
1.3) Deduce its resistance R.
2) For a voltage, across (D), U = 8 V:
2.1) give graphically the corresponding value of I;
2.2) show that the electric power consumed by (D) is P = 0.32 W;
2.3) calculate, in J, the electric energy E consumed by (D) during 10 minutes of functioning.

Exercise 3: (4 points) Study of an electric circuit

The electric circuit of document 2 is formed of:

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



(Doc. 2)

1) The switch (K) is closed.
The voltage across (L_1) is $U_{AB} = 3$ V.

1.1) Knowing that $U_{PA} = 0$ V and $U_{CN} = 0$ V, determine the voltage U_{BC}.

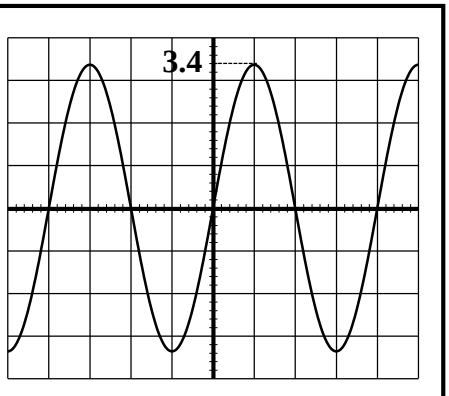
1.2) Deduce, by indicating the law used, the voltage across the terminals of (L_2) and that across the terminals of (L_3).

1.3) The generator sends a current $I_1 = 500$ mA.
The current through (L_2) is $I_2 = 300$ mA.
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 4: (6 points) Alternating Sinusoidal Voltage

Document 3 represents the waveform of an alternating sinusoidal voltage (u) delivered by a low frequency generator (LFG).
In the absence of any voltage, the horizontal luminous line passes through the center of the screen of the oscilloscope.



(Doc. 3)

1) Knowing that the frequency f of (u) is 50 Hz:

1.1) show that its period T is 20 ms;

1.2) deduce the horizontal sensitivity S_h of the oscilloscope.

2) The vertical sensitivity S_v of the oscilloscope is adjusted to 5 V/div.
Referring to document 3, calculate the maximum value U_m of (u).

3) A voltmeter, in the AC mode, connected across this generator indicates a value U.

3.1) What does U represent?

3.2) Calculate its value.

4) A lamp (L) acting as a resistor and carries the inscription 12 V is connected across this generator.

4.1) Give the significance of the inscription 12 V.

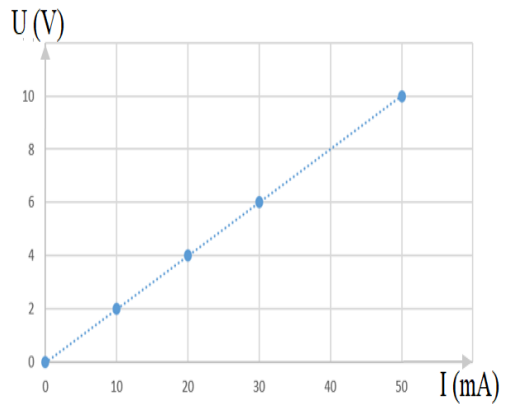
4.2) (L) glows normally. Justify.

مسابقة في مادة الفيزياء
أسس التصحيح - إنكليزي

Exercise 1: (4 points) True or false

Question	Answer	Mark
1	False. The resistance R_{eq} of the resistor equivalent to two resistors of resistances R_1 and R_2 connected in serie is: $R_{eq} = R_1 + R_2$. Or: The resistance R_{eq} of the resistor equivalent to two resistors of resistances R_1 and R_2 connected in parallel is: $R_{eq} = \frac{R1\ xR2}{R1+R2}$	**1**
2	False. The resistance of a resistor can be measured by an ohmmeter.	**1**
3	True.	**1**
4	True.	**1**

Exercise 2: (6 points) Energy consumed by an electric component

Question	Answer	Mark
1.1		**1**
1.2	Since its characteristic curve is a straight line passing through O.	**1**
1.3	for I = 10 mA, U =2 V, therefore R $= \frac{U}{I} = \frac{2V}{0.01A} = 200\ \Omega$ (Ohm's law).	**1.25**
2.1	I = 40mA = 0.04 A (graph)	**0.5**
2.2	P = U×I = 8×0.04 = 0.32 W	**1**
2.3	E = P×t = 0.32×10×60 = 192 J.	**1.25**

Exercise 3: (4 points) Study of an electric circuit

Question	Answer	Mark
1.1	$U_{BC} = U_{BA} + U_{AP} + U_{PN} + U_{NC}$ (law of addition of voltages) $U_{BC} = -3 + 0 + 9 + 0 = 6$ V.	**1**
1.2	$U_2 = U_3 = 6$ V (law of uniqueness of voltage in parallel).	**1**
1.3	$I_3 = I_1 - I_2 = 500 - 300 = 200$ mA (law of addition of currents)	**1**
2	$U_{PA} = U_{PN} = 9$ V. $U_{BC} = 0$V.	**0.5** **0.5**

Exercise 4: (6 points) Alternating Sinusoidal Voltage

Question	Answer	Mark
1.1	$T = 1/f = 1/50 = 0.02$ s = 20 ms.	**1**
1.2	$S_h = T/x = 20$ms / 4 divisions = 5 ms/div.	**1**
2	$U_m = S_v \times y_m = 3.4 \times 5 = 17$ V.	**1**
3.1	It's the effective voltage.	**0.5**
3.2	$U = U_m / \sqrt{2} = 17 / \sqrt{2} = 12.02$ V.	**1**
4.1	12 V represent the rated voltage of the lamp.	**0.5**
4.2	This lamp functions normally since its rated voltage is (almost) equal to the effective voltage of the generator.	**1**