المادة: الفيزياء – لغة إنكليزية الشهادة: المتوسطة نموذج رقم 3 / 2019 المدّة: ساعة واحدة	الهيئة الأكاديميّة المشتركة قسم: العلوم	المركز التربوي للبحوث والإنماء

This test includes four mandatory exercises in two pages.
The use of non-programmable calculators is allowed.

Exercise 1 (3 points) True or False

Answer by "True" or "False" and write the corrected false statement.

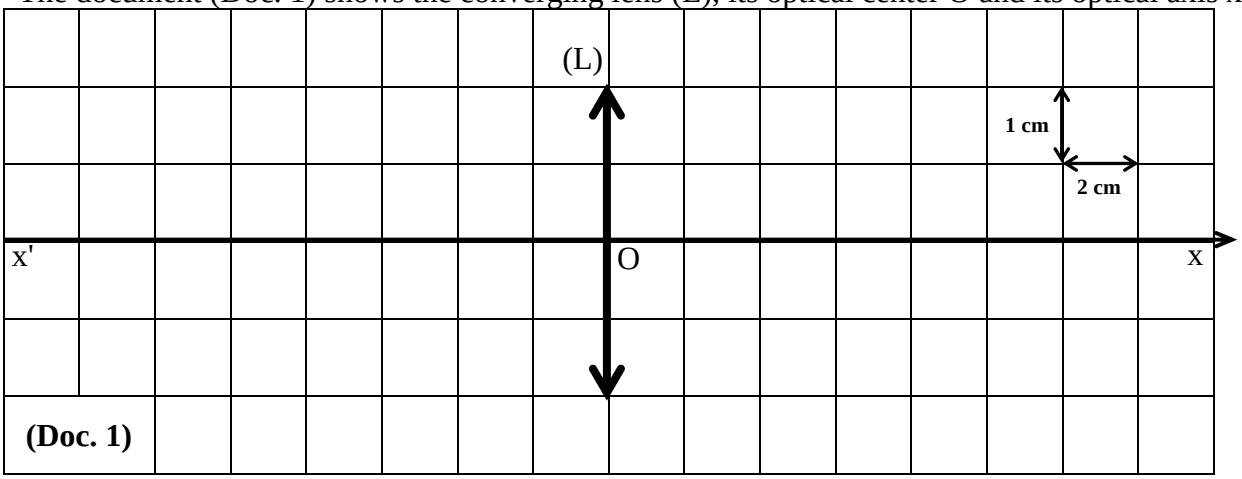
1) The pressure exerted by a box placed on the ground increases by increasing its contact surface area with this ground.

2) The pressure exerted by a liquid at the bottom of a container increases by increasing the amount of the liquid in this container.

3) The same amount of oil exerts always the same pressure at the bottom of a container of any shape.

Exercise 2 (7 points) A converging lens used in biology

The aim of this exercise is to determine, using a geometrical construction, the characteristics of the image (A'B') of a luminous object (AB) given by a converging lens (L) of focal length f = 12 cm.
The object, of size AB = 1 cm, is placed at 6 cm from (L), perpendicularly to its optical axis, A being on this axis.
The document (Doc. 1) shows the converging lens (L), its optical center O and its optical axis x'Ox.



(Doc. 1)

1) Image construction

1-1) Draw, on a graph paper, using the indicated scale, the diagram that shows this converging lens (L), its optical axis x'Ox, the object focus F, the image focus F' and the object (AB).

1-2) Construct on the diagram, giving the necessary explanations, the path of the emergent ray corresponding to the incident ray emitted by the point B:

1-2-1) And passing through O;

1-2-2) Parallel to the optical axis.

1-3) Construct the image (A'B') of the object (AB) given by (L).

2) Characteristics of the image

2-1) Specify the nature of (A'B').

2-2) Indicate the direction of the image (A'B') with respect to that of the object (AB).

2-3) Determine the size A'B' of (A'B').

3) Application

Deduce a role of converging lenses in studying the parts of small insects in biology.

Exercise 3 (5 points) Electric circuit

The circuit shown in (Doc. 2) is formed of:

- A generator (G) delivering across its terminals a constant voltage U_{PN};
- Three resistors (R_1), (R_2) and (R_3), of respective resistances $R_1 = 3\ \Omega$, $R_2 = 2\ \Omega$ and $R_3 = 10\ \Omega$, connected as shown in (Doc. 2).

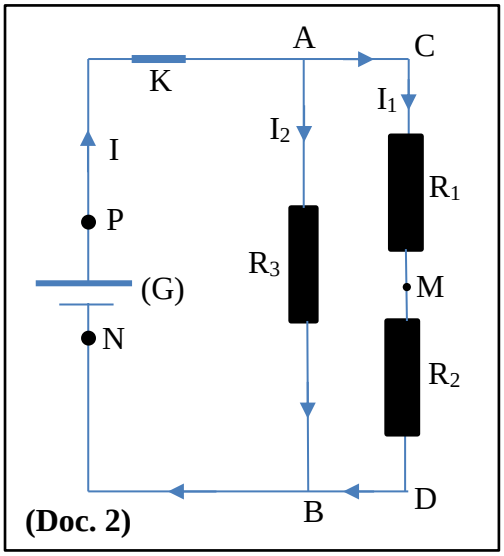
1) Calculate the resistance R' of the resistor (R') equivalent to (R_1) and (R_2).

2) The current I_2 carried by the resistor (R_3) is 0.8 A. Calculate the voltage U_{AB}.

3) An oscilloscope is connected in order to display the voltage U_{PN}. Calculate the vertical sensitivity S_v used if the luminous median line is displaced by 4 divisions up.

4) Determine the current I_1.

5) Calculate the main current I carried by (G).



(Doc. 2)

Exercise 4 (5 points) Buoyant Force

An empty flat rubber balloon, of mass 12 g, is filled with helium gas of density $\rho_{He} = 0.18\ kg/m^3$. It takes then the shape of a sphere of radius R = 0.6 m.

Given:

- g = 10 N/kg;
- Density of the air: $\rho = 1.3\ kg/m^3$;
- Volume V of a sphere of radius R: $V = \frac{4}{3}\pi R^3$.

1) Calculate the volume of the helium gas used to fill the balloon.

2) Calculate the mass of the helium gas used in this balloon.

3) Calculate the magnitude W of the weight of the system (Balloon – Helium gas).

4) Calculate the magnitude F of the buoyant force exerted by the surrounding air on the balloon.

5) Specify if the balloon rises.

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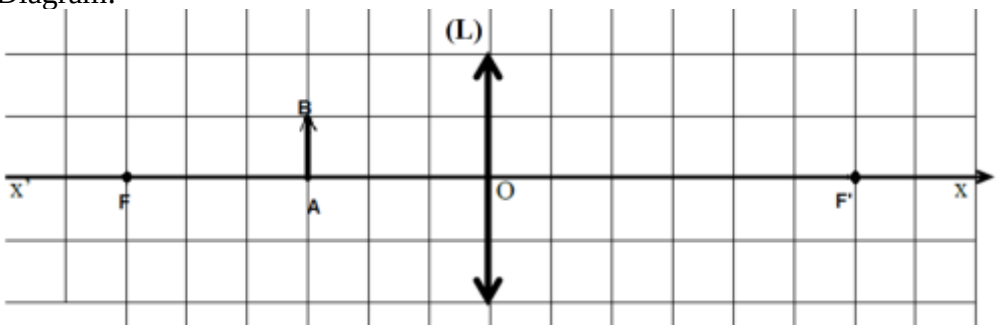
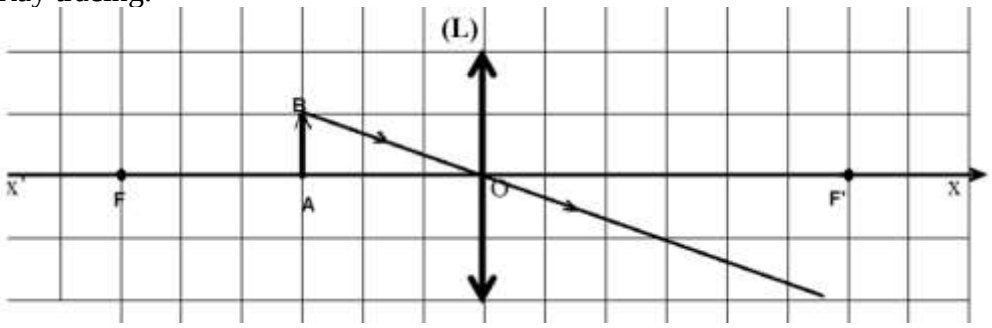
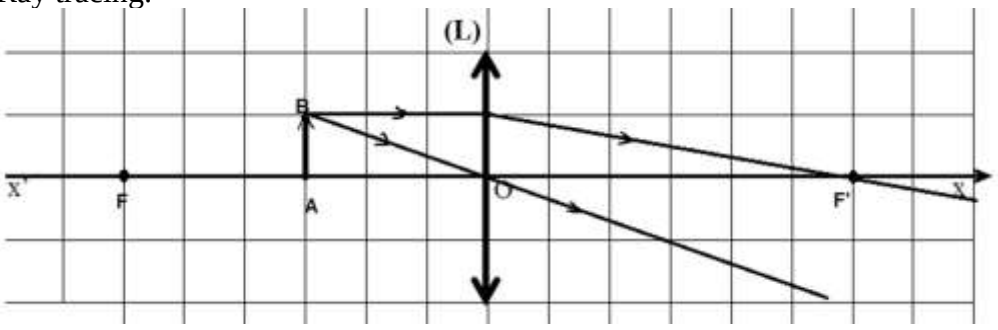
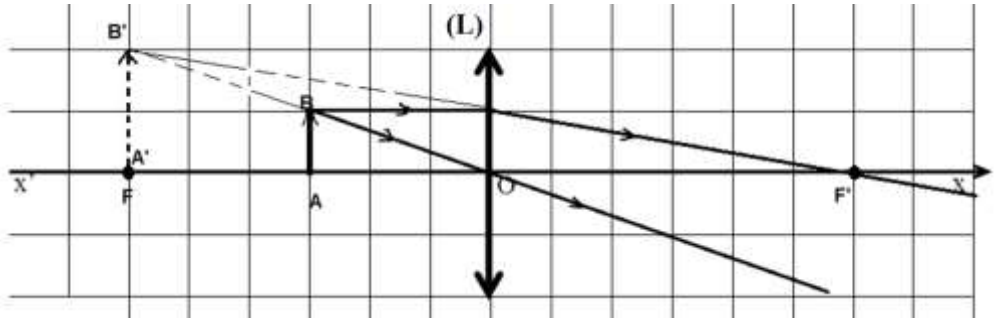
أسس التصحيح

Exercise 1 (3 points) **True or False**

Question	Answer	Mark
1	False. The pressure exerted by a box placed on the ground decreases by increasing its contact surface area with this ground.	1
2	True.	1
3	False. The same amount of oil can exert a different pressure at the bottom of a container of any shape.	1

Exercise 2 (7 points) **A converging lens used in biology**

Question	Answer	Mark
1-1	Diagram:  	1
1-2-1	The ray issued from B and passing through O continues its path without deviation. Ray tracing:  	½ ½
1-2-2	The emergent ray corresponding to the incident ray issued from B parallel to the optical axis converges towards the image focus F'. Ray tracing:  	½ ½

1-3	The intersection between the 2 emergent rays gives the image B' of B, thus forming the image (A'B') of the object (AB), A' being the foot of the perpendicular issued from B' on the optical axis. Construction:  	½ ½
2-1	(A'B') is a virtual image because it is formed on the same side as that of the object.	½ ½
2-2	(A'B') is erect with respect to (AB).	½
2-3	A'B' = 2 × 1 = 2 cm	**1**
3	The lens acts as a magnifier.	½

Exercise 3 (5 points) **Electric circuit**

Question	Answer	Mark
1	$R' = R_1 + R_2 = 3 + 2 = 5\ \Omega$	**1**
2	According to Ohm's law: $U_{AB} = I_2.R_3 = 0.8 \times 10 = 8$ V	**1**
3	$U_{PN} = U_{AB} = 8$ V $U_{PN} = S_v.Y$ so $S_v = U_{PN}/Y = 8$ V / 4 div = 2 V/div	**1**
4	$U_{CD} = U_{AB} = 8$ V $I_1 = U_{CD}/R' = 8/5 = 1.6$ A	**1**
5	$I = I_1 + I_2 = 1.6 + 0.8 = 2.4$ A	**1**

Exercise 4 (5 points) **Buoyant Force**

Question	Answer	Mark
1	The gas takes the shape of the container, thus: $V = \frac{4}{3}\pi(0.6)^3 = 0.905\ m^3$	½
2	$\rho_{He} = m_{Helium}/V$ thus: $m_{Helium} = \rho_{He} \times V = 0.18 \times 0.905 = 0.163$ kg	½ ½
3	$W = m_{total}.g = (m_{balloon} + m_{Helium}).g$ $W = (0.012 + 0.163) \times 10 = 1.75\ N \approx 1.8\ N$	**1** ½
4	$F = \rho Vg$ $F = 1.3 \times 0.905 \times 10 = 11.765\ N \approx 11.8\ N$	½ ½
5	$\vec{W}$ acts vertically downwards; $\vec{F}$ acts vertically upwards. The balloon rises since F > W.	**1**