المركز التربوي للبحوث والإنماء	الهيئة الأكاديميّة المشتركة قسم: العلوم	المادة: الفيزياء – لغة إنكليزية الشهادة: المتوسطة نموذج رقم 2 / 2019 المدّة: ساعة واحدة

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

Exercise 1 (5 points) True or False

For each of the following statements, answer by true or false, and write the corrected false statements.

1) The resistance R_{eq} of the resistor equivalent to 2 resistors of resistances R_1 and R_2 connected in parallel is: $R_{eq} = \frac{1}{R_1} + \frac{1}{R_2}$

2) The transformation of electric energy into thermal energy is called Joule's effect.

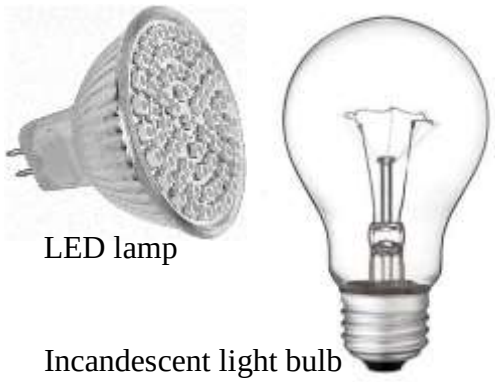
3) When a liquid is at rest, the pressure is the same at any point within this liquid.

4) When a body, subjected to two forces, is at equilibrium, these two forces have the same line of action, the same direction and the same magnitude.

5) The voltage of the mains has an effective value of 220 V and a maximum value of $220\sqrt{2}$ V.

Exercise 2 (5 points) A LED lamp replacing an incandescent light bulb

The aim of this exercise is to show evidence of the importance of the replacement of an incandescent light bulb by a LED lamp, both producing the same luminosity (Doc. 1).



(Doc. 1)

Consider the two lamps (A) and (B). (A) is an incandescent light bulb carrying the indications (220 V, 100 W) and (B) is a LED lamp carrying the indications (220 V, 25 W). The two lamps are considered as resistors functioning for the same duration of 5 hours per day.

1) Justify that the two lamps function normally when they are connected across the mains in Lebanon.

2) Calculate, in kWh, the electric energy consumed by the lamp (A) for 5 hours.

3) Show that the monthly consumption of the lamp (A) is 15 kWh.

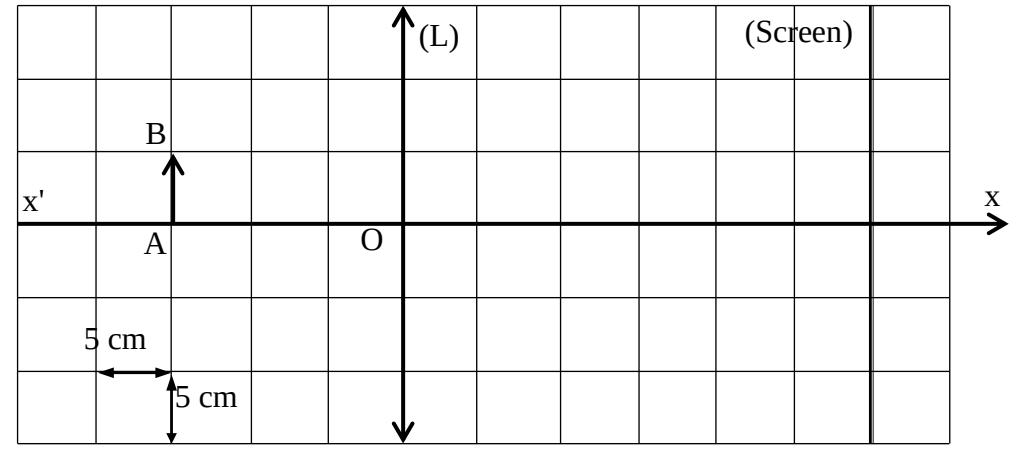
4) The average cost of each kWh is 200 LP. Deduce the monthly cost due to the use of the lamp (A).

5) The monthly cost of the electric energy consumed by lamp (B) for the same duration is 750 LP. Conclude while comparing the monthly cost of each lamp.

Exercise 3 (6 points) **Converging lens**

Consider a converging lens (L) of focal length f and a luminous object (AB) of size AB = 5 cm. (AB) is placed at a distance OA = 15 cm from (L), perpendicularly to its optical axis at A. The image (A'B') of (AB), given by (L), is received on a screen placed at a distance OA' = 30 cm from (L).

(Doc. 2)



1) The document (Doc. 2) shows the lens (L), its optical axis (x'x), its optical center O, the object (AB) and the screen.

1.1) Redraw the figure of (Doc. 2) on the graph paper using the same scale.

1.2) Trace the convenient ray to determine the position of the image B' of the point object B.

2) A ray issued from B, parallel to the optical axis of (L), emerges from (L), passes through its image focus F' and goes towards the image B' of B.

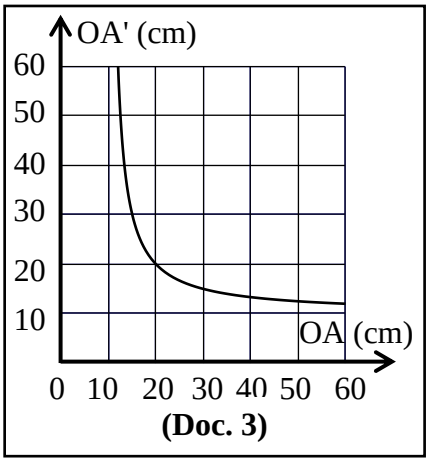
2.1) Trace this ray.

2.2) Deduce f.

3) The document (Doc. 3) shows the variation of OA' as a function of OA. Referring to (Doc. 3):

3.1) Draw out the distance OA for which the screen is at 30 cm from (L);

3.2) Determine f.



(Doc. 3)

Exercise 4 (4 points) **Is this a floating body?**

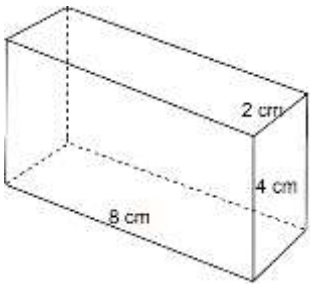
Consider a rectangular block of mass 0.24 kg and of dimensions 2 cm, 4 cm and 8 cm as shown in (Doc. 4).

Given: g = 10 N/kg; density of water $\rho = 1000\ kg/m^3$.

1) Calculate the magnitude of the weight of the block.

2) Show that the volume of the block is $V = 64\times10^{-6}\ m^3$.

3) An object floats on the surface of water when its density is smaller than that of water. Specify whether this block can float on the surface of water or sink to the bottom.



(Doc. 4)

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أسس التصحيح

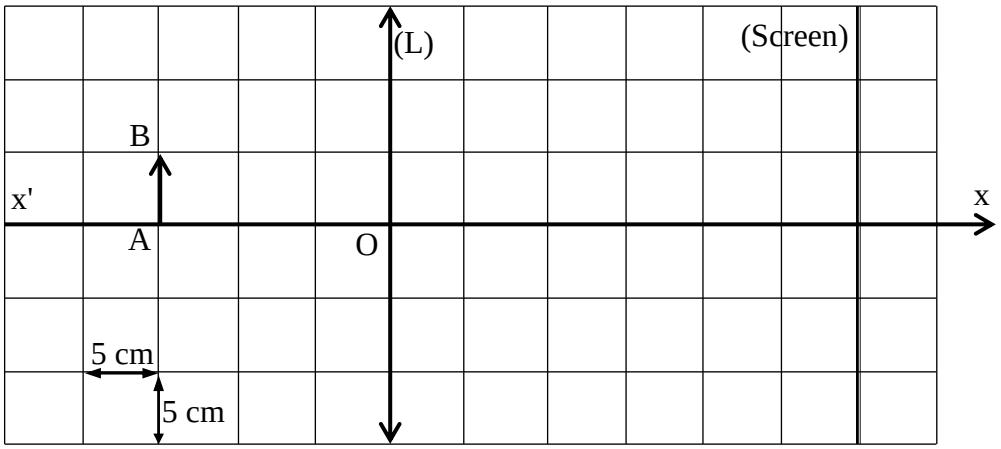
Exercise 1 (5 points) True or False

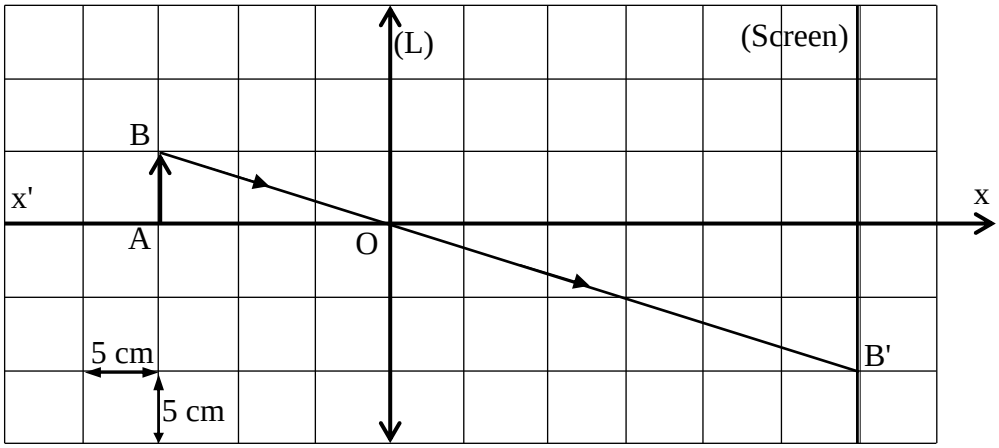
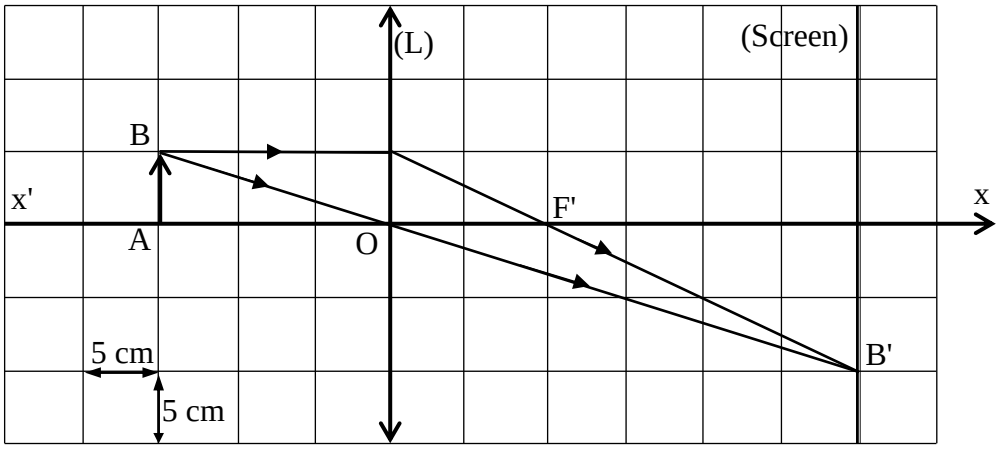
Question	Answer	Mark
1	False. The resistance R_{eq} of the resistor equivalent to 2 resistors of resistances R_1 and R_2 connected in parallel is: $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$	1
2	True.	1
3	False. When a liquid is at rest, the pressure is the same at any point on the same horizontal level within this liquid.	1
4	False. When a body, subjected to two forces, is at equilibrium, these two forces have the same line of action, the same magnitude and opposite directions.	1
5	True.	1

Exercise 2 (5 points) A LED lamp replacing an incandescent light bulb

Question	Answer	Mark
1	The two lamps have rated voltage of 220 V, which is equal to the effective value of the voltage of the mains in Lebanon.	1
2	$E_{(kWh)} = P_{(kW)} \times \Delta t_{(h)} = 0.1 \times 5 = 0.5$ kWh.	1
3	Monthly consumption = $(0.5 \times 30) = 15$ kWh.	1
4	Monthly cost = $15 \times 200 = 3000$ LP.	1
5	Monthly cost (Lamp (A)) = 3000 LP Monthly cost (Lamp (B)) = 750 LP. It's better to use the LED lamp because it is more economical.	1

Exercise 3 (6 points) Converging lens

Question	Answer	Mark
1.1	Figure reproduction: 	1

1.2	A ray issued from B and passing through O continues its path without deviation and meets the screen at B'. Ray tracing:  	½ ½
2.1	Ray tracing.  	**1**
2.2	The emergent ray meets the optical axis at F' OF' = 2 div × 5 cm/div = 10 cm	**1**
3.1	The screen is at 30 cm from (L), hence OA' = 30 cm. Referring to (Doc. 3), OA = 15 cm.	**1**
3.2	When the object and the image are at equal distances from the lens, the focal length f = OA/2 = OA'/2 Referring to (Doc. 3), OA = 20 cm f = 20/2 = 10 cm	**1**

Exercise 4 (4 points) **Is this a floating body?**

Question	Answer	Mark
1	$W = mg = 0.24 \times 10 = 2.4$ N	**1**
2	$V = 0.08 \times 0.04 \times 0.02 = 64 \times 10^{-6}$ m^3	**1**
3	The density of the block $\rho = m/V = 0.24/(64 \times 10^{-6}) = 3750$ kg/m^3. The density of the block is larger than the density of water, then the block sinks to the bottom.	**1** **1**