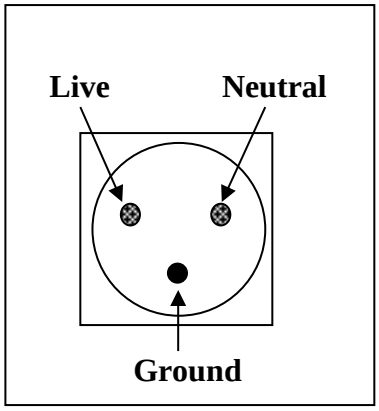
وزارة التّربية والتّعليم العالي المديريّة العامّة للتّربية دائرة الامتحانات الرّسميّة	امتحانات الشّهادة المتوسّطة	دورة العام ٢٠١٧ العاديّة الجمعة ٩ حزيران ٢٠١٧
	مسابقة في مادّة الفيزياء المدّة: ساعة واحدة	الاسم: الرّقم:

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

Exercise 1 (4 pts) Wall outlet (Socket)

Document 1 represents a wall outlet of the mains for which the effective voltage is 220 V.



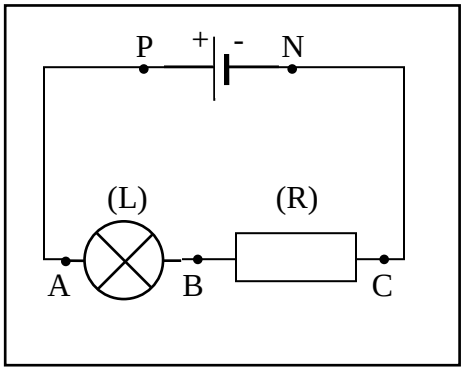
Document 1

Indicate, for each of the following statements, if it is true or false. Correct the false statements.

1. To distinguish between the live and the neutral terminals, we use a tester.
2. A voltmeter, adjusted on AC mode and connected across the ground and the neutral terminals, displays 220 V.
3. The voltage delivered by the wall outlet is alternating triangular.
4. The maximum value of the voltage of the mains is : $U_m = \frac{220}{\sqrt{2}}$ V.

Exercise 2 (5 pts) Normal functioning of a lamp

Consider a lamp (L) carrying the inscriptions (9 V; 0.3 A) and a dry cell of constant voltage U_{PN}. (L) acts as a resistor (ohmic conductor) of resistance R_L.
In order to **function normally**, the lamp (L) is connected in series with a resistor (R) of resistance R (Document 2).

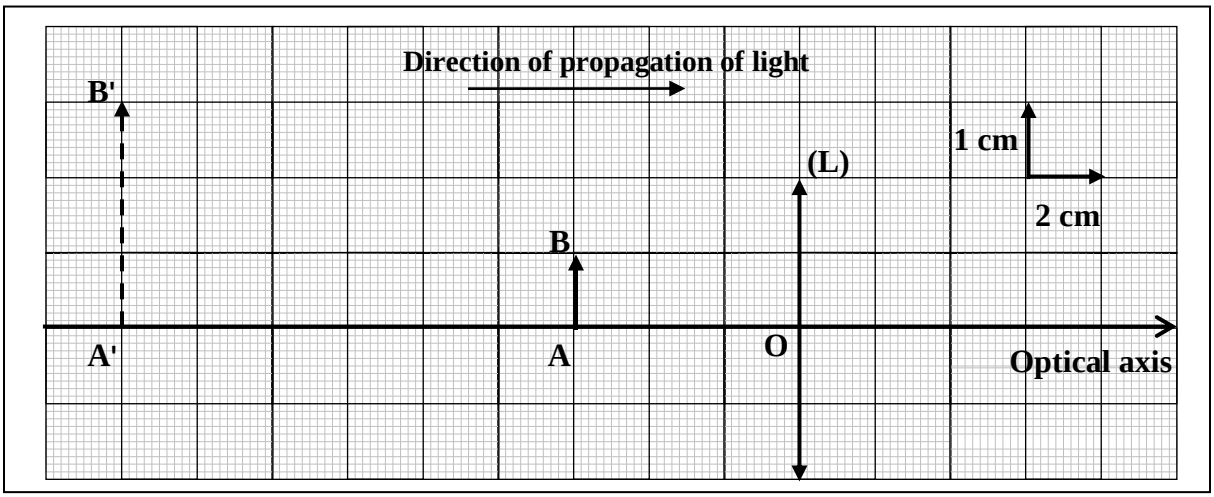


Document 2

1. What does each of the inscriptions carried by (L) represent?
2. Determine R_L.
3. Show that the current passing through (R) is I = 0.3 A.
4. Using the law of addition of voltages, calculate the voltage U_{BC} across (R) knowing that U_{PN} = 12 V.
5. Deduce R.

Exercise 3 (5 pts) Converging lens

The aim of this exercise is to determine the focal length of a converging lens (L).
For this, consider a luminous object (AB) and its image (A'B') given by (L) as shown in document 3.



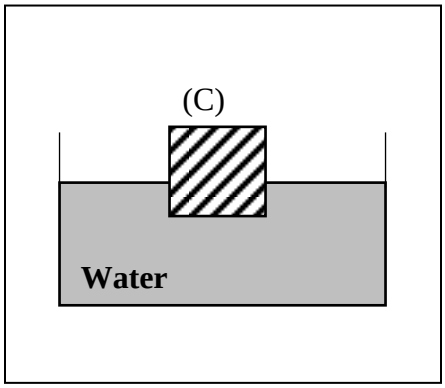
Document 3

1. The image (A'B') is virtual. Justify.
2. Reproduce, on a graph paper and with the same scale, the figure of the above document.
3. Let f be the focal length of (L).
   - **3.1.** Determine, using the path of a luminous ray issued from B and parallel to the optical axis, the position of the image focus F'.
   - **3.2.** Deduce f.

Exercise 4 (6 pts) Immersed volume

A wooden cube (C), of side a = 2 cm, floats on the surface of water.
Given:

- density of wood: $\rho_{wood} = 400$ kg/m^3;
- density of water: $\rho_{water} = 1000$ kg/m^3.



Document 4

1. Show that the volume of (C) is $V = 8 \times 10^{-6}$ m^3.
2. Show that the mass of (C) is $m = 3.2 \times 10^{-3}$ kg.
3. The cube is submitted to two forces: its weight $\vec{W}$ and Archimedes up-thrust force $\vec{F}$.
   - **3.1.** Indicate for each of the two forces if it is a contact force or a force acting from a distance.
   - **3.2.** Write the relation between the magnitudes of these two forces.
   - **3.3.** Determine the volume V_i of the immersed part of the cube.

معيار التصحيح **مسابقة في مادّة الفيزياء**

Exercise 1 (4pts) wall outlet (Socket)

Part of the Q.	Answer	Mark
1.	True	**1**
2.	False, a voltmeter, adjusted on AC mode, across the ground and neutral terminals indicates approximately 0V OR A voltmeter, adjusted on AC mode and connected across the live and neutral terminals, displays 220 V.	**1**
3.	False, the voltage of the mains is alternating sinusoidal.	**1**
4.	False, The maximum value of the voltage of the mains is : $U_m = 220x\sqrt{2}$ V.	**1**

Exercise 2 (5pts) normal functioning of the lamp

Part of the Q.	Answer	Mark
1.	9 V: Rated voltage - 0.3 A: Rated current	**1**
2.	$R_L = \frac{U}{I} = \frac{9}{0.3} = 30\ \Omega$	**1**
3.	Since (L) functions normally and (R) is connected in series with (L) then $I_R = I_L = 0.3$ A	**1**
4.	$U_{PN} = U_{AB} + U_{BC}$ $U_{BC} = U_{PN} - U_{AB} = 12 - 9 = 3$ V	**1**
5.	$R = \frac{U}{I} = \frac{3}{0.3} = 10\ \Omega$	**1**

Exercise 3 (5 pts) converging lens

Part of the Q.	Answer	Mark
1.	Since the direction of the obtained image is erect with respect to the object (AB), the image is virtual.	**1**
2.	See document	**1**
4.	Draw from B an incident ray parallel to the optical axis. It emerges as if coming from the image B'. The point of intersection between the emergent ray and the optical axis is the image focus F′ + Figure	**2**
6	f = OF' = 4.5x2 = 9cm	**1**

Exercise 4 (6 pts) Immersed volume

Part of the Q.	Answer	Mark
1.	$V_C = a^3 = 2^3 = 8cm^3$	**1**
2.	$m_C = \rho_{wood} \times V_C = 400 \times 8x10^{-6} = 3.2\times10^{-3}$ kg	**1**
3.1	weight: force acting from a distance . Archimedes up thrust: contact force.	**1.5**
3.2	the cube floats on the surface of liquid then: W = F	**1**
4.2	$W = F \Rightarrow mg = \rho\times V_i\times g$ $V_i = \frac{m}{\rho_{water}} = \frac{3.2x10^{-3}}{1000} = 3.2\times10^{-6}\ m^3$	**1.5**