


<p>المادة: الفيزياء الشهادة: المتوسطة نموذج رقم 3 المدة: ساعة واحدة</p>	<p>الهيئة الأكاديمية المشتركة قسم: العلوم</p>	 <p>المركز التربوي للبحوث والأبحاث</p>
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نموذج مسابقة (يراعي تعليق الدروس والتوصيف المعدل للعام الدراسي 2016-2017 وحتى صدور المناهج المطورة)

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

### Exercise 1 (3 points) Pressure

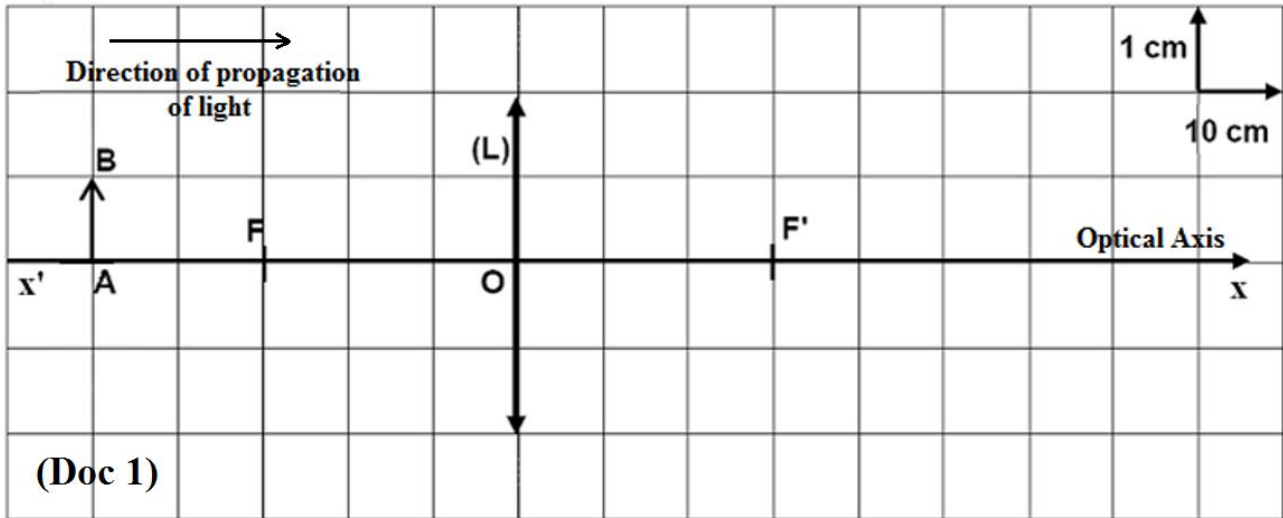
For the following statements, indicate whether each is true or false. For the false ones, write the correct statements.

- 1) Pressure is expressed in N in SI units.
- 2) The pressure is inversely proportional to the magnitude of the pressing force.
- 3) Liquids transmit wholly the pressure to which they are subjected.

### Exercise 2 (6 points) Image given by a converging lens

The aim of this exercise is to determine the characteristics of the image A'B', of an object AB, given by a converging lens (L).

The diagram (Doc 1) below represents the converging lens (L), its optical axis x'Ox, the object focus F, the image focus F' and the object AB.



- 1) Construction of the image A'B'
  - 1-1) Reproduce the above diagram (Doc 1) on the graph paper using the same scale.
  - 1-2) Construct the image A'B' and give the necessary explanations.
- 2) Characteristics of the image A'B'
  - 2-1) Specify the nature of the image A'B'.
  - 2-2) Indicate if the image A'B' is erect or inverted with respect to the object AB.
  - 2-3) Give the size of the image A'B'.
  - 2-4) Determine the distance d separating the image A'B' from (L).

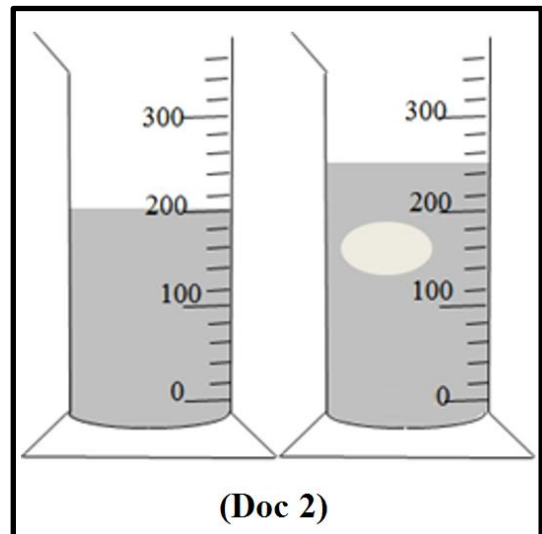
**Exercise 3 (5 points)****Egg in salty water**

In an experiment, we use an egg of mass  $m = 55 \text{ g}$  and a graduated cylinder containing  $200 \text{ cm}^3$  of salty water of density  $\rho_{\text{salty}} = 1200 \text{ kg/m}^3$ .

Take:  $g = 10 \text{ N/kg}$ .

We immerse the egg completely in the salty water. The level of the salty water rises till  $250 \text{ cm}^3$  as shown in the adjacent document (Doc 2).

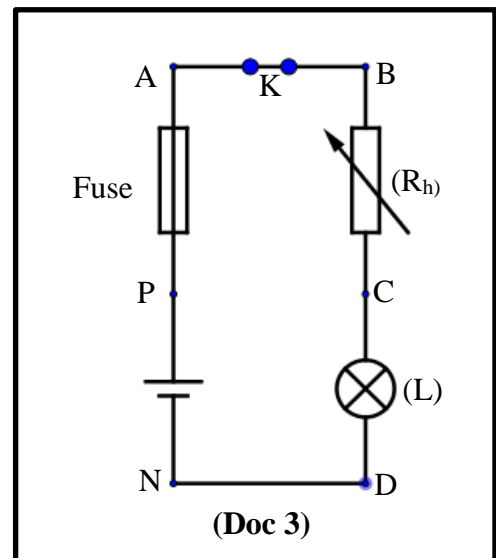
- 1) Calculate the magnitude  $W$  of the weight of the egg.
- 2) Calculate the volume of the egg.
- 3) Calculate the magnitude  $F$  of the Archimedes' upthrust exerted by the salty water on the egg (the egg being completely immersed in the salty water).
- 4) We release the egg. Specify whether the egg rises to the surface of the salty water or falls to the bottom of the cylinder.


**Exercise 4 (6 points)****Protection of a lamp**

The adjacent document (Doc 3) represents a circuit formed of:

- A battery supplying, across its terminals, a constant voltage  $U_{PN} = 12 \text{ V}$ ;
- A fuse that can support a maximum current of  $0.6 \text{ A}$ ;
- A closed switch  $K$ ;
- A rheostat ( $R_h$ ) of adjustable resistance;
- A lamp ( $L$ ) acting as a resistor and carrying the label ( $9 \text{ V}; 4.5 \text{ W}$ ).

- 1) The lamp functions normally.
  - 1-1) Indicate the significance of the label ( $9 \text{ V}; 4.5 \text{ W}$ ).
  - 1-2) Deduce the value of the current  $I$  carried by the lamp ( $L$ ).
  - 1-3) Calculate the resistance  $R$  of the lamp ( $L$ ).
- 2) Starting from a certain value, we decrease the resistance of the rheostat. The brightness of the lamp increases gradually. Calculate, just before the fuse melts:
  - 2-1) The voltage  $U_{CD}$  across the lamp ( $L$ );
  - 2-2) The voltage  $U_{BC}$  across the rheostat knowing that the voltage across the fuse is nil;  $U_{PA} = 0$ .



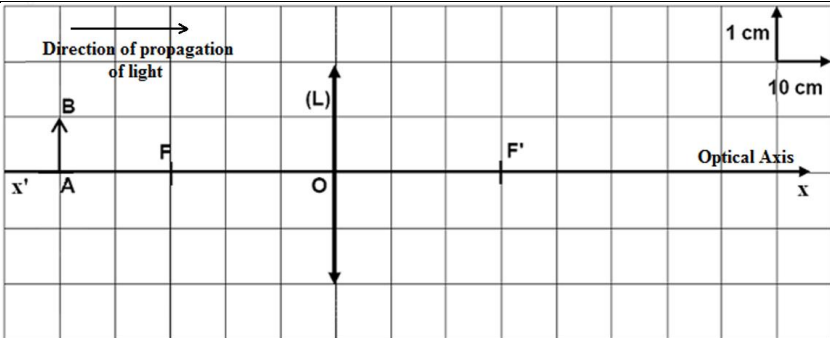
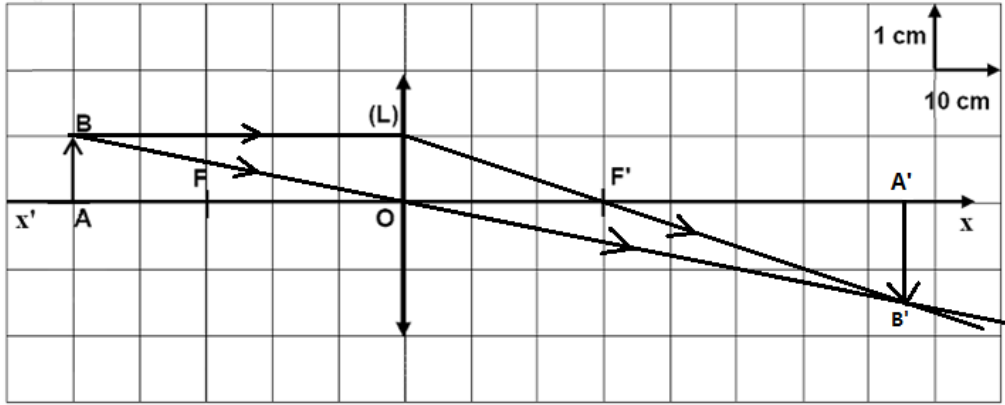
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أسس التصحيح (تراعي تعليق الدروس والتوصيف المعدل للعام الدراسي 2016-2017 وحتى صدور المناهج المطورة)

### Exercise 1 (3 points) Pressure

Question	Answer	Mark
1	False. Pressure is expressed in Pa in SI units. <i>or</i> False. Force is expressed in N in SI units.	1/4 3/4 1/4 3/4
2	False. The pressure is proportional to the magnitude of the pressing force. <i>or</i> False. The pressure is inversely proportional to the area of the contact surface.	1/4 3/4 1/4 3/4
3	False. Liquids transmit wholly the variations of pressure to which they are subjected.	1/4 3/4

### Exercise 2 (6 points) Image given by a converging lens

Question	Answer	Mark
1-1		1
1-2	 <p>From point B, we draw a ray that passes through point O. This ray emerges from point O of the lens without deviation.</p> <p>From point B, we draw an incident ray parallel to the optical axis. This ray emerges from the lens passing through point F'.</p> <p>Both emerging rays meet at point B'. From B', we draw a perpendicular line to the optical axis. This line intersects the optical axis at point A'.</p>	1 1/2 1/2 1/2

2-1	A'B' is a real image because it forms on the side of the emerging rays.	1/2
2-2	A'B' is inverted with respect to AB.	1/2
2-3	A'B' = 1.5 cm.	1/2
2-4	$d = 7.5 \times 10 = 75 \text{ cm.}$	1/2

**Exercise 3 (5 points) Egg in salty water**

Question	Answer	Mark
1	$W = m \times g$ $W = 55 \times 10^{-3} \times 10 = 0.55 \text{ N}$	3/4 3/4
2	$V = 250 - 200 = 50 \text{ cm}^3$	1/2
3	$F = \rho \times V_{\text{immersed}} \times g$ but $V_{\text{immersed}} = V$ since the egg is completely immersed in the salty water then $F = \rho \times V \times g$ $F = 1200 \times 50 \times 10^{-6} \times 10 = 0.6 \text{ N}$	3/4 1/2 3/4
4	$W < F$ then the egg rises to the surface of the salty water. (it will float on the surface of the salty water).	1/2 1/2

**Exercise 4 (6 points) Protection in an electric circuit**

Question	Answer	Mark
1-1	9 V: rated voltage. 4.5 W: rated power.	1/4 1/4
1-2	$P = UI$ then $I = \frac{P}{U}$ $I = \frac{4.5}{9} = 0.5 \text{ A}$	1/2 1/2
1-3	Using Ohm's law $U = RI$ $R = \frac{U}{I}$ $R = \frac{9}{0.5} = 18 \Omega$	1/2 1/2 1/2
2-1	Just before the fuse melts, the value of the current is $I_{\text{max}} = 0.6 \text{ A.}$ $U_{\text{CD}} = RI_{\text{max}}$ $U_{\text{CD}} = 18 \times 0.6 = 10.8 \text{ V.}$	1/2 1/2
2-2	Using the law of addition of voltages: $U_{\text{PN}} = U_{\text{PA}} + U_{\text{AB}} + U_{\text{BC}} + U_{\text{CD}} + U_{\text{DN}}$ $U_{\text{BC}} = U_{\text{PN}} - U_{\text{PA}} - U_{\text{AB}} - U_{\text{CD}} - U_{\text{DN}}$ $U_{\text{DN}} = 0$ since it is the voltage across a connecting wire. $U_{\text{AB}} = 0$ since it is the voltage across a closed switch (connecting wire). $U_{\text{BC}} = 12 - 0 - 0 - 10.8 - 0$ $U_{\text{BC}} = 1.2 \text{ V}$	1/2 1/2 1/2 1/2