

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

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

Exercise 1 (3 points) Pressure

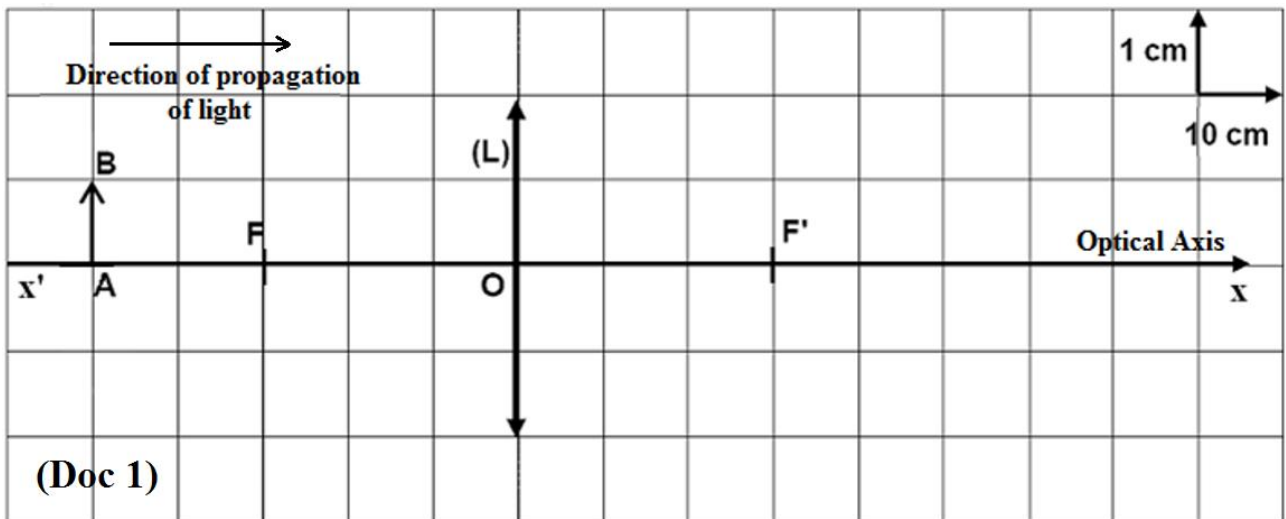
For the following statements, indicate whether each is true or false. For the false ones, write the correct statements.

- 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).

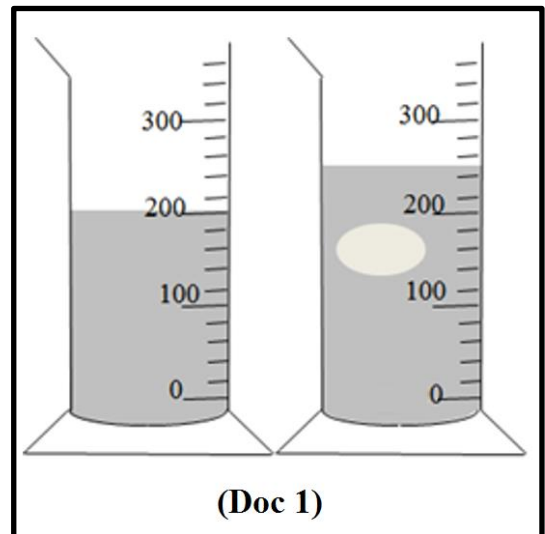
Exercise 3 (5 points)**Egg in salty water**

In an experiment, we use an egg of mass $m = 55 \text{ g}$ and a graduated cylinder containing 200 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 cm^3 as shown in the adjacent document (Doc 1).

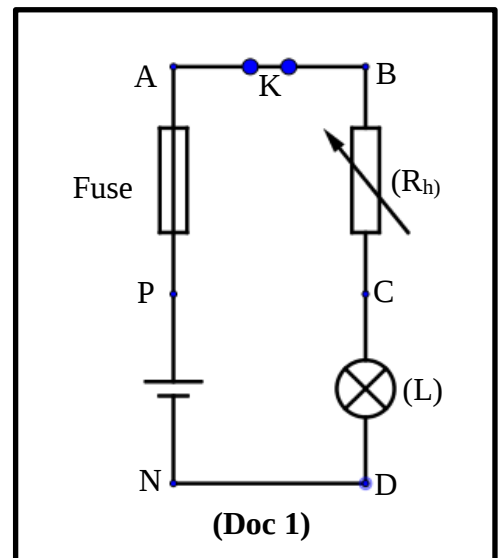
- 1) Calculate the magnitude W of the weight of the egg.
- 2) Calculate the volume of the egg.
- 3) Calculate the magnitude F of the Archimedes' upthrust exerted by the salty water on the egg (the egg being completely immersed in the salty water).
- 4) We release the egg. Specify whether the egg rises 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 1) 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 A ;
- A closed switch K ;
- A rheostat (R_h) of adjustable resistance;
- A lamp (L) acting as a resistor and carrying the label (9 V ; 4.5 W).

- 1) The lamp functions normally.
 - 1-1) Indicate the significance of the label (9 V ; 4.5 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 null; $U_{PA} = 0$.



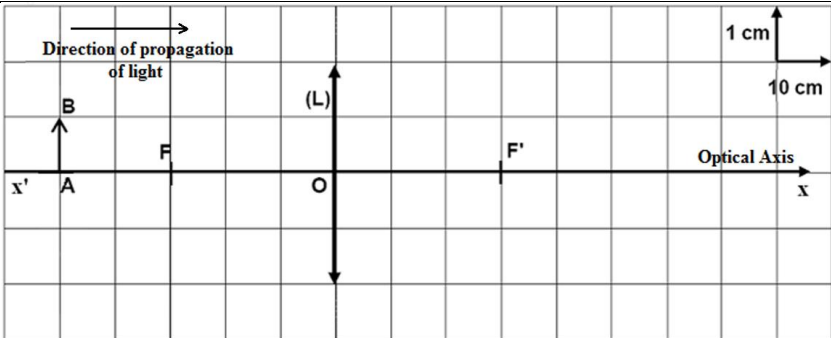
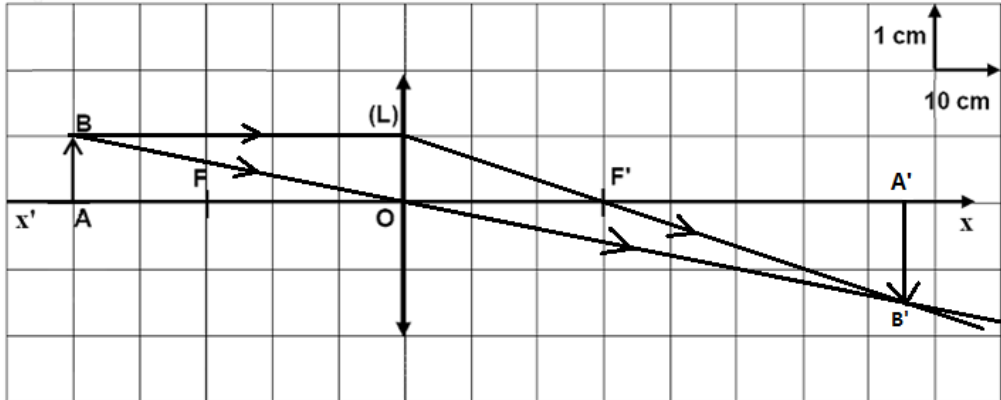
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أسس التصحيح (تراعي تعليق الدروس والتوصيف المعدل للعام الدراسي 2016-2017 وحتى صدور المناهج المطورة)

Exercise 1 (3 points) Pressure

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

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

Question	Answer	Mark
1-1		1
1-2	 From point B, we draw a ray that passes through point O. This ray emerges from point O of the lens without deviation. From point B, we draw an incident ray parallel to the optical axis. This ray emerges from the lens passing through point F'. 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'.	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

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

Exercise 3 (5 points) Egg in salty water

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

Exercise 4 (6 points) Protection in an electric circuit

Question	Answer	Mark
1-1	9 V: rated voltage. 4.5 W: rated power.	$\frac{1}{4}$
1-2	$P = UI$ then $I = \frac{P}{U}$ $I = \frac{4.5}{9} = 0.5 \text{ A}$	$\frac{1}{2}$
1-3	Using Ohm's law $U = RI$ $R = \frac{U}{I}$ $R = \frac{9}{0.5} = 18 \Omega$	$\frac{1}{2}$
2-1	Just before the fuse melts, the value of the current is $I_{\text{max}} = 0.6 \text{ A.}$ $U_{\text{CD}} = RI_{\text{max}}$ $U_{\text{CD}} = 18 \times 0.6 = 10.8 \text{ V.}$	$\frac{1}{2}$
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). $U_{\text{BC}} = 12 - 0 - 0 - 10.8 - 0$ $U_{\text{BC}} = 1.2 \text{ V}$	$\frac{1}{2}$