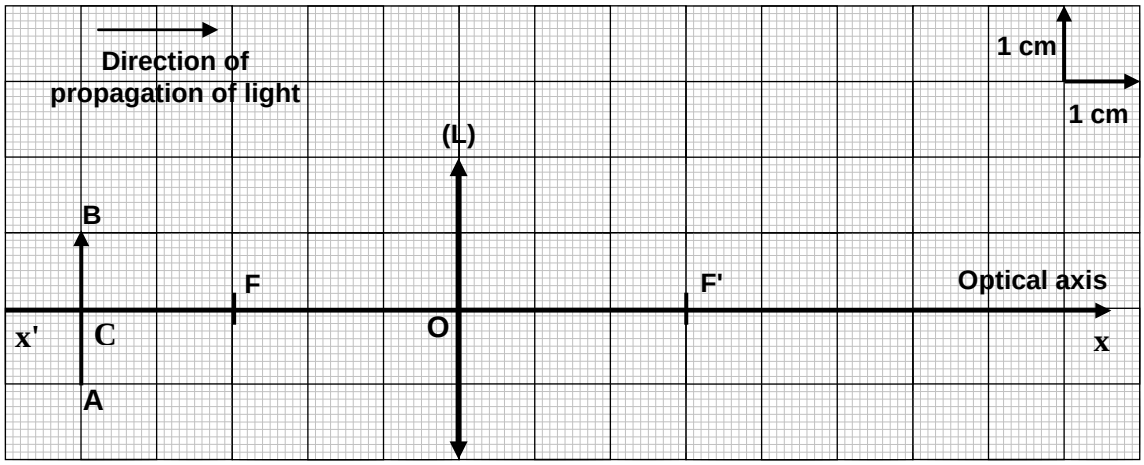
وزارة التربية والتعليم العالي المديرية العامة للتربية دائرة الامتحانات	الشهادة المتوسطة	دورة سنة ٢٠٠٨ العادية
	مسابقة في مادة الفيزياء المدة: ساعة واحدة	الاسم: الرقم:

This exam consists of three obligatory exercises written on two pages.
Non- programmable calculators are allowed.

First exercise (7 pts) Image given by a converging lens

The object 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 below shows a converging lens (L), its optical axis x'Ox, its two foci F and F' and the object AB.



I) **Construction of the image A'B'**

1) Reproduce, on the graph paper the above diagram with the same given scale.
2) Construct, by tracing two particular luminous rays, the image A' of A.
3) Specify, with justification, the position of the image C' of C.
4) Determine, by tracing only one particular ray, the image B' of B.

II) Characteristics of A'B'

1) Give, with justification, the nature of A'B'.
2) Is A'B' erect or inverted with respect to AB ?
3) Determine the length of the image A'B'.
4) **a)** The image A'B' of AB may be collected on a screen. Why ?
b) At what distance d from (L) should this screen be placed?

Second exercise (7 pts) Functioning of a lamp

In order to study the functioning of a lamp (L), we consider the following components:

- A DC generator (G) of adjustable voltage ;
- The lamp (L) of rated voltage 9 V ;
- An ammeter (A) ;
- A voltmeter (V) ;
- Connecting wires.

1) Draw a circuit diagram, formed of the preceding components, that allows us to measure the values of the voltage U across (L) as well as the current I through it.
2) We vary the voltage delivered by (G) from 0 to 3 V. We record the values of U and I displayed respectively by (V) and (A). The results are shown in the table below :

U (V)	0	1	1,5	2	3
I (A)	0	0.1	0.15	0.2	0.3

a) Trace the characteristic Current-Voltage curve of the lamp.
Scale: on the ordinate axis 1cm for 1 V and on the abscissa axis 1cm for 0.1 A.
b) The lamp may be considered in this case as a resistor. Why?
c) Deduce the resistance R of the lamp.

3) Now, we vary U between 3 V and 9 V and we take the corresponding values of I. The results are shown in the following table:

U (V)	4	5	6	7	8
I (A)	0.35	0.39	0.43	0.46	0.49
$\frac{U}{I}$					

a) Copy the table on your answer sheet and fill the empty boxes.
b) The lamp cannot be considered in this case as a resistor. Why ?

<u>Third exercise</u> (6 pts) Density and flotation

The object of this exercise is to study the influence of the density of a liquid on the flotation of a solid immersed in this liquid.
In order to do this, we consider a solid cube (S), of mass m = 0.9 kg and of side a = 10 cm.
Given: g = 10 N/kg.

I- Characteristics of (S)

1) Verify that the volume of (S) is $V = 10^{-3}\ m^3$.
2) Deduce that the density of (S) is $\rho = 900\ kg/m^3$.
3) Calculate the weight W of (S).

II- (S) is in oil

We immerse (S) completely in oil of density $\rho_1 = 800\ kg/m^3$.
1) Calculate the value F_1 of the Archimedes up thrust exerted by oil on (S).
2) By comparing W and F_1, deduce that the solid sinks to the bottom of the liquid container.

III- (S) is in water

We repeat the experiment by immersing (S) completely in water of density $\rho_2 = 1000\ kg/m^3$.

1) Calculate the value F_2 of the Archimedes up thrust exerted by water on (S).
2) Deduce that the solid (S) floats on the surface of water.

IV- Condition for flotation

By comparing ρ_1 and ρ_2 to ρ, Give the condition that must be satisfied by the density of a solid and the density of a liquid for a solid to float on the surface of the liquid.

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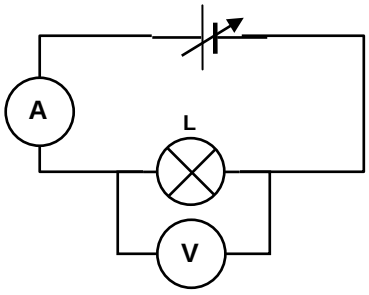
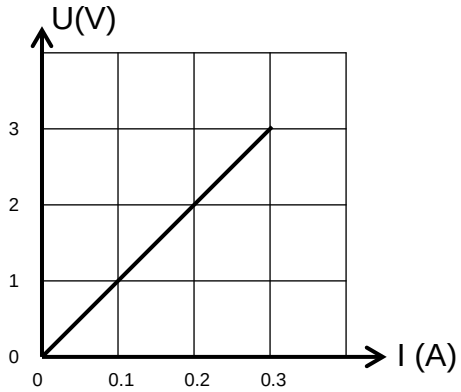
مشروع معيار التصحيح	مسابقة في مادة الفيزياء

First exercise (7 points)

Part of the Q	Answer	Mark
I. 1.	Redrawing	0.5
I.2	i) Trace of the 1st particular ray (0.5) ii) Trace of the 2nd particular ray (0.5) iii) Construction of A' : intersection of two emergent rays (0.5)	1.5
I. 3	C' is found on the optical axis and on the other hand it is foot of the perpendicular from A' on the optical axis.	1
I. 4	Trace	1
II. 1	. A'B' is a real image as it is behind L or…	1
II. 2	. A'B' is inverted with respect to AB	0.5
II. 3	II. 3. A'B' = 3cm	0.5
II. 4 a)	Since it is real	0.5
II. 4 b)	A'B' is at 7, 5cm from L (0.5)	0.5

Second exercise (7 points)

Part of the Q	Answer	Mark
1)		1.5 pt
2.a)		2 pts
2.b)	Since the characteristic curve is a straight line passing through the origin.	1 pt
2.c)	$R = \frac{U}{I} = 10\ \Omega$. (or graphically by calculating the slope of the straight line)	1 pt

3.a)	<table><tr><td>U (V)</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr><tr><td>I (A)</td><td>0.35</td><td>0.39</td><td>0.43</td><td>0.46</td><td>0.49</td></tr><tr><td>$\frac{U}{I}$</td><td>11.4</td><td>12.8</td><td>14.0</td><td>15.2</td><td>16.3</td></tr></table>	1 pt
3. b)	Since the ratio $\frac{U}{I}$ is not constant.	0.5 pt

Third exercise (6 ts)

Part of the Q	Answer	Mark
I.1)	$V = a^3$ (0.25) $V = (10^{-1})^3 = 10^{-3}\ m^3$(0.25)	**0.5**
I.2)	$\rho = m/V$ (0.5) $\rho = 0.9 / 10^{-3} = 900\ kg/m^3$ (0.25)	**0.75**
I.3)	$W = m.g$ (0.25) $W = 0.9\times10 = 9$ N (0.5)	**0.75**
II.1)	$F_1 = \rho_1.v.g$ (0.25) $F_1 = 800\times10^{-3}\times 10 = 8$ N (0.5)	**0.75**
II.2)	$W = 9N$ and $F_1 = 8N$ $\Rightarrow W > F_1$: The solid remains at the bottom of the container (0.5)	**0.5**
III.1)	$F_2 = \rho_2 .v. g$ (0.25) $F_2 = 1000\times10^{-3}\times10 = 10N$ (0.5)	**0.75**
III.2)	$F_2 = 10N$ and $W = 9N$ $\Rightarrow F_2 > W$: The solid floats on the surface of the liquid (0.5)	**0.5**
IV)	$\rho_1 = 800\ kg/m^3$ and $\rho = 900\ kg/m^3$ $\Rightarrow \rho > \rho_1$: the solid sinks to the bottom (0.5) $\rho_2 = 1000\ kg/m^3$ and $\rho = 900\ kg/m^3$ $\Rightarrow \rho < \rho_2$: The solid floats on the surface (0.5) Thus a solid floats on the surface of a liquid if its density is smaller than the density of the liquid (0.5)	**1.5**