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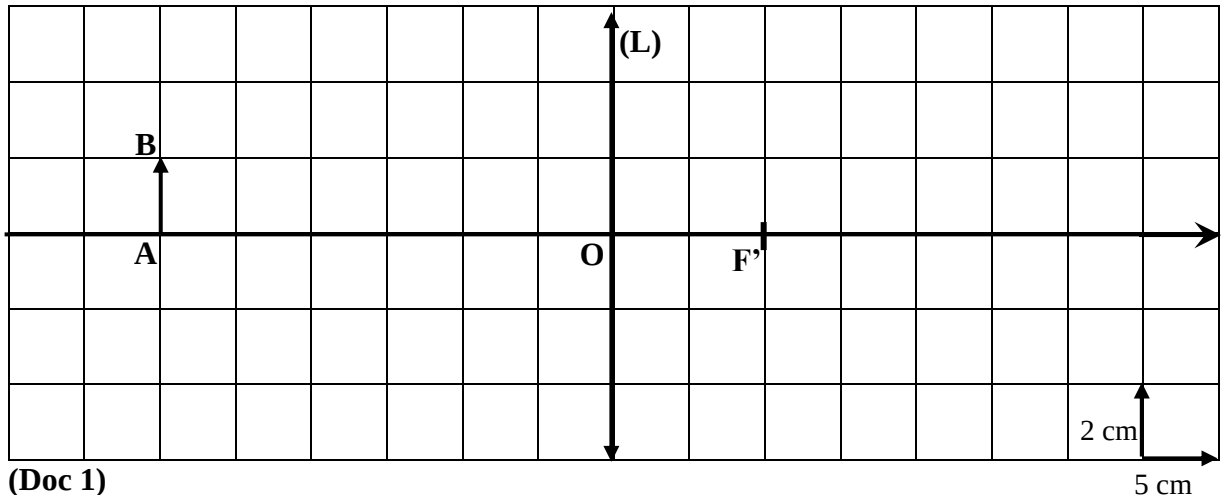
|---|---|---|
| المادة: الفيزياء<br>الشهادة: المتوسطة<br><br>نموذج رقم 1<br>المدّة : ساعة واحدة | الهيئة الأكاديميّة المشتركة<br>قسم : العلوم | المركز التربوي للبحوث والإنماء |

**نموذج مسابقة (يراعي تعليق الدروس والتوصيف المعدّل للعام الدراسي 2016-2017 وحتى صدور المناهج المطوّرة)**

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

## Exercise 1 (6 points) Image given by a converging lens

The document (Doc 1) below represents a converging lens (L), its optical axis and optical center O, the image focus F' and a luminous object (AB).

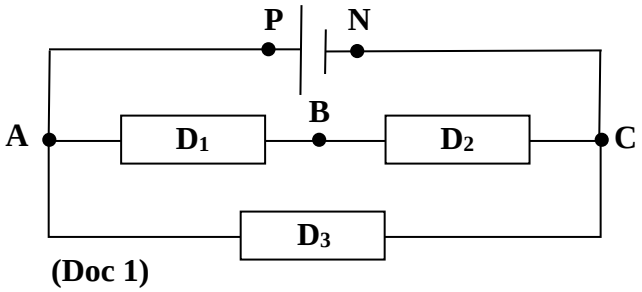



**(Doc 1)**

**1)** Reproduce the above document (Doc 1) on a graph paper.
**2)** Indicate the position of the object focus F of (L) and justify.
**3)** Find the focal length f of (L).
**4)** Let (A'B') be the image of (AB) given by (L):
- **4-1)** Construct (A'B') and provide the necessary explanations.
- **4-2)** Specify the nature of (A'B').
- **4-3)** Find the distance d between (L) and (A'B').

## Exercise 2 (6 points) Laws of voltages and laws of currents

The circuit, shown in the figure of (Doc 1) below, consists of:
- A battery supplying across its terminals a constant voltage: $U_{PN} = 20$ V.
- Three electric components $D_1$, $D_2$ and $D_3$.




**(Doc 1)**

**1) Calculation of voltages**

**1-1)** Show that $U_{AC} = 20$ V.

**1-2)** Indicating the law used, Calculate the voltage $U_{AB}$ knowing that $U_{BC} = 12$ V.

**2) Calculation of currents**

Given:

$I_1$ is the electric current carried by the electric component $D_1$;

$I_3$ is the electric current carried by the electric component $D_3$.

The electric current carried by the battery is I = 10 mA.

The electric current carried by the electric component $D_2$ is $I_2 = 3$ mA.

Indicating the laws used, calculate $I_1$ then $I_3$.

## Exercise 3 (4 points) Equilibrium of a solid body

(S) is a solid body of mass m = 300 g.

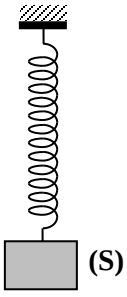
Given:

Gravitational acceleration: g = 10 N/kg

Stiffness constant of the spring: k = 2 N/cm

The solid (S) is suspended from the free end of the spring as shown in the figure (Doc 1).

The solid (S) is in equilibrium under the action of its weight $\vec{W}$ of magnitude W and another force.




**(Doc 1)**

**1)** Give the name of the other force exerted on (S).

**2)** Specify the vector relation between the two forces exerted on (S).

**3)** Calculate the value of each of these two forces.

**4)** Calculate the elongation $\Delta L$ of the spring.

## Exercise 4 (4 points) Archimedes upthrust

(S) is a solid body of weight W = 3 N and volume V = 100 $cm^3$.

Given:

Gravitational acceleration: g = 10 N/kg

Density of water: $\rho = 1\,000$ $kg/m^3$

The solid (S) is completely immersed in water.

**1)** Calculate the magnitude F of the Archimedes upthrust exerted by the water on (S).

**2)** The solid (S) is left to itself.

**2-1)** Compare W to F. Deduce if (S) sinks or floats at the surface of the water.

**2-2)** Calculate, in this case, the magnitude $W_{app}$ of the apparent weight of (S).

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**أسس التصحيح (تراعي تعليق الدروس والتوصيف المعدّل للعام الدراسي 2016-2017 وحتى صدور المناهج المطوّرة)**

## Exercise 1 (6 points) Image given by a converging lens

| Question | Answer | Mark |
|---|---|---|
| 1 | *« Figure »* | 1 |
| 2 | F is the point symmetric to F' with respect to O.<br>*«indicate the point F on the graph»* | ½<br>½ |
| 3 | $f = \overline{OF'}$<br>$f = 2 \times 5 = 10\,cm$ | ½<br>½ |
| 4-1 | From point B, we draw a ray that passes through point O. This ray emerges from point O of the lens without deviation.<br><br>From point B, we draw a ray parallel to the optical axis, which is incident on the lens. This ray emerges from the lens bent and passes through point F'.<br><br>Both emerging rays meet at point B'. From B', we construct a perpendicular line to the optical axis. This line intersects the optical axis at point A'. | ½<br><br>½<br><br>½ |
| 4-2 | A'B' is a real image<br>because it forms on the side of the emerging rays. | ½<br>½ |
| 4-3 | $d = 3 \times 5 = 15\,cm$ | ½ |

## Exercise 2 (6 points) Laws of voltages and laws of currents

| Question | Answer | Mark |
|---|---|---|
| 1-1 | Law of uniqueness of voltages:<br>$U_{AC} = U_{PN} = 20$ V<br>or<br>Law of addition of voltages:<br>$U_{AC} = U_{AP} + U_{PN} + U_{NC} = 0 + U_{PN} + 0 = U_{PN} = 20$ V | ½<br>¾<br><br>½<br>¾ |
| 1-2 | Law of addition of voltages:<br>$U_{AC} = U_{AB} + U_{BC} \Rightarrow U_{AB} = U_{AC} - U_{BC}$<br>therefore $U_{AB} = 20 - 12 = 8$ V | ½<br>½<br>¾ |
| 2 | Law of uniqueness of currents:<br>$I_1 = I_2 = 3$ mA<br>Law of addition of currents:<br>$I = I_1 + I_3 \Rightarrow I_3 = I - I_1$<br>therefore $I_3 = 10 - 3 = 7$ mA | ½<br>¾<br>½<br>½<br>¾ |

**Exercise 3 (4 points)** **Equilibrium of a solid body**

| Question | Answer | Mark |
|---|---|---|
| 1 | The tension $\vec{T}$ of the spring. | ½ |
| 2 | (S) is in equilibrium, $\vec{T}+\vec{W}=\vec{0}$. | ½ |
| 3 | W = m.g<br>$\Rightarrow$ W = 0.3 x 10 = 3 N<br>$\vec{T}=-\vec{W} \Rightarrow$ T = W = 3 N | ½<br>½<br>½ |
| 4 | Hooke's law :<br>T =k.ΔL<br>$\Delta L=\frac{T}{k} \Rightarrow \Delta L=\frac{3}{2}=1.5\,cm$ | ½<br>½<br>½ |

**Exercise 4 (4 points)** **Archimedes upthrust**

| Question | Answer | Mark |
|---|---|---|
| 1 | $F = \rho.V_{immersed}.g$<br>but $V_{immersed}$ = V because (S) is completely immersed in water<br>therefore F = ρ.V.g<br>$F = 1\,000 \times 100 \times 10^{-6} \times 10 = 1$ N | ½<br>½<br>½<br>½ |
| 2-1 | W > F<br>therefore (S) sinks. | ½<br>½ |
| 2-2 | $W_{app} = W - F$<br>$W_{app} = 3 - 1 = 2$ N | ½<br>½ |