Grade: 9
physics

First exercise   (7.5 pts)
Magnifying an object using a converging lens

Two students of Grade 9, use a converging lens (L) and a screen (E) to show their classmates the details of a small dimensional object AB.

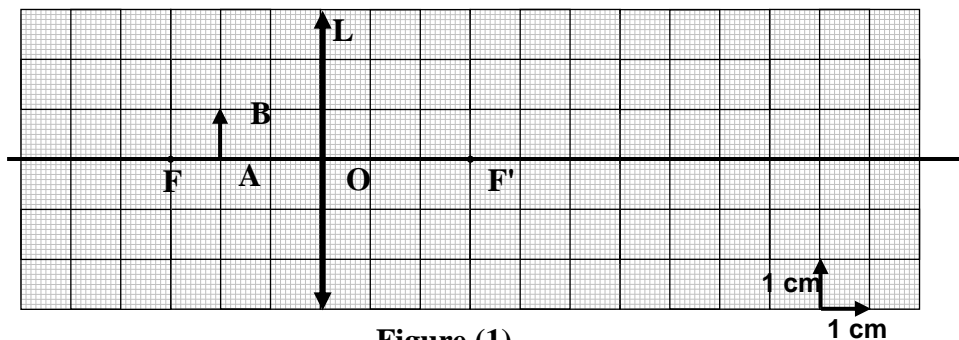**I – One of these two students places the object AB in front of (L) as shown in figure (1).**

Figure (1)

1- Redraw, in a real scale, the figure (1) on a graph paper.
2- Draw, with justification, the image A'B' of AB.
3- Give the nature and the size of A'B'.

II – The other student places AB as shown in figure (2). Its image A''B'' is thus formed on the screen (E).
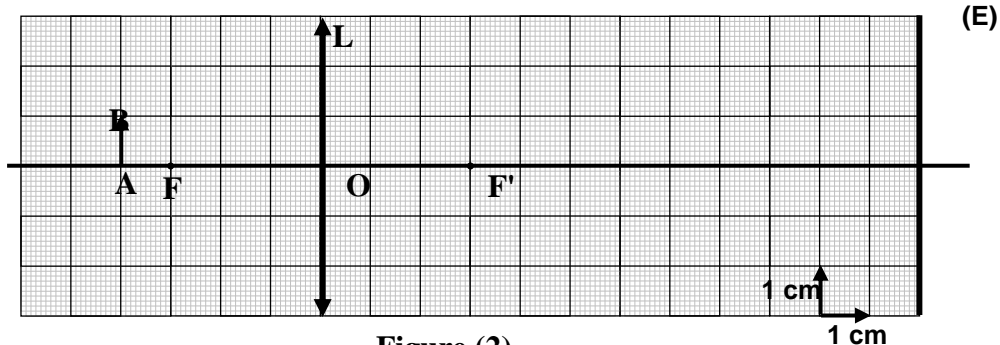

Figure (2)

1- Redraw, in a real scale, figure (2) on the graph paper.
2- Specify on the redrawn figure, with justification, the position of B'' the image of B.
3- Draw the image A''B''.
4- Give the nature and the size of A''B''.

III – Which of the two students was able to show the details of AB to his classmates? Why?

Second Exercise (7.5 points)
Refraction of Light

A and B are two transparent media. The figures below show a luminous ray SI, falling at the same angle of incidence at the surfaces of separation air- A in figure (a), and air- B in figure (b).
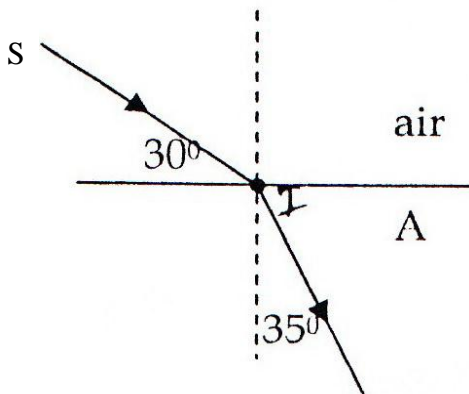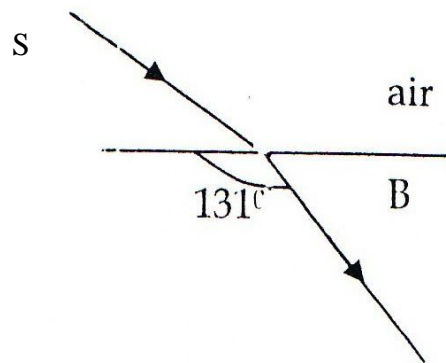

Figure (a)   Figure (b)

1- Determine the value of the angle of incidence i, of the ray SI.

2- Find the values of the angles of refraction i'_a and I'_b of the refracted rays corresponding to ray SI in the two media A and B respectively.

3- Calculate the angle of deviation in figure (a).

4- Knowing that the speed of propagation of light in the two media A and B is respectively 2×10^8 m/s and 2.25×10^8 m/s, calculate the indices of refraction of the two media A and B.
Given: The speed of propagation of light in vacuum $c = 3 \times 10^8$ m/s.

5- Which of the two media (A and B) is more refractive? Justify the answer.

6- The figure below shows two optical systems made up respectively of the same materials of media A and B. The first (A) is a semi cylinder while the second (B) is a rectangular prism MNPQ.
The two systems are separated by the surface MN.
A luminous ray SI falls on the surface of the semi-cylinder.
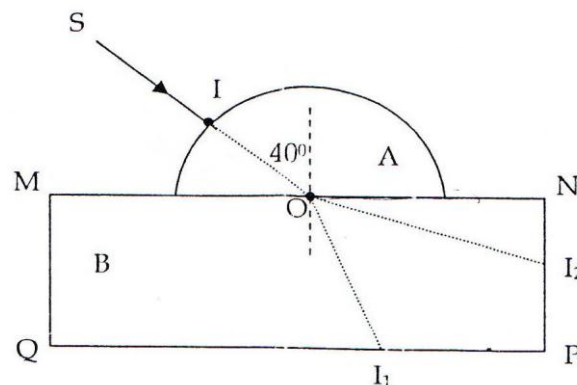
a- SI continues its path without deviation in the semi- cylinder. Justify why.
b- Choose **with justification**, from OI_1 and OI_2, the refracted ray corresponding to SI.

Third Exercise (5 points)
Determination of the position and nature of a lens

In the figure below A'B' is the image of the object AB given by a lens.(the measurements in the figure are not correct).

Given: AB=2cm , A'B'=1cm, AA'=2.5cm.
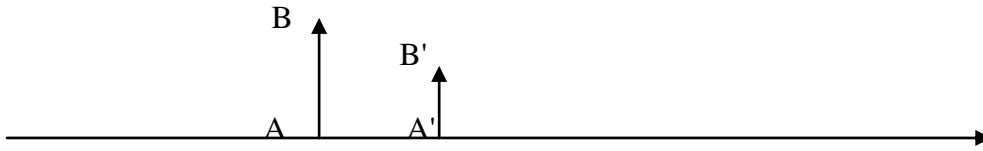
1- Reproduce the figure on a real scale.
2- Specify on the figure the position of the optical center of the lens.
3- Determine by construction the position of the image focus.
4- Deduce for this lens:
      a- Its nature.
      b- Its focal length.