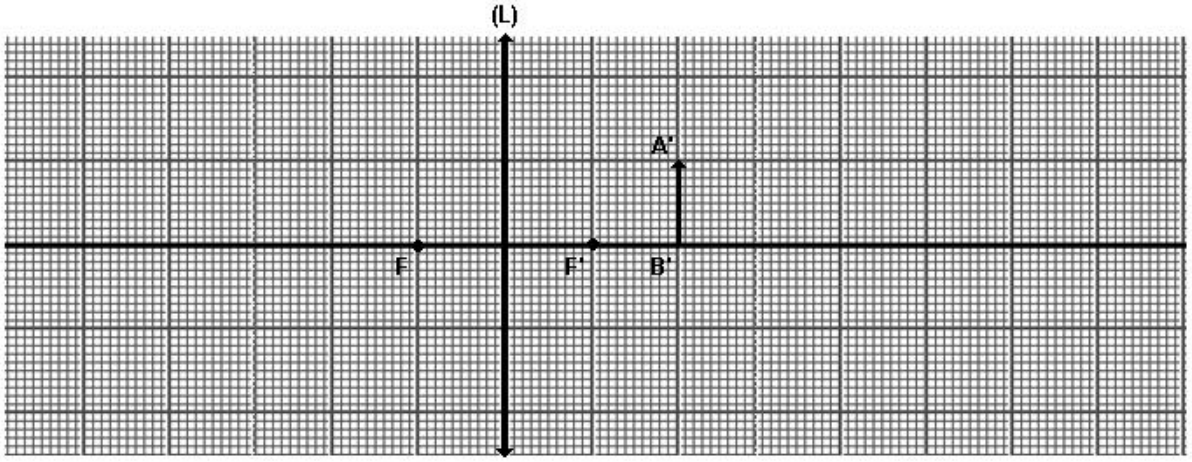
Grade: 9

physics

First exercise (8 pts)

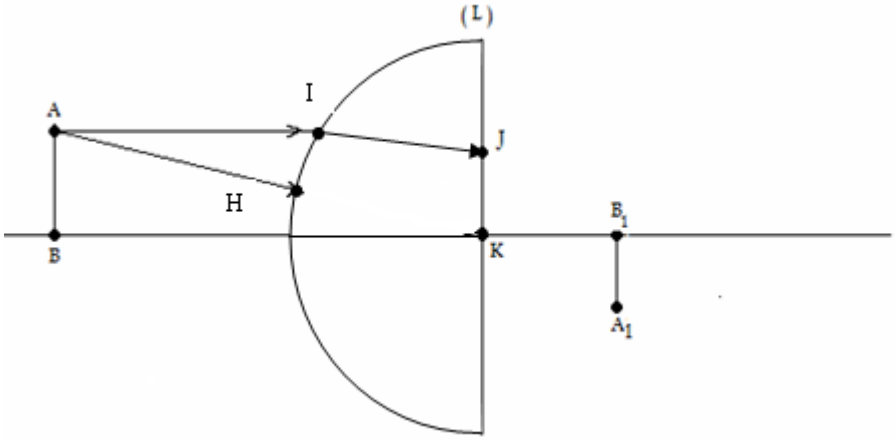
A- A'B'= 1cm is the image of an object AB given by the converging lens (L) as shown in the figure below.



1. Reproduce the figure in the real scale.
2. Determine by construction, without explanation, the object AB.
3. We change the position of AB to obtain an image A''B'' of size 0.5 cm which is located at 1.5cm from the lens. How has AB been moved, nearer or farther away, from the lens? Justify by a new construction, without explanation, providing a new graph.

B- We intend to study the refraction of light inside the lens (L) which is in reality a semi cylinder of center K. We consider the object AB and its image A_1B_1 given by the semi cylinder (the lens L) which is made of glass. We consider two rays issued from A and directed towards (L) to study their path.

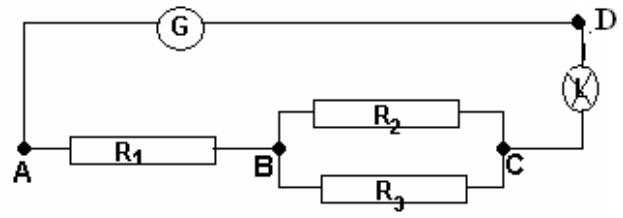
Given: the index of refraction of glass is 1.52 and that of air is 1.



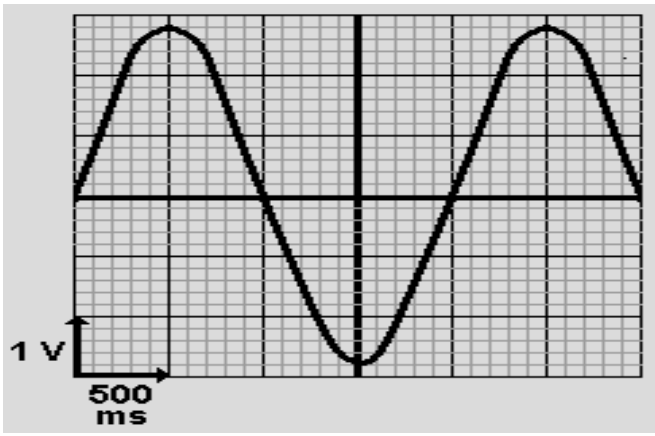
1. Complete, on the question sheet, and justify, the path of ray AH inside the lens **and** when it emerges in air.
2. Ray AI refracts in the lens along IJ. Explain, the path of AI as it penetrates the lens (L).
3. Trace the path of the ray IJ as it emerges out of the glass. Explain.

Second question (12 pts)

A LFG (low frequency generator) (G) that delivers an effective voltage U_{eff} = 7 V is used to feed three resistors R_1, R_2,R_3 and a lamp (L) as given in the circuit below. Given $\sqrt{2}$=1.4.



A- An oscilloscope is connected **across R_1** and its oscillogram is presented to the right.



1. a- Indicate, from the figure, the values of S_v and V_b.

   b- Describe the voltage displayed on the screen of the oscilloscope.

   c- Verify by calculation that U_{max} = 2.8 V and the period is T = 2 S.

   d- Deduce the effective value of this voltage (across R_1).

2. If the sweeping is turned off, what will you observe on the screen of the oscilloscope?

B- The lamp of the above circuit bears the inscription (3V). The lamp glows normally in the above circuit.

1. Verify that the voltage across BC is U_{BC} = 2V.
2. Determine the equivalent resistance R_{BC} of the two resistors $R_2 = 200\Omega$ and $R_3 = 300\Omega$.
3. Calculate the intensity of the current I_2 that passes through R_2.
4. Without calculus, compare I_2 to I_3, noticing that I_3 is the current that passes through R_3. Justify your answer.
5. Calculate the intensity of the main current in the circuit above.
6. If a wire connects the points A and C, how does the lamp glow? Justify.

C- The LFG (G) is made to deliver a triangular voltage and the oscilloscope across R_1 displaces a new oscillogram.

1. Knowing that U_{max} = 2.8 V and S_v= 2 V/div, calculate the vertical displacement (y_{max}).
2. The frequency is F = 5Hz, calculate the period T and deduce the horizontal displacement (x), knowing that S_h = 500 ms/div.
3. Represent on your graph paper the variation of the voltage with respect to time using the following scale: on the horizontal 1cm → 0.5 S, on the vertical 1cm → 1V. (Represent only one oscillation).