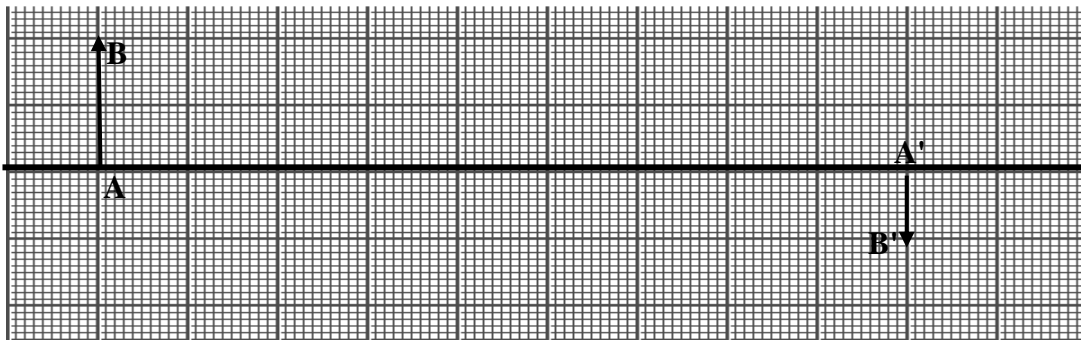Grade: 9
physics

First Exercise (7.25 points)

Determining the nature and the focal length of a thin lens (X)

A real and inverted image A'B' of an object AB is formed by a lens (X). The distance separating the object from the image is AA' =45cm. A student uses a certain scale and represents this given by the diagram below:

1- Reproduce the diagram, on a graph paper, using the same scale.
2- a) Determine the scale used by the student.
   b) Deduce the actual size of AB and A'B', knowing that the same scale is used on the vertical and the horizontal axis.
3- Indicate the type of lens (X). Justify.
4- a) Construct a ray by which you can precise the position of lens (X) on the diagram.
   b) Place the lens on the figure.
5- Determine the focal length of lens (X).
6- "In the above diagram, lens (X) works as a magnifier." Is this statement correct? Justify.

Second Exercise (3.25 points)

Using a circuit breaker to protect an electric installation.

For the electric installation of a kitchen we need: 2A for lighting, 10 A for the electric oven, 7.7 A for the washing machine and 3A for the refrigerator.

1- How are the different components connected in the kitchen? Justify.
2- Determine the intensity of the main current when all the components function at the same time.
3- We want to protect this installation by a circuit breaker. Among the circuit breakers having respectively the indications: 20A, 25A, 30A, which is the convenient one? Justify.

Third Exercise (9.5 points)

Determining the voltage of a car battery

In order to determine the voltage U_{AB} between the terminals A(+) and B(-) of a car battery (G), some students performed the following three experiments.

A- First experiment: Using an oscilloscope:

The first group of students adjusts the oscilloscope such that the horizontal luminous line is confounded with the middle line of the screen in the absence of any voltage across its terminals. (Fig.1)
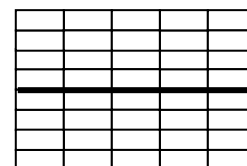
Fig.1

The students connect the oscilloscope to the terminals A and B of (G). The vertical sensitivity of the oscilloscope being adjusted for 3V/div, the luminous line is displaced upwards by 3 divisions. (Fig.2)
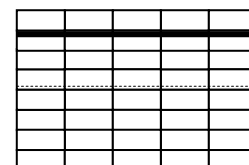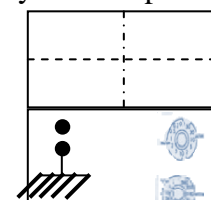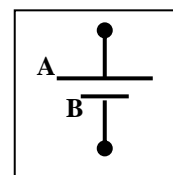
Fig.2

1- "The oscilloscope displays in this case the voltage U_{AB} and not U_{BA}". Justify this statement.

2- Specify the connections of the battery (G) to the oscilloscope displaying U_{AB} shown by the setup in the adjacent figure.

3- Calculate the value of the voltage U_{AB}.

4- A student turns off the sweeping. What will the shape of the displayed voltage U_{AB} be?

B- Second experiment: Using an electric circuit:

The second group of students constructs an electric circuit consisting of:

- **the car battery (G).**
- **an ammeter (A) of negligible resistance**.
- **a lamp (L) of 3V.**
- **a resistor (D) of resistance R= 12 Ω.**
- **a switch (K).**

1- a) Draw the diagram of the above circuit knowing that all the dipoles are connected in series across the battery (G).

b) Indicate, on the diagram, the direction of the current.

2- We close (K). The ammeter (A) reads a current I = 0.5A.

a) What is the value of the current carried by resistor (D)?

b) Determine the voltage U_D across the resistor (D).

3- Deduce the voltage U_G across the dry cell (G), knowing that the lamp functions normally.

C- Third experiment: Direct measurement.

The third group measured directly the value of voltage U_G using a certain instrument.

1- Name this instrument.

2- How should this instrument be connected in the circuit?

Good Work