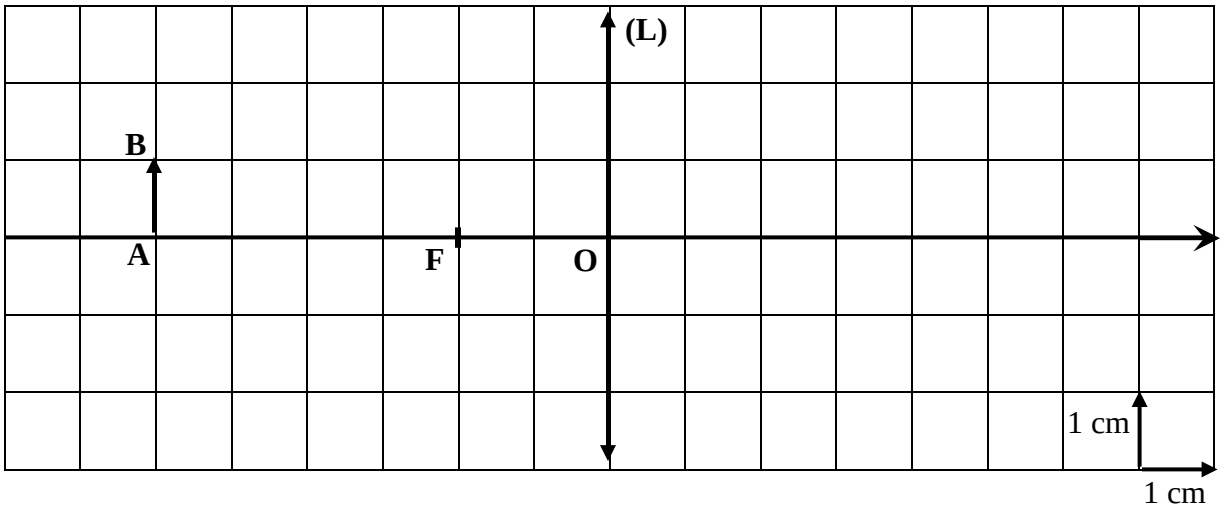
وزارة التربية والتعليم العالي المديرية العامة للتربية دائرة الامتحانات	امتحانات الشهادة المتوسطة	دورة سنة 2005 العادية
	مسابقة في الفيزياء المدة: ساعة واحدة	الاسم: الرقم:

This exam, including three obligatory exercises, is formed of two pages.
The use of non programmable calculators is allowed.

First exercise **The image given by a converging lens (7 pts)**

The aim of this exercise is to study, by geometrical construction, the variation of the distance lens-image as a function of the distance lens-object (object between infinity and the object focus).
The document below represents a converging lens (L), its optical axis, its object focus and a luminous object (AB).



I–The object (AB) is at 6 cm from (L)

1) Reproduce at a real scale, the document above on the graph paper.
2) Show on the figure, with justification, the position of the image focus F' of (L).
3) Find the focal length of (L)
4) a – Construct, with the necessary explanations, the image (A_1B_1) of (AB) given by (L).
   b – Specify, with justification, the nature of (A_1B_1).
   c – Find the distance (d_1) between (L) and (A_1B_1).

II – The object (AB) is at 4 cm from (L)

1) Construct, without explanations, on a new diagram, the image (A_2B_2) of (AB)given by (L).
2) Find the distance (d_2) between (L) and (A_2B_2).

III – Conclusion

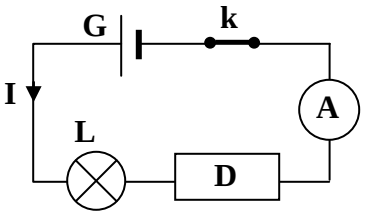
Deduce then how does the image distance from L vary as the object approaches F.

Second exercise **Voltage across a dry cell (6.5 pts)**

In order to determine the voltage across a dry cell G, we construct the circuit of the following figure.

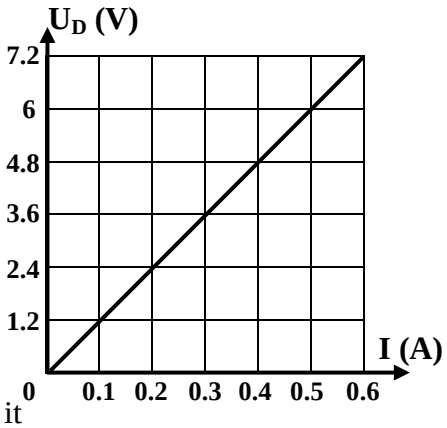
This circuit includes:

- the dry cell G;
- a lamp (L) with the indications (3 V; 1.5 W);
- an ohmic conductor (D);
- an ammeter (A) of negligible resistance;
- a switch (k);



1) a - Explain the meaning of each of the indications labeled on (L).
   b - Prove, using these indications, that the intensity of the current flowing through (L), in normal functioning, is 0.5 A.

2) We close (K). (D) is chosen so that the ammeter (A) reads 0.5 A.
   a- The same current of intensity **I** is then flowing through (D) and (L). Why? Determine the value of **I**.
   b- The characteristic voltage-current (V-I) of the conductor (D) being given by the curve on the right, determine graphically the value of the voltage U_D across the terminals of (D).
   c- Apply the law of addition of voltages to calculate the voltage U_G across the dry cell (G).

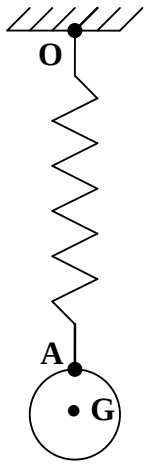


3) Name an instrument that allows the direct measurement of U_G. How must it be connected in the circuit?

<u>Third exercise</u> **Tension of a spring (6.5 pts)**

We have a spring (R) of free length L_0 = 0.2 m and of stiffness K = 100 N/m.
We fix the extremity O of (R) to a support and we suspend to its free extremity A, a ball of mass m = 0.6 kg and of center of gravity G (See the figure).

1- The two forces exerted on the ball are: its weight $\vec{W}$ and the tension $\vec{T}$ of the spring.
   a- Specify whether each of the two forces is a contact force or an action at a distance force.
   b- Calculate the value of $\vec{W}$. Take g = 10 N/kg.
   c- State the other characteristics of $\vec{W}$.



2- For a length L = 0.25 m of the spring (R),
   a- calculate, by applying Hooke's law, the value of the tension $\vec{T}$;
   b- state the other characteristics of $\vec{T}$;
   c- represent $\vec{W}$ and $\vec{T}$ with a scale of 2 N for 1 cm ;
   d- the ball is not at equilibrium. Why?

3- The ball, still connected to the spring, is now in equilibrium. Determine, with justification, the value of $\vec{T}$ in this case.

Premier exercice : Image donnée par une lentille convergente (7 pts)

I – 1) Reproduction (½ pt)

2) Position (½ pt) F' symétrique de F par rapport à O (½ pt pt)

3) f = 2 cm (½ pt)

4) a - Construction (1pt)

Explication du dessin:les rayons, leur point d'intersection,la perpendiculaire à l'axe optique. (1pt)

b – A_1B_1 image réelle (½ pt) car le faisceau émergent est convergent
ou image derrière la lentille
ou objet avant F (½ pt)

c – d_1 = 3cm (½ pt)

II – 1) Construction (½ pt)

2) d_2 = 4 cm (½ pt)

III – d_2 = 4cm > d_1 = 3cm donc quand l'objet s'approche de F l'image s'éloigne de (L).(½ pt)

Deuxième exercice : Tension aux bornes d'une pile (6,5 pts)

1) a – 3V : représente la tension nominale de (L) (½ pt)

1,5 W : représente la puissance nominale de (L) (½ pt)

b – P = UI (½ pt) I = 1,5 / 3 = 0,5 A (½ pt)

2) a – car D et L sont placés en série (½ pt)

I = 0,5 A (½ pt)

b – Pour I = 0,5 A on trouve U_D = 6 V d'après le graphe (1pt)

c – $U_G = U_L + U_D + U_A$ (½ pt) = 3 +6 + 0 = 9 V (1 pt)

3) un voltmètre ou un oscilloscope (½ pt) branché en dérivation aux bornes de G (½ pt)

Troisième exercice : Tension d'un ressort (6,5 pts)

1 – a - $\vec{P}$: force à distance (½ pt) $\vec{T}$: force de contact (½ pt)

b – P = mg (½ pt) P = 0,6 x 10 = 6 N (½ pt)

c - Point d'application : G (¼ pt) ; direction : verticale (¼ pt) ; sens : descendant (¼ pt)

2 – a – T = k x ΔL (¼ pt) ΔL = 0,25 – 0,2 = 0,05 m (¼ pt) T = 100 x 0,05 = 5 N (½ pt)

b - Point d'application : A (¼ pt) ; direction : verticale (¼ pt) ; sens : ascendant (¼ pt)

c – Représentations vectorielles de longueurs 3 cm et 2,5 cm (¼ pt) + (¼ pt)

d – car P = 6 N ≠ T = 5 N ou $\vec{P} + \vec{T} \neq \vec{0}$ (½ pt)

3 - Boule en équilibre : donc $\vec{P} + \vec{T} = \vec{0}$ ou P = T (½ pt) T = 6 N (½ pt)