وزارة التربية والتعليم العالي
المديريّة العامة للتربية
دائرة الامتحانـات الرسمية

امتحانات الشهادة المتوسطة

دورة العـام ٢٠١٩ الاستثنائية
السبت ٢٧ تموز ٢٠١٩
مكيّفة

مسابقة في مادة الفيزياء	الاسم:	
المدة: ساعة واحدة	الرقم:	

This exam is formed of four obligatory exercises in six pages
Non programmable calculators are allowed

مسابقة في مادة الفيزياء

المدة: ساعة واحدة

(باللغة الانكليزيّة)

الاسم:...

الرقم:...

Exercise 1 (3 points) Mercury barometer

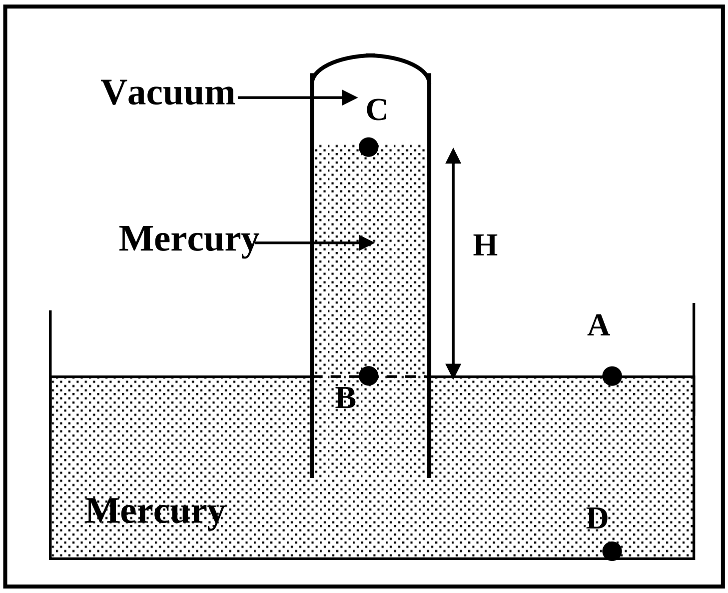
Consider the mercury barometer shown in the document 1.

Given:

- The atmospheric pressure
  P_{atm} =102000 Pa.

We denote by:

- ρ : the density of mercury;
- g : the gravitational field strength.



(Doc. 1)

Copy and **complete** the statements below:

1) The pressure P_C at C is ……... Pa.

2) The pressure P_A at A is ……... Pa.

3) The pressure exerted by the column of mercury at B is given by the relation

P_B = …×…×... .

4) The pressures at A and B are equal because A and B belong to the same liquid at rest, and are at the same ……... ……... .

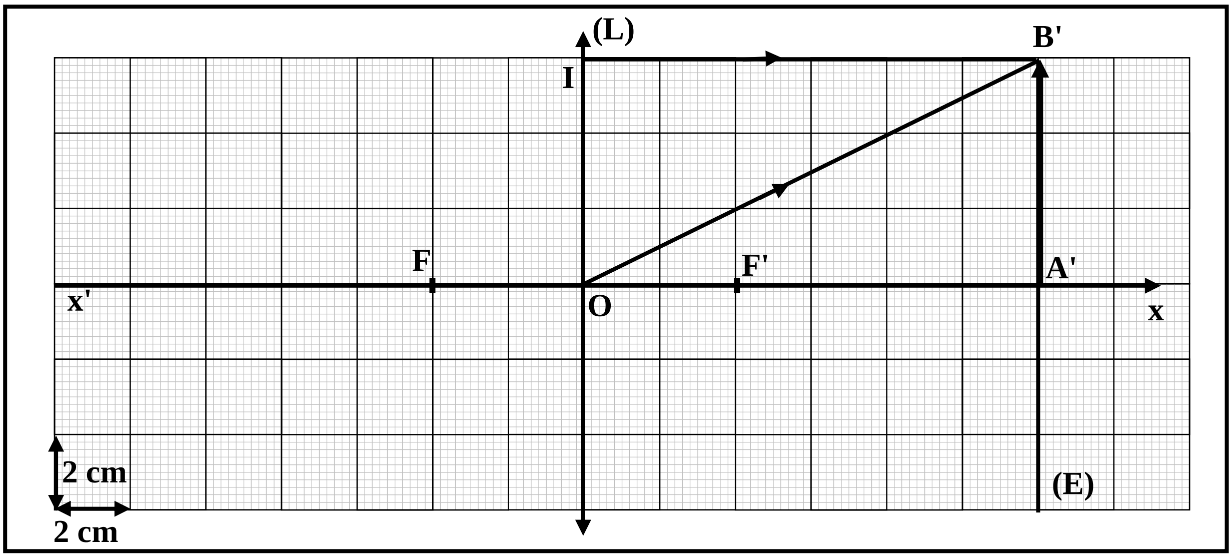
5) The pressure at B is ……... than that at D.

Exercise 2 (6 points) **The slide projector**

The slide projector is an apparatus used to give for an object **a magnified image collected on a screen.**

The document 2 shows:

- a converging lens (L), its optical axis x'x, its image focus F' and its object focus F;
- the image (A'B') of an object (AB) given by (L) and collected on the screen (E);
- Two emergent rays IB' and OB' corresponding to two incident rays issued from B.



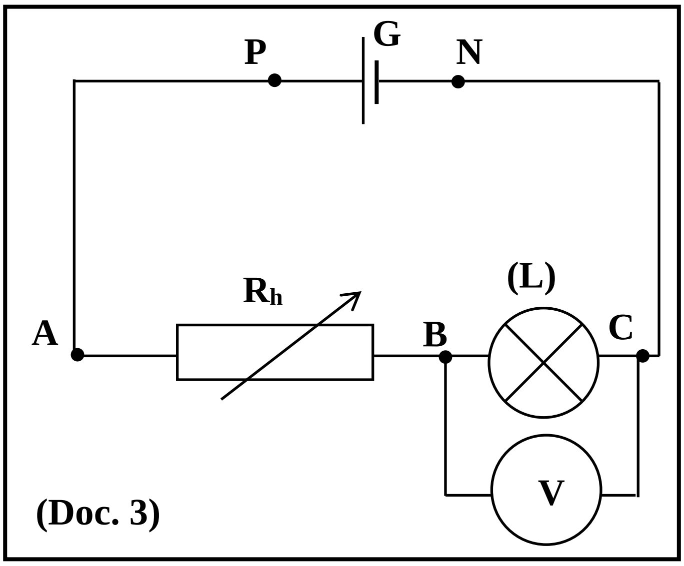
(Doc. 2)

1) **Redraw** the document 2 with the <u>same scale</u>.
2) **Show that** the focal length f of (L) is **4 cm**.
3) **Indicate** whether (A'B') is real or virtual. **Justify**.
4) **Determine** in **cm** the size A'B' of (A'B').
5) **Draw** the incident rays corresponding to the emergent rays IB' and OB'.
6) **Construct** the object (AB).
7) (L) acts as a slide projector. **Why**?

Exercise 3 (6 points) Rheostat in an electric circuit

The electric circuit of the document 3 consists of:

- a generator (G) of constant voltage $U_{PN} = 24$ V;
- a rheostat (R_h) of variable resistance;
- a lamp (L) acting as a resistor and carrying the indications (12 V; 6 W);
- a voltmeter (V) connected across the terminals of (L).



(Doc. 3)

1) The resistance of the rheostat is adjusted such that **the lamp functions normally.**

1.1) What does the indication (12 V) carried by (L) represent?

What does the indication (6 W) carried by (L) represent?

1.2) **Show**, <u>by applying the relation</u> $P = U \times I$, that the electric current flowing in (L) is $I_1 = 0.5$ A.

1.3) **Show**, <u>by applying the law of addition of voltages</u>, that the voltage U_{AB} across the terminals of the rheostat is 12 V.

1.4) **Show**, <u>by applying Ohm's law $U = R \times I$</u>, that the resistance of the rheostat is $R_1 = 24\ \Omega$.

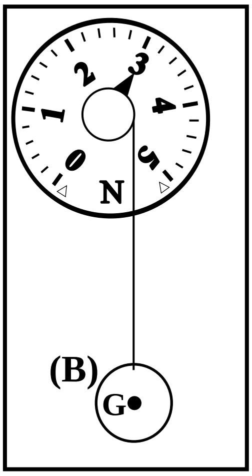
2) **The resistance of the rheostat** is now adjusted at $\mathbf{R_2 = 0\ \Omega}$.

2.1) The voltmeter reads 24 V. **Justify**.

2.2) The lamp burns out. **Explain**.

Exercise 4 (5 points) **Magnetic force**

An iron ball (B), of mass m and of center of gravity G, is suspended to the free extremity of a spring balance which indicates 3 N as shown in the document 4.



(Doc. 4)

1) **(B) is at equilibrium** under the action of **two forces**.

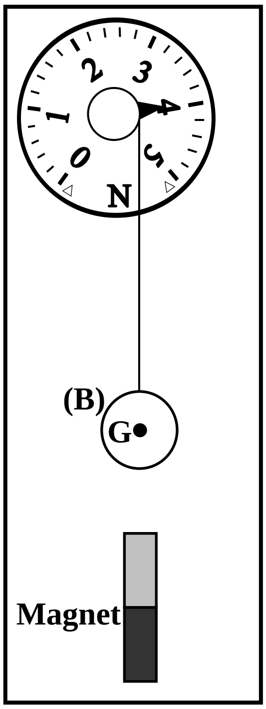
   1.1) **Give** the name of each force.

   1.2) **Indicate**, for each force, whether it is a contact force or force acting from a distance.

   1.3) **Write** the vector relation between these two forces.

   1.4) **Show that** the mass m of (B) is m = 0.3 kg. Take g =10 N/kg.

2) A bar magnet is placed below (B) as shown in document 5. The indication of the spring balance increases due to the magnetic force $\vec{F}$ exerted by the magnet on (B).



(Doc. 5)

2.1) **Indicate** the **line of action** and the **direction** of $\vec{F}$.

2.2) The magnitude F of $\vec{F}$ is 1 N. **Represent** $\vec{F}$ at G using the scale: 1 cm $\rightarrow$ 0.5 N.