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

مسابقة في مادة الفيزياء

المدة: ساعة واحدة

(باللغة الانكليزية)

الاسم:.....

الرقم:.....

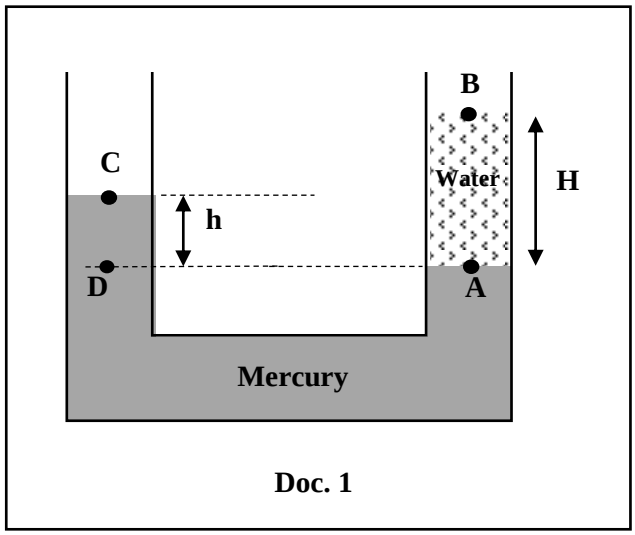
Exercise 1 (5 points) **Pressure in liquids**

Consider a U-tube, of uniform cross-section S, containing mercury. In one of the two branches we pour a quantity of water of volume V = 80 cm^3 (water and mercury are immiscible).

At equilibrium, the height of water is H = 40 cm and that of mercury above the surface of separation of the two liquids is h (document 1).

Given:

- g = 10 N/kg;
- atmospheric pressure P_0 = 102000 Pa at Beirut;
- pressure of water P_{water} = 40000 Pa ;
- density of mercury ρ_{Hg} = 13600 kg/m^3.



Doc. 1

Choose, with **justification**, the correct answer:

1. Knowing that Pc = atmospheric pressure, the pressure P_C at C is:

a. greater than that at B. **b.** equal to that at B. **c.** smaller than that at B.

2. Knowing that the volume is equal to the product of the area and the height, the value of S is:

a. 3200 cm^2. **b.** 0.5 cm^2. **c.** 2 cm^2.

3. The total pressure P_A at A is:

a. 502000 Pa. **b.** 4000 Pa. **c.** 106000 Pa.

4. Knowing that $P_D - P_C$ = 4000 Pa. The value of h is equal to:

a. 0.029 m. **b.** 0.136 m. **c.** 0.29 m.

5. We repeat the same experiment at Al Barouk Mountain where the atmospheric pressure is less than P_0. The value of h:

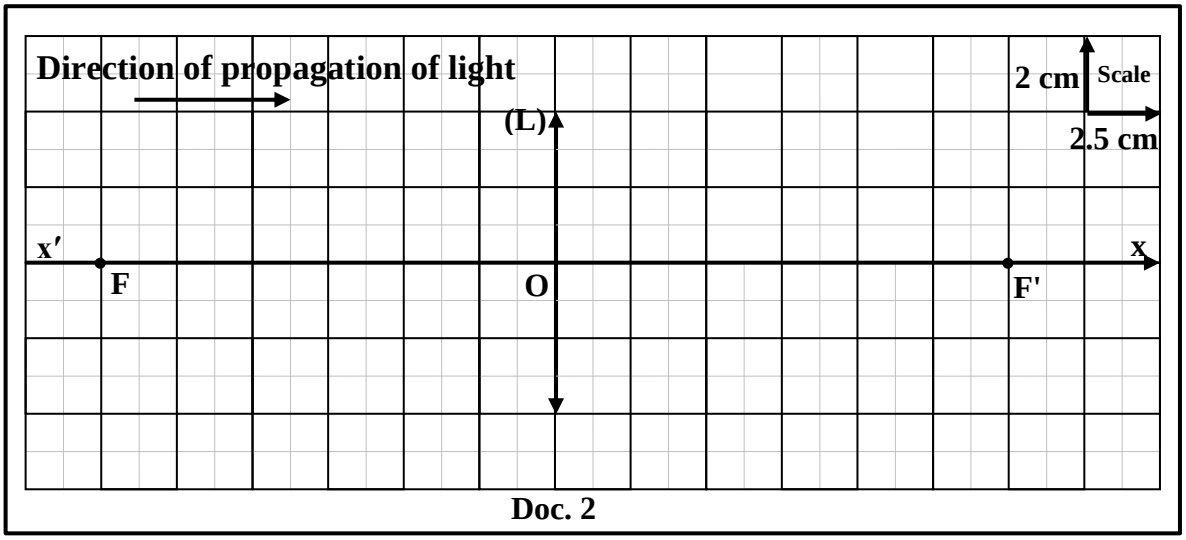
a. remains the same. **b.** increases. **c.** decreases.

Exercise 2 (6 points)

Position of the virtual image given by a converging lens

Document 2 shows a converging lens (L), its optical center O, its optical axis x′x, its object focus F and its image focus F'.

A luminous object (AB) of size AB = 2 cm is placed at a distance d_1 from (L) perpendicularly to the optical axis at A. (A'B') is the image of (AB) given by (L). It is situated at a distance d_2 from (L).



Doc. 2

1. **Show that,** using the scale, the focal length of (L) is f = 15 cm.
2. The table below gives, for different values of d_1, the corresponding values of d_2.

d_1 (cm)	2.5	5	7.5	10
d_2 (cm)	3	7.5	x	30

2.1. Referring to the table, **how** does **d_2** vary when **d_1** increases?

2.2. Choose x, out of the following values :

5 cm	**15 cm**	**40 cm**

3. **Reproduce**, on your graph paper and using the same scale, the document 2.
4. The object (AB) is at **7.5** cm from (L).

4.1. Place (AB) on the preceding reproduction respecting the chosen scale.

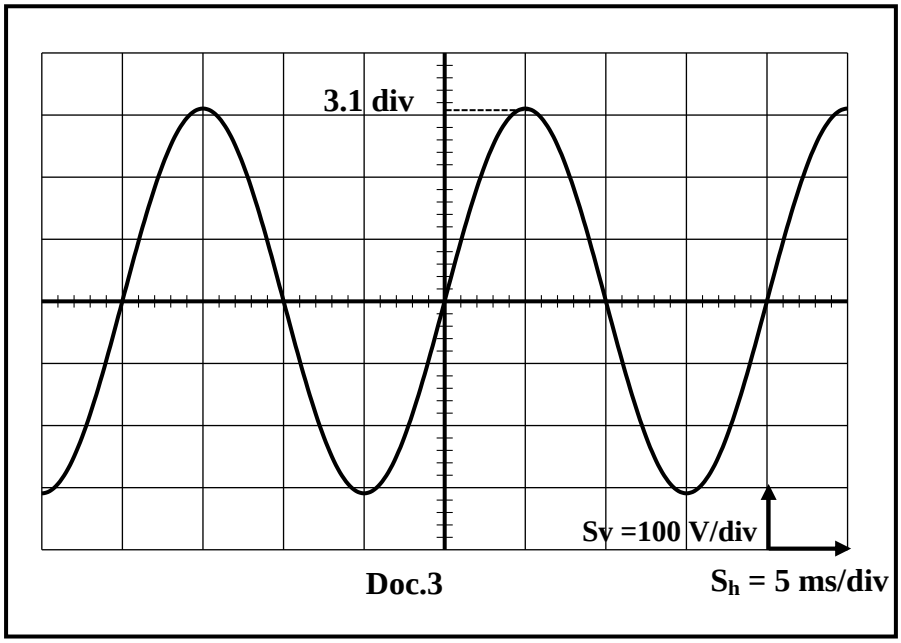
4.2. Construct, without explanation, the image (A'B').

4.3.Verify graphically the value of x.

Exercise 3 (4 points)

Characteristics of the voltage of the mains (Electricity in the home)

The waveform of document 3 represents the variations of the voltage of the mains (u), delivered by EDL (Electricity of Lebanon), as a function of time



Doc.3

1. Referring to document 3:

1.1.indicate the type of the voltage (u).

1.2.show that the maximum voltage U_m of (u) is equal to 310 V.

1.3.verify that the period T is equal to 20 ms .

2. Deduce:

2.1. that the value of effective voltage U of (u) is approximately equal to 220 V.

Take: $\sqrt{2} = 1.41$.

2.2. the value of the frequency f of (u).

3. On the rating plates of two electric devices, we read the following inscriptions:

Device A	Device B
110 V ; 60 Hz ; AC ~	220 V ; 50 Hz ; AC ~

Using part 2**, choose**, with **justification**, the electric device that can function normally when it is fed by the voltage (u).

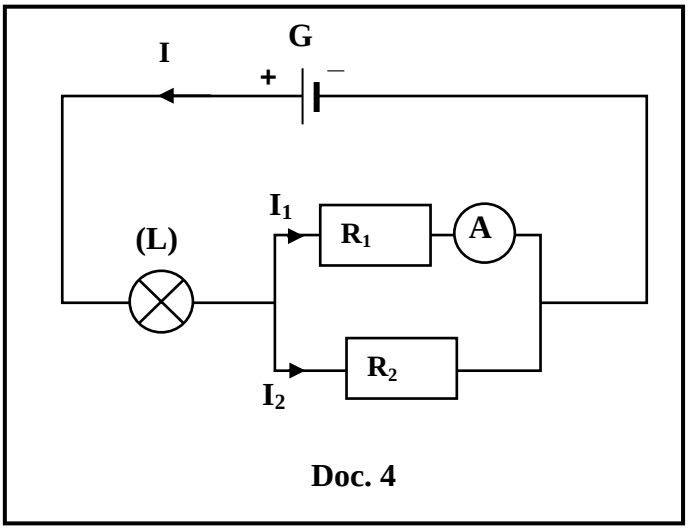
Exercise 4 (5 points) Normal functioning of the lamp

A lamp (L), carrying the inscriptions (6 W; 12 V), is assumed as a resistor (ohmic conductor) of resistance r.

1. **Show that** the current carried by the lamp (L) while functioning normally is $I_o = 0.5$ A.
2. **Show that the resistance** r of the lamp is 24 Ω.
3. The lamp (L) is placed in an electric circuit as shown in document 4.

   The resistors (R_1) and (R_2) have resistances $R_1 = 10$ Ω and $R_2 = 20$ Ω respectively.

   The ammeter (A), of negligible resistance, displays 0.1 A.



Doc. 4

3.1. Calculate, by applying the Ohm's law**,** the value of the voltage U_1 across (R_1).

3.2.a. Justify that the value of the voltage U_2 across (R_2) is equal to that of U_1

b. Deduce, by applying the Ohm's law**, that** the current I_2 by (R_2) is 0.05 A.

3.3.Show that the current I carried by the lamp (L) is 0.15A.

3.4.Justify that (L) does not function normally in this circuit.