دورة سنة ٢٠٠٨ الإكمالية الإستثنائية	الشهادة المتوسطة	وزارة التربية والتعليم العالي المديرية العامة للتربية دائرة الامتحانات
الاسم: الرقم:	مسابقة في مادة الفيزياء المدة: ساعة واحدة	

This exam is formed of 3 obligatory exercises in 2 pages.
The use of non-programmable calculators is allowed.

First exercise (7 points) Refraction of light

A luminous ray (SI), propagating in air, falls on the free surface of water at a point I (fig. 1) under an angle of incidence i. It then refracts along (IR) making an angle r with the normal (NN') at point I

1) Redraw figure 1 and represent on it: (NN'), (IR), i and r.

2) We vary i between 0 and 90^o. The curve below (fig. 2) gives the variations of r as a function of i.

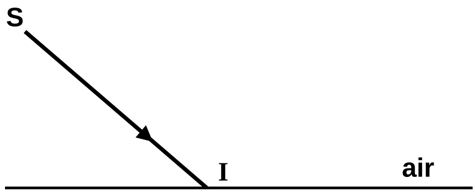
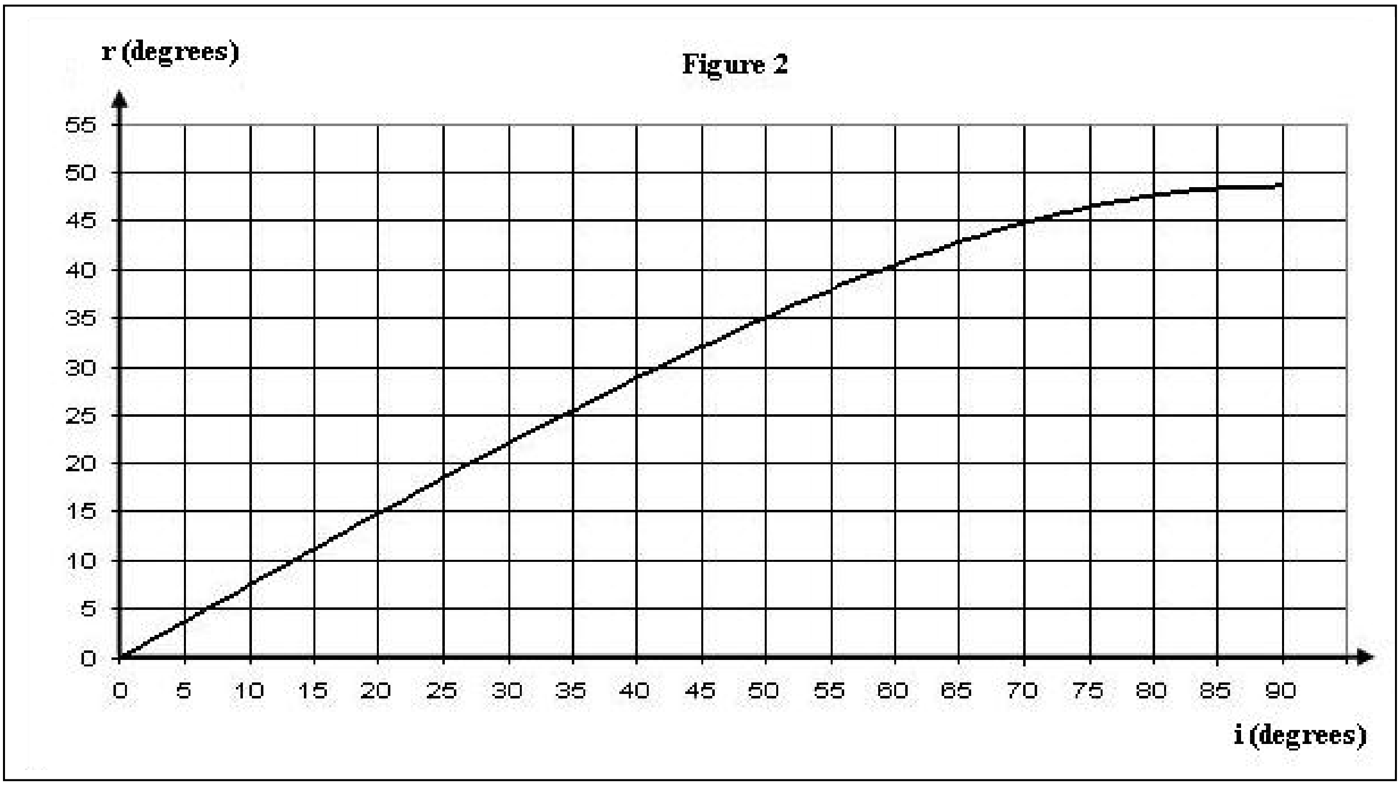


Figure 1



a) Determine graphically the value of r for i = 0. Deduce how does a luminous ray refract when it falls normally on the surface of water.

b) Determine graphically the value of i for r = 15^o and the value of r for i = 70^o.

c) For i = 90^o, the angle of refraction is 49^o. What does this angle represent for the system (water-air}?

3) Another luminous ray (AJ) passes **from water to air** under an angle of incidence of 35^o.

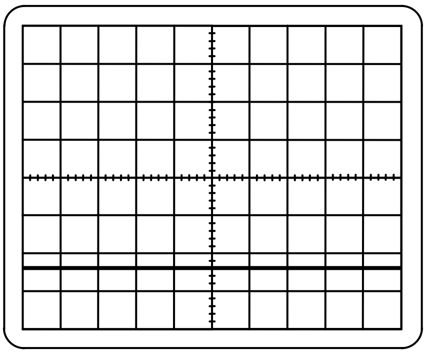
a) Determine graphically, by applying the principle of reversibility of light, the value of the angle of refraction corresponding to this incidence.

b) Draw a diagram showing the surface of separation {water-air}, the incident ray (AJ), the normal at the point of incidence J, the refracted ray (JB) as well as the angle of deviation d.

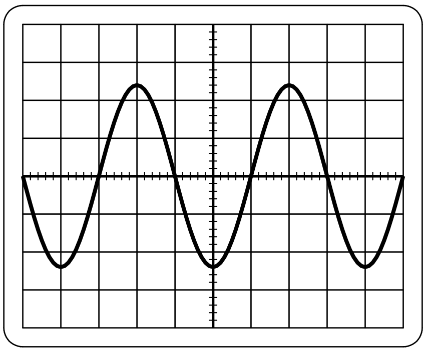
c) Calculate the value of d.

Second exercise (7 points) Electric voltage

The two waveforms (I) and (II) represent the two electric voltages u_{AB} and u_{CD} respectively.
In the absence of any voltage, the horizontal line passes through the center of the screen of the oscilloscope.
The vertical sensitivity on both channels is S_V = 5 V/div.



(I)



(II)

I- Exploitation of the waveform (I)

1) Give the type of the voltage u_{AB} represented by waveform (I). Justify.
2) The value of this voltage is negative. Why?
3) Determine the value of u_{AB}.
4) Is the phase of the oscilloscope connected to the point A or to B ? Why ?
5) Give the name of a source of tension that may deliver such voltage.

II- Exploitation of the waveform (II)

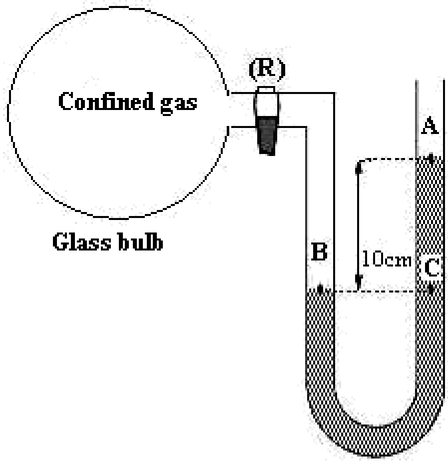
1) Give the type of voltage u_{CD} represented by the waveform (II).
2) Determine the maximum value of u_{CD}. Deduce the effective value of u_{CD}.

III- Feeding a lamp

Consider a lamp L labeled (12 V).
1) What does the indication 12 V represent for this lamp?
2) Upon feeding this lamp successively with the voltages u_{AB} and u_{CD}.
a) (L) functions normally under the voltage u_{AB} .Why?
b) (L) does not function normally under the voltage u_{CD}. Why?

Third exercise (6 points) Pressure of a confined gas

The object of this exercise is to determine the pressure of a confined gas. For this we consider a glass bulb having a closed tap (R) and filled with a gas, a rubber tube connects the glass to a U tube manometer. This manometer contains water in equilibrium. The surfaces of water in the two branches are at the same level.



Given:
Atmospheric pressure: P_{atm} = 76 cm of mercury;
Density of mercury: ρ_1 = 13600 kg/m^{3};
Density of water: ρ_2 = 1000 kg/m^{3};
g = 10 N/kg.

We open the tap (R). We notice that at equilibrium, the difference in levels between the surfaces of water is10 cm. (see the figure).
1) Determine, in pascal (Pa), the value of the pressure exerted by air at A.
2) Calculate the value of the pressure exerted by water at C.
3) Deduce the value of the total pressure at C.
4) a) B and C are under the same pressure. Why?
b) Deduce then the value of the pressure of the confined gas.

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First exercise (7 points)

Part of the Q	Answer	Mark
1	Redrawing (0.5) NN' ; IR ; i ;r (1.5)	2
2)a)	i =0 thus r = 0 (0.5) This ray continues its path without deviation. (0.5)	1
2)b)	r = 15° → i = 20° (0.5) i = 70 ° → r = 45° (0.5)	1
2)c)	r = 49° represents the limiting angle of refraction (Critical angle)	0.5
3) a)	i = 35° → r = 50 °	0.5
3) b)	Diagram	1
3) c)	d = r – i = 50° - 35° = 15°	1

Second exercice (7 points)

Part of the Q	Answer	Mark
I.1)	U_{AB} is a DC voltage (0.5) Since U_{AB} is represented by a horizontal straight line (0.5)	1
I.2)	Because the displacement of the horizontal line is downwards	0.5
I.3)	U_{AB} = - 2.4 × 5 = -12V	0.5
I.4)	The phase of the oscilloscop is connected to the terminal A (0.5) Since the oscilloscope measures U_{AB} (0.5)	1
I.5)	an accumulator , a dry cell , D· C· generator	0.5
II.1)	Sinusoidal alternating	0.5
II.2)	$U_m = S_v . y_m$ = 5×2.4 = 12V (0.5) U_{eff} = Um / √2 (0.5) = 8.5V (0.5)	1.5
III.1)	12V is the rated voltage of the lamp	0.5
III.2)a)	U_{AB} is a constant voltage of value 12V equal to the voltage of normal functioning of (L)	0.5
III.2)b)	Since the effective voltage of U_{CD} (8.5V) is different from the rated voltage of the lamp	0.5

Third exercise (6 points)

Part of the Q	Answer	Mark
1)	$P_A = P_{atm} = \rho_1.g.H$ (1) = 13600×10×0.76 = 103360 P_a (1)	2
2)	P_{water} exerted by water = ρ_2.g.h = 1000×10×0.1 = 1000 P_a	1
3)	$P_{total} = P_{water} + P_{atm}$ (0.5) = 104360 P_a (0.5)	1
4)a)	Since B and C are in the same horizontal plane and in the same liquid at equilibrium	1
4)b)	The pressure of the confined gas is the pressure at point B or $P_{gas} = P_B$ (0.5) Thus : P_{gas} = 104360 P_a (0.5)	1