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COMPETITIVE ENTRANCE EXAMINATION
SERIE : GCE/AL

PHYSICS EXAMINATION
Duration : 2 Hours

EXERCISE 1 (MOVEMENT IN FORCE FIELDS AND THEIR APPLICATIONS) / 7 marks.

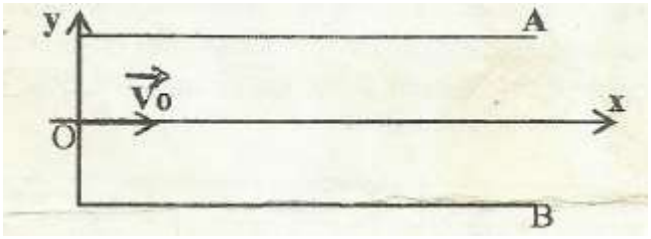
We give: elementary charge : $e=1.6 .10^{-19}$; mass of an electron : $m=9,1.10^{-31}$kg

A. A lithuim ion Li^+, of mass $m= 1.2 * 10^{-26}$ kg , enters at O with a velocity $V_O = 2.83 *10^5$ m/S between two parallel and horizontal plates A and B of length D= 5.0 cm , separated by a distance d = 2.0 cm. A potential difference U_{AB}=15 V is maintain between the two plates. (See the figure below).

1) Draw a diagram showing the electric field and the electric force acting upon the Lithuim ion Li^+. **1 mark**
2) Give the shape of the trajectory of the lithuim ion. **0,5 mark**
3) Determine the equation of trajectory of this ion and deduce the coordinates of the point S at the exit of the electric field **1,5 mark**

B. We consider a satellite rotating on a circular orbit around the earth .The altitude of the satellite is h= 3200km. The radius of the earth is R= 6400km and the acceleration due to gravity g is 9.81m/ s^2.

1) State the law of gravitation for two solids A and B **1 mark**
2) Draw a diagram showing the force the earth exerts on the satellite S **1 mark**
3) Study the movement of the satellite and give the expression of its acceleration **1 mark**
4) Calculate the linear velocity and the period **1 mark**



EXERCISE 2 (OSCILLATORY SYSTEMS) /4Marks

1- The time law of a vibratory phenomenon propagating along a string is given by $y= 5.10^{-2}\cos(200\pi t-\frac{\pi}{2})$ with y in meters

1.1 Determine the period and the initial phase of the phenomenon **0,5 mark**
1.2 Define wave length **0,5 mark**

2- Define: Simple pendulum and give the expression of its period TO **1 mark**

3. A simple pendulum of mass m=50g and string length 80cm is initially displaced from its stable equilibrium position by an angle of $\theta=\frac{\pi}{6}$ rad in the positive direction and left to itself withouth initial velocity

3.1 Calculate the heartbeat of this pendulum **1 mark**
3.2 Determine the time law of the oscillations of this pendulum **1 mark**

EXERCISE 3 (UNDULATORY AND CORPUSCULAR PHENOMENA) /5 marks

1- Define : Mechanical wave **0,25 mark**

2- A progressive sinusoidale wave of freauency 50HZ, created by a source S from a date t_o=0 propagates at the surface of water. The figure below represents, at a date t, a section of this surface by a vertical plane passing through S. At this date, the elongation of S is zero.

The distance AB is 3cm , the constant amplitude of the wave is 4cm

2.1 Is the wave Longitudinal ? Transversale ? **0,25 mark**

2.2 What is the value of the wavelength ? **0,5 mark**

2.3 In the diagram, how many points are vibrating in phase opposition with S **0,5 mark**

2.4 What is the speed of this wave ? **0,5 mark**

3- Given h= $6{,}63.10^{-34}$ J.s ; c=3.10^{8}m/s ;1ev=$1{,}6.10^{-19}$J ; 1nm=10^{9}m

3.1 Define : Photoelectric effect **0,25 mark**

3.2 The extraction energy of an electron of a metal is E_O = 1.90 ev

Calculate the length corresponding to the photoelectric threshold **0,25 mark**

a) The cathode is illuminated simultaneously by three radiations of wavelength λ_1=700nm ;λ_2=600nm ;λ_3=500nm .

What are the radiation that causes photoelectric effect? Why ? **0,5 mark**

b) The cell is illuminated only by the radiation of wavelength $\lambda_{.3.}$ What is the maximum speed of emission of an electron **0,5 mark**

4- A monochromatic light of wavelength λ = 643nm, resulting from a slit F falls on a diaphragm pierced with two slits F1 and F2 parallel and separated by a distance of a= 0.15mm. The distance between the plane of the sources and the screen of observation is D = 140cm.

4.1 Describe the aspect of the screen **0,25 mark**

4.2 Determine the fringe spacing **0,25 mark**

4.3 A point M of the interference field is located at a distance x = 1.8 cm from the middle of the central fringe.

a) Determine the path difference of the light rays arriving at M **0,5 mark**

b) Does the point M correspond to a bright fringe or a dark fringe? **0,5 mark**

EXERCISE 4 (EXPERIMENTAL TYPE) /4 marks

Natural induim contains 4.3% of $^{113}_{49}$In and 95.7% of $^{115}_{49}$In. A sample is irradiated for several hours by means of neutrons. The sample, which has become radioactive, is placed in an enclosure. After about a quarter of an hour, measurements are made using a scintillation detector which detects the radioactive nuclei and a counting set. The latter is done for a duration of one minute every 10 minutes. Let N be the number of pulses read, we obtain the following results:

t (min)	0	10	20	30	40	50	60
N	3700	3295	2900	2530	2225	1950	1720
$\frac{1}{t}\ln(\frac{N}{NO})$	———						

1- Define : Half life of a radioactive element **0,5 mark**

2- Indium $^{115}_{49}$In is radioactive α. Write the equation of its disintegration, specifying the laws of conservation used. **0,5 mark**

3- Give an application and a risk related to radioactive nuclides. **0,5 mark**

4- Complete the table above **1.25 mark**

5- Give the expression of the law of radioactive decay **0.5 mark**

6- Express $\frac{1}{t}\ln(\frac{N}{NO})$ **0.5 mark**

7- Determine the radioactive constant λ of this radioactive element **0.75 mark**

$_{46}$Pd	$_{47}$Ag	$_{48}$Cd	$_{49}$In	$_{50}$Sn	$_{51}$Sb