فیزیاء

Eng

الجامعة اللبنانية

كلية الصحة العامة

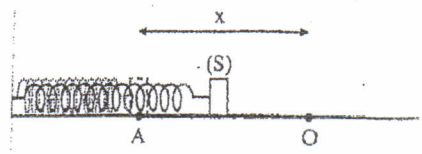
مباراة الدخول ٢٠١٢ – ٢٠١٣

مسابقة في الفيزياء (A)

المدة : ٦٠ دقيقة

N° 1

A solid (S) of mass m = 500g is connected to a light spring having a stiffness k = 50 N/m as shown in the figure.



The horizontal plane passing through the center of gravity of the solid is taken as a reference level for gravitational potential energy.

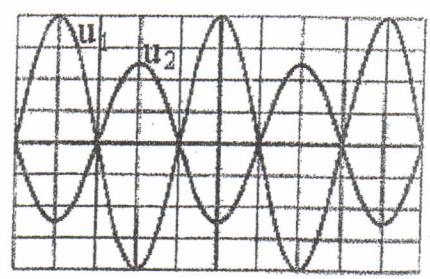
We compress the spring by a distance x = OA = 10 cm from the equilibrium position O and we release it from rest at t = 0.

1) Name, at t = 0, the form of the energy possessed by the system (Solid, spring, Earth).
2) Calculate, at t = 0, the mechanical energy of the system.
3) Neglecting the frictional forces, determine the speed v_0 of (S) as it passes through the equilibrium position O.
4) Calculate the tension of the spring when the speed of (S) is v =1 m/s.

N° 2

The following oscillogram represents the voltages u_1 and u_2 across the primary and the secondary coils respectively of a transformer.

The vertical sensitivity is the same on both channels of the oscilloscope.



1) The two voltages u_1 and u_2 have same physical quantity. Name it.
2) Calculate the transformation ratio of the transformer.
3) Calculate the phase difference between u_1 and u_2.
4) Name the phenomenon that forms the base of the functioning of the transformer.

N° 3

We illuminate the cathode of a photocell with a monochromatic light such that each photon has an energy of 2.75 eV.

1) Calculate the wavelength λ of the light.
2) Determine the speed of the ejected electron from the cathode, knowing that the extraction energy of the photocell is w_s = 2.25 eV.
3) To increase the intensity of the current in the cell, do we have to increase, the power of the radiation or the speed of the emitted electrons? Justify your answer.

Given: h = 6.6 × 10^{-34} J.s ; m_e = 9.1 × 10^{-31} kg ; c = 3 × 10^8 m/s ; 1 eV = 1.6× 10^{-19} J

N° 4

In a nuclear power station, one of the possible reaction is:

$$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{94}_{x}Sr + {}^{139}_{54}Xe + y\,{}^{1}_{0}n$$

1) Determine x and y, specify the used laws.
2) Determine, in MeV, the energy liberated by the fission of one uranium nucleus.
3) Determine the energy liberated by the fission of 1 g of uranium.

Given:

$m\,^{235}_{92}U = 234.99345\ u$; $m\,^{139}_{54}Xe = 138.88917\ u$; $m\,^{94}_{x}Sr = 93.89451\ u$;
$m\,^{1}_{0}n = 1.00866\ u$; $N_A = 6.02 \times 10^{23}\ mol^{-1}$. $1u = 931.5\ MeV/C^2$

الجامعة اللبنانية
كلية الصحة العامة

مباراة الدخول ٢٠١٢ – ٢٠١٣

مسابقة في الفيزياء (B)

المدة : ٤٥ دقيقة

N° 1

A stone of mass m = 200 g is launched vertically upward, from the ground, with an initial speed v = 5 m/s. Neglect air resistance and take the ground as a reference level for gravitational potential energy.

1) Calculate the kinetic energy of the stone and the gravitational potential energy of the system (Stone, Earth) at the instant of launching.
2) Specify the transformation of energy during the upward motion of the stone.
3) The mechanical energy of the system (Stone, Earth) is conserved. Why?
4) Determine the maximum height reached by the stone.

Take g = 10 m/s² .

N° 2

In a nuclear power station, one of the possible reaction is:

$$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{94}_{x}Sr + {}^{139}_{54}Xe + y\,{}^{1}_{0}n$$

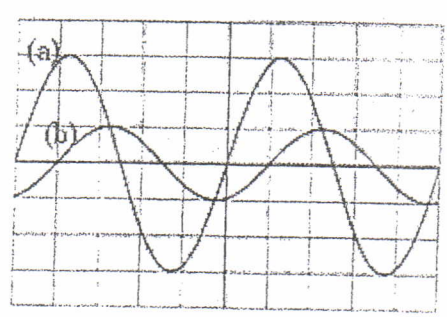
1) Determine x and y, specify the used laws.
2) Determine, in MeV, the energy liberated by the fission of one uranium nucleus.
3) Determine the energy liberated by the fission of 1 g of uranium.

Given:

$m^{235}_{92}U = 234.99345\ u$; $m^{139}_{54}Xe = 138.88917\ u$; $m^{94}_{x}Sr = 93.89451\ u$;
$m^{1}_{0}n = 1.00866\ u$; $N_A = 6.02 \times 10^{23}\ mol^{-1}$ $1u = 931.5\ MeV/C^2$

N° 3

An oscilloscope visualizes two voltages in an electric circuit, as shown in the figure.



For both channels: S_v = 5 v/ div and S_h = 2 ms/div

1) Calculate the effective value of each voltage.
2) Calculate the period and the frequency of the generator.
3) Which oscillogram (a) or (b) leads the other ?
4) Calculate the phase difference between (a) and (b).
5) The expression of the voltage of the oscillogram (a) is $u_a = U_{ma} \sin(\omega t)$.
6) Write the instantaneous voltage u_b representing the oscillogram (b).

الجامعة اللبنانية

كلية الصحة العامة

الجامعة اللبنانية
كلية الصحة العامة

مباراة الدخول ٢٠١١ – ٢٠١٢

مسابقة في الفيزياء (A)

المدة : ساعة واحدة

N° 1 : (5 pts)

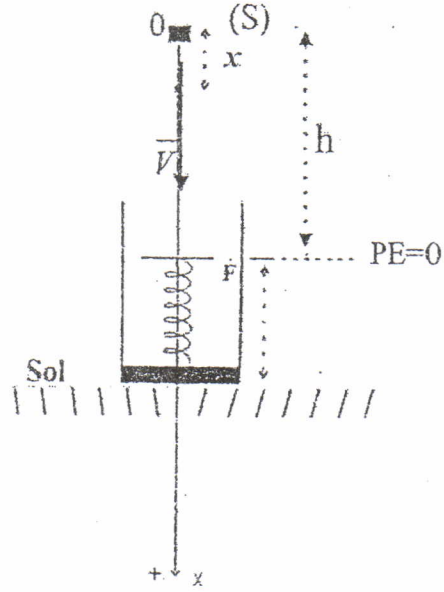
A block (S) of mass m=200g, considered as a material point, is located at an altitude h=0.8m above the end F of a vertical light spring, of stiffness constant k=300 N/m.

At t=0, the bloc is released from the point O. The horizontal plane passing through F is taken as the gravitational potential energy reference. Neglect the air resistance and g=10m/s^2.

a) Write the expression of the mechanical energy of the system (S-ground) when the block moves down a distance x.

b) Determine the speed of the block just before hitting the end F of the spring.

c) Find the maximum compression of the spring.



N° 2 : (5 pts)

A coil of inductance L and of internal resistance r =2 Ω carries a current that varies in terms of time:
i(t) = -20 t+1.4 (i in A and t in s)

a) Determine the inductance L of the coil when the potential difference across its ends is zero at t=20ms.

b) Find the magnetic flux through the coil at t=20ms.

c) Calculate the power of the coil at t=20ms given that its internal resistance is negligible.

N° 3 : (5 pts)

A laser is diffracted by a thin slit of width a=0.1mm, the image is obtained on a screen located at a distance D=2m from the opaque plane of the slit. The width of the central fringe is L=2.1 cm.

a) Write the relation of the angular width α(rd) of the central fringe and then establish the relation $L=\frac{2\lambda D}{a}$

b) Deduce the value of the wavelength λ

c) Calculate the distance between the centers of the first bright fringe and the forth dark fringe located on the same side with respect to the central fringe.

N° 4 : (5 pts)

The fission of a nucleus of uranium ^{235}U delivers energy of 200 MeV.

a) Calculate, in joules, the energy liberated by the fission of 1 Kg of uranium ^{235}U.

b) The capacity of the electric power of a country is of the order of 5 x 10^{11} W. If 30% of this power are produced by nuclear means from the fission of uranium, what is the mass of uranium ^{235}U needed, in each second, in order to get this power?

Take N_A=6.02 x 10^{23} mol^{-1} and 1eV=1.6 x 10^{-19}J.

الجامعة اللبنانية

كلية الصحة العامة

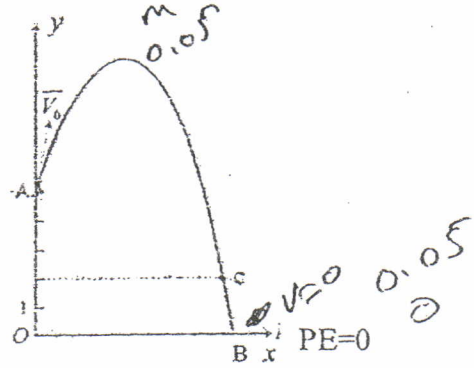
مباراة الدخول ٢٠١١ – ٢٠١٢

مسابقة في الفيزياء (B)

المدة : ٤٥ دقيقة

N° 1 : (7 pts)

A projectile of mass m=50g is launched with an initial speed v_0 = 10 m/s from a point A located 5 m above to the ground considered as a reference of gravitational potential energy. Neglect the air resistance and take g=10m/s^2.



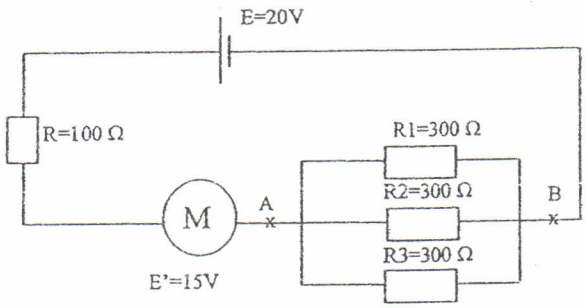
a) Calculate the mechanical energy of the system (projectile-ground) at the launching point.

b) Is the mechanical energy conserved? Explain.

c) Deduce the speed of the projectile when it passes by the point C located at 2m above the ground.

N° 2 : (7 pts)

Consider the circuit shown in figure below in which M is an electric motor:



a) Calculate the equivalent resistance of the circuit.

b) Calculate the intensity of the current delivered by the generator.

c) Calculate the potential difference between A and B.

N° 3 : (6 pts)

The fission of a nucleus of uranium ^{235}U delivers energy of 200 MeV.

a) Calculate, in joules, the energy liberated by the fission of 1 Kg of uranium ^{235}U.

b) The capacity of the electric power of a country is of the order of 5×10^{11} W. If 30% of this power are produced by nuclear means from the fission of uranium, what is the mass of uranium ^{235}U needed, in each second, in order to get this power?

Take $N_A=6.02 \times 10^{23}$ mol^{-1} and $1eV=1.6 \times 10^{-19}$J.

الجامعة اللبنانية

كلية الصحة العامة

مباراة الدخول ٢٠١٠ – ٢٠١١

مسابقة في الفيزياء A – انكليزي

المدة : ساعة واحدة

N° I – A particle M moves along a segment 8 cm long in a sinusoidal motion of frequency 10 Hz.
At t = 0, M passes through the mid point of its trajectory moving in the positive direction.

a) Determine the time equation of motion of M.
b) Calculate its velocity at t = 2s.

N° II – A capacitor of capacitance C = 1 mF cannot support at its terminals a voltage greater than 60 V.

a) Calculate the maximum value of the possible stored energy.
b) The capacitor is charged under a voltage U = 6V, through a resistor R = 10 Ω.
   1. Draw a diagram of the circuit.
   2. What is the maximum power dissipated by the resistor?

N° III – In Young's apparatus using green light, we get the following results :

a) distance between 11 bright fringes that are consecutive is 10 mm;
b) distance between the slits is 1.5 mm;
c) Distance between the plane of the slits and the screen of observation is 2,8m;
Calculate the wavelength of the green light used.

N° IV – Consider a sample of $^{137}_{55}Cs$ of period T = 30 years.

a) Calculate the radioactive constant of this sample in h^{-1} and in s^{-1}.
b) At the instant t = 0, the activity A_0 is equal to 3.7×10^5 Bq.
Calculate the number N_0 of the radioactive nuclei present in the sample at that instant.

الجامعة اللبنانية

كلية الصحة العامة

مباراة الدخول 2010 – 2011

مسابقة في الفيزياء (B)

المدة : 45 د

N° 1 – A particle M starts from rest on a circular trajectory of radius 10 m so that its tangential acceleration a_t is constant it thus attains a speed $V = 5ms^{-1}$ within 10s. Take at $t = 0$ and $s_0 = 0$.

Determine:

a) The expression of the velocity as a function of time ;
b) The normal acceleration of M at $t = 10s$;
c) The acceleration vector $\vec{a}$ at $t = 10$ s;

N° 2 – In Young's apparatus using green light, we get the following results:

a) Distance between 11 bright fringes that are consecutive is 10 mm; ;
b) distance between the slits is: 1,5 mm ;
c) distance between the plane of the slits and the screen of observation is 2,8 m;
Calculate the wavelength of the green light used.

N°3 – Consider a sample of $^{137}_{55}Cs$ of period $T = 30$ years.

a) Calculate the radioactive constant of this sample in h^{-1} and in s^{-1}.
b) At the instant $t = 0$, the activity A_0 is equal to $3,7 \times 10^5$ Bq. Calculate the number N_0 of the radioactive.

الجامعة اللبنانية
كلية الصحة العامة

الجامعة اللبنانية
كلية الصحة العامة

مباراة الدخول ٢٠٠٩ – ٢٠١٠

مسابقة في الفيزياء (Série A)

المدة : ساعة واحدة

I- Les équations horaires du mouvement d'un mobile ponctuel lancé dans l'espace sont :
$x=4t$, $y=-5t^2+4t$ et $z=0$ (x,y et z en m, t en s).
L'axe $(O,\vec{i})$ est vertical ascendant.

a) Dans quel plan s'effectue le mouvement ? Déterminer l'équation cartésienne de la trajectoire dans ce plan.

b) Déterminer les coordonnées du vecteur vitesse instantanée $\vec{V}$ du mobile à l'instant t. Ecrire l'expression générale de $\vec{V}$ et déduire sa norme v en fonction du temps.

c) Déterminer les coordonnées du vecteur accélération $\vec{a}$ du mobile.
Ecrire l'expression de $\vec{a}$. Quelle est sa norme ? (5 pts).

II- Un parachutiste avec son parachute a une masse de 90kg. Il saute sans vitesse initiale d'un hélicoptère d'une altitude h=1000m et arrive au sol avec une vitesse limite de 10m/s. On considère le sol comme niveau d'énergie potentielle de pesanteur nulle et comme système l'ensemble (parachutiste, air, Terre).

a) Quelle est la variation de l'énergie potentielle de pesanteur du système ?

b) Quelle est la variation de l'énergie cinétique du système, sachant que le mouvement est étudié par rapport au sol.

c) Quelle est la variation de l'énergie mécanique du système ? (5 pts).

III- Un solénoïde de 50cm de longueur, de 6cm de diamètre comporte 1000 spires.

a) Calculer son inductance L. L est donnée par $L=\frac{\mu_o N^2 S}{l}$ avec $\mu_o = 4\pi \times 10^{-7}$ SI.

b) Quelle est la f. é. m d'auto-induction qui apparaît dans la bobine lorsque l'intensité du courant qui la traverse a un taux de variation de 200 $A\,s^{-1}$.

c) On introduit dans la bobine un noyau de fer doux. Le taux de variation de i est le même. La valeur de la f.é.m d'auto-induction augmente-elle ou diminue-t-elle ? (4 pts).

IV- L'iode $^{131}_{53}I$ a une période voisine de 8jours. On fait intégrer à un malade une dose de 1 μg d'iode 131.

1- a) Déterminer la masse du radionucléide présente dans le corps du malade au bout de 32 jours (à peu près un mois).
b) puis au bout de 360 jours (à peu près un an).
c) . Conclure.

2- Déterminer le temps en jour au bout duquel la masse restante dans le corps du malade est de 1% de la masse initiale. (6 pts).

الجامعة اللبنانية

كلية الصحة العامة

مباراة الدخول ٢٠٠٩ – ٢٠١٠

مسابقة في الفيزياء (Série B)

المدة : ٤٥ دقيقة

I- A moving particle has the parametric equations in the reference system $(O, \vec{i}, \vec{j}, \vec{k})$ as:

$x = 2t$; $y = t + 2$; $z=0$ (x,y and z in m, t in s)

a) Show that the motion of M is rectilinear.

b) Determine the components of the instantaneous velocity vector.

c) Deduce the nature of motion of M.

(5 pts)

II- The mass of a parachutist and his equipment is 90 kg. He falls without initial velocity from a helicopter from an altitude h = 1000m and reaches the ground with a limiting speed of 10 m/s. Take the ground level as a potential energy reference for the system (parachutist, air, Earth).

a) What is the variation in the gravitational P.E of the system?

b) What is the variation in the kinetic energy of the system whose motion is studied relative to a terrestrial reference?

c) What is the variation of the mechanical energy of the system? (5 pts).

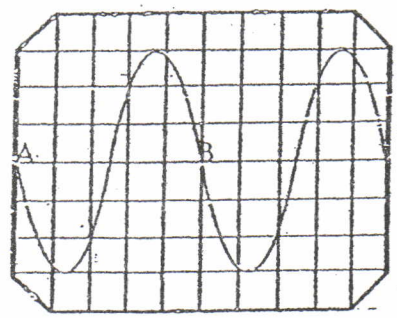
III- The adjacent waveform represents the alternating sinusoidal voltage of a LFG on channel-I(A) of a grounded oscilloscope :

Calibration of the oscilloscope :

- Time base : $V_b = 2ms/div.$
- Y-amplitude gain : $S_v = 2v/div.$

a) What is the value of the crest to trough voltage. Deduce the maximum voltage U_m and the effective voltage U.

b) What is the value of the period and of the frequency of this voltage?



(5 pts)

IV- Iodine $^{131}_{53}I$ has an approximate period of 8 days. A Patient is made to ingest a dose of $1\ \mu g$ of iodine 131.

a) Determine the mass of the radionuclide present in the body of the patient at the end of 32days (nearly a month).

b) Then after 360 days (nearly a year).

c) What do you conclude?

(5 pts)

الجامعة اللبنانية

كلية الصحة العامة

مباراة الدخول ٢٠٠٨ – ٢٠٠٩

مسابقة في الفيزياء B

المدة : ٤٥ دقيقة

I- A wagon of mass m_1=50 tons moving at $\vec{V_1}$ of magnitude 10 km/h, hits another wagon of mass m_2=30 tons initially at rest.
Knowing that the two wagons remain connected after impact, find their velocity $\vec{V}$ just after the collision. Given that the linear momentum of the system is conserved.

4pts

II- The dimension of a book are 22cm X 24cm X 3.5cm and its mass is 1.2kg. calculate the pressure that it exerts on a horizontal table when it is placed on:
a- On its largest face.
b- On the face 22cm X 3.5cm.
Take g=10m/s^2.

3pts

III- A generator supplies a circuit with a sinusoidal voltage
U=28 sin 100 π t (U in V, t in s).

The current carried by the circuit is of the form:

$i = 0.7 \sin\left(2\pi f t - \frac{\pi}{4}\right)$ (I in A, and t in s)

a- Calculate the effective current and the effective voltage across the circuit. Use $\sqrt{2}$ =1.4.

b- We call impedance, Z of a circuit, the effective voltage across its terminals to the effective current flowing through it. Calculate the impedance of the preceding circuit.

c- What is the frequency of the current?

6 pts

IV- Cesium $^{137}_{55}Cs$ is a β^- emitter and gives as daughter nucleus, the barium Ba, that deexcites later its period is 30 years and its activity during preparation, in June 1994, was 3 x 10^4 Bq.

a- Write the balanced equation of the disintegration of cesium and specify the used laws.

b- Calculate the number of nuclei contained in the sample during its preparation

c- Find the activity of the source in June 2024.

7pts

مباراة إمتحانات الدخول
العام الدراسي 2007_2008

مسابقة في الفيزياء (ب)
المدة: 45 دقيقة

مجلس طلاب الفرع-1

I- The time equation of motion of a particule moving along $(O, \vec{i})$, is $x = 2t + 1$ (x in m, t in s).
a) What is the nature of motion ? U.R.M.
b) What are the characteristics of the velocity vector $\vec{V}$ and the acceleration vector $\vec{a}$.
c) Specify the position of the particle at t = 0 and t = 20 s. (5pts)

II- A solid of mass 10 Kg moves in translation within the gravitational field of earth. Its mechanical energy does not vary. Its K.E varies by $\Delta K.E = -570$ J
a. Determine the variation in the gravitational P.E of (Solid , Earth).
b. Determine the variation Δz of the level of its center of mass. (4pts)

III- A capacitor of capacitance C = 1 mF cannot support at its terminals a voltage greater than 60 V.
a. Calculate the maximum value of the possible stored energy.
b. The capacitor is charged under a voltage U = 6V, through a resistor R = 10 Ω.
   i. Draw a diagram of the circuit.
   ii. What is the maximum power dissipated by the resistor?
   iii. Calculate the charge carried by each of the armatures. (5pts)

IV- The law of exponential decay of an element is : $N(t) = N_0 e^{-\lambda t}$.
a) Give the meaning to the terms N, N_0 and λ.
b) Bismuth 210 undergoes a sudden disintegration β^-. Its radioactive constant is $\lambda = 5{,}77 \times 10^{-4}\ s^{-1}$.
   1. Define and calculate the radioactive period T of bismuth 210.
   2. Define the activity of the sample at the instant t. Give the expression that represents this definition.
c) A sample contains at the instant t = 0 a mass $m = 10^{-6}$ kg of bismuth 210. Determine the activity of the sample at the instants t = 0 and t = T. (6pts)

$N_A = 6{,}02 \times 10^{23}$.

Good Work.

-86-

مباراة إمتحانات الدخول
العام الدراسي 2006_2007

مسابقة في الفيزياء (أ)
المدة: ساعة واحدة

مجلس طلاب الفرع-1

I- A small steel ball (B) of mass M=100g, is released from rest from a height h=3.2m, above a rigid ground, it rebounds vertically up to the same height. Take g=10 m s^{-2}.

a) Determine just before impact :
- the velocity vector $\vec{V_i}$ of (B)
- the linear momentum P_i of (B).

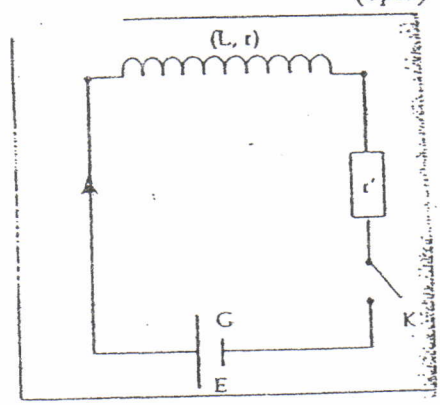
b) Specify :
- the velocity vector $\vec{V_f}$ of (B) just after impact.
- the linear momentum P_f of (B).

c) Determine the variation in the linear momentum $\vec{\Delta P}$ that (B) undergoes during impact.

(6pts)

II- In the circuit of figure : E = 10V,
r = 4 Ω, r'=1Ω and L=1.2H.

1- In the steady state :
a) Calculate the current in the circuit.
b) Calculate the potential difference across the coil.



2- We open the switch K suddenly; Calculate the self-induced e.m.f in the coil, assuming that the current decays linearly with time, and becomes zero in a time of 4.8ms.
Do you notice a spark at the switch ? (5pts)

III- The surface of the metal of a cathode of a photocell is illuminated by UV radiation of wavelength λ = 0.33 μm. The extraction energy of the metal of the cathode is Wo = 2.75 eV.

a) The cathode emits electrons. why ?
b) Calculate the maximum kinetic energy of the emitted electron.
c) Calculate the cut-off potential of the photocell.

Given :
- plank's constant : h = 6.6 x 10^{-34} j x s ;
- charge of the electron: -e = -1.6 x 10^{-19} C ;
- mass of an electron: m = 9.1 x 10^{-31} kg ;
- the speed of light in vacuum: c = 3 x 10^{8} ms^{-1}.

(4.5 Pts)

IV- In the following nuclear reactions:

$$^{214}_{83}Bi \longrightarrow X + {}^{0}_{-1}e$$

$$X \longrightarrow Y + {}^{4}_{2}He$$

a) Fill in the missing mass numbers and atomic numbers.
b) Identify particles or nuclei X and Y as well as the types of the above nuclear reactions.
(Hint $^{210}_{84}Po$ is polonium and $^{207}_{82}Pb$ is lead).
c) Write the complete equations of the nuclear reactions.

(4.5 Pts)

مباراة إمتحانات الدخول
العام الدراسي 2005_2006

مسابقة في الفيزياء (ب)
المدة: 45 دقيقة

مجلس طلاب الفرع-1

1- Calculate the linear momentum of :
a) a car of mass 1,2 tons moving at 72 km.h^{-1}.
b) an electron of mass 9,1.10^{-31} kg moving at 20000 km.s^{-1}. (3 pts)

2- A small pebble of mass 100g is shot vertically up from a point O on ground is thus reaches a maximum height of 25m before it movs back. (g = 10 m/s^2)
Calculate, taking the ground as an origin (reference) the gravitational potential energy of the system (Earth, pebble) and its kinetic energy, when the stone is:
- 25 m above ground;
- on ground level;
- at the bottom C of a well 20 m deep. (6 pts)

3- A capacitor of capacitance $C_1 = 2\mu F$ charged under the voltage $V_1 = 2000$ volts and a second capacitor $C_2 = 5\mu F$ charged with the voltage $V_2 = 100$ volts.
a) Calculate the charge and the energy for each capacitor.
b) The two capacitors were placed in parallel. Calculate the capacitance of the equivalent capacitor (we assume that the total charge is constant).
c) Calculate the new voltage V across the equivalent capacitor. (6 pts)

4- The thorium $^{227}_{90}Th$ is an α radioactive nuclide emitter.
a) Write the balanced equation of this radioactive disintegration such that it produces radon Ra.
b) The period (or half-life) of thorium 227 is T = 18.3 days. Calculate the activity A_0 of a thorium 227 sample of mass 1 mg.
Take: N=6,023.10^{23} mol^{-1} (5 pts)

Good Work

مباراة إمتحانات الدخول
العام الدراسي 2005_2006

مسابقة في الفيزياء (أ)
المدة: ساعة واحدة

مجلس طلاب الفرع-1

N°1- Consider two cars: The first A of mass $m_A = 800$ kg, moving with a velocity $\vec{V}_A$ whose magnitude $V_A = 72$ km h^{-1}; the second car B of mass $m_B = 1200$ kg moving with a velocity $\vec{V}_B$ whose magnitude $V_B = 36$ km h^{-1}.

1°) Determine the linear momentum of the system (A + B) in each of the following cases:

a) $\vec{V}_A$ and $\vec{V}_B$ are collinear of the same direction.

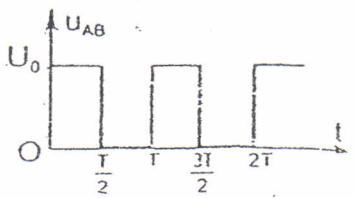
b) $\vec{V}_A$ and $\vec{V}_B$ are collinear of opposite directions.

c) A and B leave from the same point with $\vec{V}_A$ and $\vec{V}_B$ perpendicular.

2°) Specify in case (c) the motion of the center of mass of the system (A + B). Justify your answer.

(5 pts)

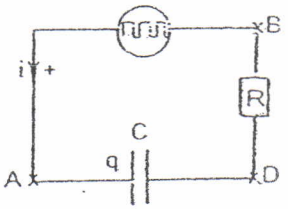
N°2- The adjacent figure represents a circuit fed with a square voltage signal of a LFG.



a) Derive the differential equation of the voltage $u_C = u_{AD}$ across the capacitor during charging.

b) Determine the constants a and b of the equation: $U_C = a(1 - e^{-bt})$

c) At the instant t = 0.2 s, the voltage across the capacitor is $\frac{1}{3}$ of its maximum value U_0. Calculate the value of the time constant τ of the (RC) circuit. (6 pts)



N°3- The thorium $^{227}_{90}Th$ is an α radioactive nuclide emitter.

a) Write the balanced equation of this radioactive disintegration such that it produces radon Ra.

b) The period (or half-life) of thorium 227 is T = 18.3 days. Calculate the activity A_0 of a thorium 227 sample of mass 1 mg.

Take: $N=6{,}023.10^{23}$ mol^{-1} (5 pts)

N°4- The primary ionization energy (energy necessary to release the first electron) of the helium atom is equal to 24.6 eV.

a) Calculate the energy of the ground state? ($E_\infty = 0$)

b) A helium atom if found in an excited state of energy -21.4 eV. What is the wavelength of the radiation emitted by the deexcitation of the atom that returns it to the ground state?

Take: $h=6{,}62.10^{-34}$ Js, $c=3.10^8$ m/s, 1 eV$=1{,}6.10^{-19}$ J. (4 pts)

Good Work

مسابقة في الفيزياء (ب) — مباراة إمتحانات الدخول
المدة: 45 دقيقة — العام الدراسي 2005_2004
مجلس طلاب الفرع-1

N°I: (6 pts)

A point M of mass m = 10g describes a straight line the time equation of motion:
$x = t^2 - 2t + 2$ (x in m , t in sec).

a) Calculate the velocity of (M) at t = 1sec and t = 2sec.
b) Calculate the acceleration of (M).
c) Calculate the kinetic energy of the point (M) at t = 1sec and t = 2sec.
d) Calculate the work done by the force applied to the point M at t = 1sec and t = 2sec.

N°II: (7 pts)

With the discovery of artificial radioactivity, it is now possible et associate each element with a certain number of radio-isotopes having the same chemical properties as the stable element. Such radio-elements are used in medical analysis.

1) The isotope $^{24}_{11}Na$ is obtained by bombarding the element $^{23}_{11}Na$ with neutrons. Write down the reaction of formation of the sodium $^{24}_{11}Na$.

2) The sodium 24 is a β^- emitter and its period is 15h. Knowing that the daughter (produced) nucleus is a magnesium one Mg, write the balanced reaction of disintegration of $^{24}_{11}Na$.

3) A $10cm^3$ of a solution containing $^{24}_{11}Na$ with a concentration 10^{-3}mol/L is injected in the blood of human body. Find the number of moles of sodium 24 introduced in the blood.

N°III: (7 pts)

A capacitor of capacity c=1.3μF is initially charged under a voltage of V=6.0V and connected to a resistance R=2.0KΩ.

a) Draw the electric circuit figure.
b) Calculate the time constant τ of the Rc circuit, what is the physical significance of it?
c) What is the time of maximum change?
Calculate the potential difference U_0 across the capacitor, the charge Q_0 and the stored energy E_0 by the capacitor.

Good Luck