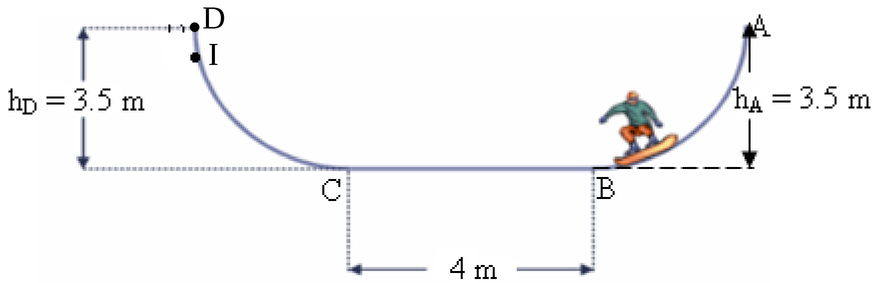
دورة سنة 2009 العادية	امتحانات شهادة الثانوية العامة فرعا : الاجتماع و الاقتصاد و الآداب و الإنسانيات	وزارة التربية والتعليم العالي المديرية العامة للتربية دائرة الامتحانات
الاسم: الرقم:	مسابقة في مادة الفيزياء المدة: ساعة واحدة	

<u>This exam is formed of three exercises in two pages</u>
<u>The use of non- programmable calculators is recommended</u>

<u>First Exercise</u> (7 points)

Transformations of energy

The object of this exercise is to study the transformations of energy during the motion of a skater, taken as a particle, on the path ABCD.



The mass of the skater with his equipment is 60 kg. The force of friction along the part BC (BC = 4m) is constant and horizontal and of magnitude f = 60 N ; we neglect the force of friction along the parts AB and CD of the path.
The horizontal plane containing BC is taken as a gravitational potential energy reference.
Take $g = 10\ m/s^2$.
The skater starts from rest from the point A at an altitude $h_A = 3.5$ m.

1) ***a)*** In what form is the energy stored in the system (S) [skater -Earth] at point A? Calculate the value of this energy.
b) Deduce the value of the mechanical energy $M.E_A$ of the system (S) at point A.

2) While going down from A to B, the system (S) loses gravitational potential energy. Why?

3) Determine the mechanical energy $M.E_B$ of the system (S) at point B.

4) While moving from B to C, the system (S) loses a part E_1 of its energy.
a) In what form of energy does this loss appear?
b) Knowing that $E_1 = f \times BC$, calculate E_1.
c) Deduce the value of the mechanical energy of (S) at point C.

5) Determine the height of the highest point I that the skater may reach on the part CD.

<u>Second Exercise</u> (7 points)

Effect of radiations on the living organism

Read carefully the following selection then answer the questions that follow

« Radiotherapy is a technique used in medicine for destroying cancerous cells. It may be done using cobalt ($^{60}_{27}Co$) or polonium ($^{210}_{84}Po$) …

Cobalt disintegrates giving γ radiation that destroy the malignant (infected) cells without altering deeply the healthy ones.
The implanted polonium produces intense but localized α radiation thus destroying also the malignant (infected) cells without altering the surrounding healthy tissues…
A person (A), treated by cobalt, absorbs 0.05 J/kg of γ radiation; another person (B), treated by polonium, absorbs 0.05 J/kg of α radiation » .
Given : R.B.E (γ) = 1 and R.B.E (α) = 20 .

Physiological Equivalent of dose (Sv)	**Effect**
> 10	Mortality
5	Diarrhea and 50% mortality
2	10% mortality and cancer
1	Digestive troubles
0.05	Modification of the blood formula

Questions
The disintegration of cobalt takes place according to the following reaction:

$$^{60}_{27}Co \rightarrow {}^{60}_{26}Fe + {}^{A}_{Z}X + \gamma$$

.

1) ***a)*** Determine, specifying the laws used, the values of A and Z
b) Identify the emitted particle $^{A}_{Z}X$.
2) We read in the selection about radiotherapy as a medical technique. Give the names of two other techniques used in medicine.
3) Draw from the selection the statement that refers to the absorbed dose.
4) Calculate, in Sv, the physiological equivalent of dose for the person (A) and that for (B).
5) Specify, with justification, the effect of these radiations on (A) and on (B).

Third Exercise (6 points)

Motion of the planets

Read carefully the following selection then answer the questions that follow
« The motion of the planets in the deep sky has been a mystery since ancient times … the retrograde motion of Mars was particularly surprising … Tycho Brahé (1546 - 1601), performing so accurate observations without using a telescope, was able to draw large data from which Kepler (1571-1630) was able to establish the three empirical laws of the planetary motion… Later on, Isaac Newton (1642 - 1727), by his law of universal gravitation, confirmed these laws of Kepler … »
Questions

1) The planet Mars belongs to one of the two groups of the solar system.
   a) What is the name of this group?
   b) What do we call the other group of planets? Give the name of one planet of this group.
   c) The retrograde motion of Mars was interpreted by Ptolemy by introducing two trajectories. Give the names of these two trajectories.
2) What is the basic difference between the geocentric theory and the heliocentric theory?
3) Draw from the selection the statement that shows the contribution of Tycho Brahé in astronomy.
4) Kepler established three laws of the planetary motion. Give the statements of these laws.
5) Two satellites (A) and (B), of equal masses, orbit the Earth at the respective distances d_A and d_B so that $d_A > d_B$. Earth exerts on (A) and (B) forces of attraction of respective magnitudes F_A and F_B. Compare, with justification, F_A and F_B.

امتحانات الشهادة الثانوية العامة
فرعا : الاجتماع و الاقتصاد والآداب و الإنسانيات
اسس التصحيح مادة الفيزياء.دورة سنة 2009 العادية

First Exercise (7 points)

1)

a) Gravitational potential energy (½)
$PE_A = mgh_A = 60\times10\times3.5 = 2100$ J (**1½**)

b) $ME_A = KE_A + PE_A$
$= 0 + PE_A = 2100$ J (½)

2) Because height decreases (½)

3) Mechanical energy is conserved because no friction (½)

$\Rightarrow ME_B = ME_A = 2100$ J. (½)

4)

a) In the form of heat (½)

b) $E_1 = f\times BC = 60\times4 = 240$ J (½)

c) $ME_C = 2100 – 240 = 1860$ J (**1**)

5) $ME_C = ME_I = 0 + mgh_I = 1860$
$\Rightarrow h_I = 3.1$ m. (**1**)

Second exercise (7 points)

1)

a) Conservation of mass number : **(½)**
$60 = 60 + A \Rightarrow A= 0$. **(½)**

Conservation of charge number : **(½)**
$27 = 26 + Z \Rightarrow Z = 1$. **(½)**

b) The emitted particle is positron (${}^{0}_{+1}e$). **(½)**

2) Scitigraphy and tomography **(1½)**

3) The body absorbs an energy of 0.05 J/kg **(½)**

4) E = D ×R.B.E . **(½)**
For (A) : $E_A = 0.05\times1 = 0.05$ Sv. **(½)**
For (B) : $E_B = 0.05\times20 = 1$ Sv . **(½)**

5) **For (A)**: Modification of blood formula **(½)**
For (B): Digestive problem **(½)**

Third exercise (6 points)

1)

a) Inner group (or terrestrial). **(½)**
b) Outer group. **(½)**
any one of (Saturn Jupiter, Uranus, Neptune, Pluto. **(½)**
c) Epicycle and deferent **(½)**

2) In the heliocentric theory the Sun is the center of the universe, but in the Geocentric theory, the Earth is the center of the universe. **(1)**

3) « … having done so accurate observations without using a telescope was able to draw large data … » **(½)**

4) **1st law** :
The planets move along ellipses around the Sun. **(½)**
2nd law :
The speed decreases as the distance from the Sun increases and vice versa. **(½)**
3rd law :
The period increases with the average distance from the Sun. **(½)**

5) $F_A < F_B$ **(½)** because $d_A > d_B$, and Earth exerts a force of attraction which is proportional the inverse of the square of the distance between the Earth and the satellite. **(½)**