وزارة التربية والتعليم العالي
المديرية العامة للتربية
دائرة الامتحانات

امتحانات الشهادة الثانوية العامة
فرعا الاجتماع والاقتصاد والآداب والإنسانيات

دورة سنة ٢٠٠٥ الاستثنائية

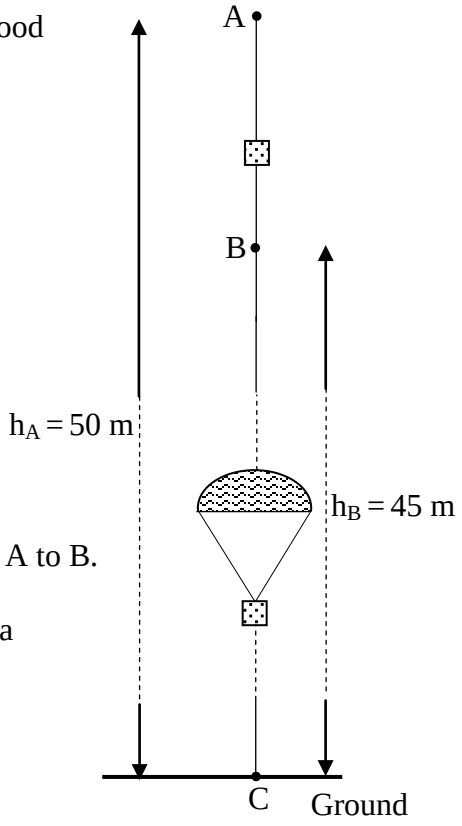
مسابقة في مادة الفيزياء
المدة: ساعة واحدة

الاسم:
الرقم:

This exam is formed of three exercises in two pages.
<u>The use of a non- programmable calculator is allowed.</u>

<u>First exercise</u> (7 pts) Mechanical energy of a system

In order to help an isolated village, a stationary helicopter releases boxes of food supplies from a height $h_A = 50$ m. Each box is provided with a parachute.
The set (S) [box, parachute] has a mass M = 50 kg.
(S), released at A without initial velocity ($V_A = 0$), moves down along the vertical trajectory ABC and reaches B, of height $h_B = 45$ m, with a speed $V_B = 10$ m/s (see the figure).
The horizontal ground is taken as a gravitational potential energy reference $(PE_g = 0)$. Take g = 10 m/s^2.



1 –The parachute remaining closed while falling from A to B, all the forces of friction are thus neglected .
a-The mechanical energy of the system [(S), Earth] is conserved along the path from A to B. Why?
b-Specify the transformation of energy that takes place while falling from A to B.

2 – Upon reaching B, the parachute opens and the set (S) continues its fall at a constant speed of 10m/s until it reaches C ($V_C = 10$ m/s).
a- Find the decrease in the mechanical energy of the system [(S), Earth] when it passes from B to C.
b- How does this loss of energy appear?

3- One of the parachutes did not open while falling from A to C. Determine, in this case, the speed with which this box reaches C.

4- What can you conclude about the role of the parachute in the fall of the box?

<u>Second exercise</u> (6 ½ pts) Nuclear medicine

Read carefully the following text then answer the questions that follow

« The spontaneous nuclear disintegrations may be used in medicine, especially in radiotherapy.
The infected cells are more sensitive to radioactive radiations than the non-infected ones. It is thus possible to destroy the infected cells by irradiation in a selective way. We may treat, for example, the tumors, of sinus , of lips , of cheeks , and of the tongue , by implanting around the cancerous cells ,3 needles or wires containing iridium $^{192}_{77}$Ir whose radioactive period is 74 days.

The activity of iridium of the implanted needle is 7×10^7 disintegrations per second; we leave these needles long enough for the dose absorbed to be sufficient. »

Questions

1- What do the numbers 192 and 77 represent with respect to the iridium nuclide?

2- The balanced equation of the nuclear disintegration of iridium 192 may be written as :

$$^{192}_{77}\text{Ir} \rightarrow \ ^{a}_{b}\text{X} + \ ^{192}_{76}\text{Os}$$

a) Applying the two laws of conservation, determine a and b.

b) Is the radioelement $^{192}_{77}\text{Ir}$ then an α, β^- or β^+ emitter?

3- We read in the text about the radioactive period, the activity and the absorbed dose.

a) Determine the time at the end of which 1g of iridium becomes 0.25g.

b) Give the definition of the activity and that of the absorbed dose.

4- Give the names of two side effects of treatment by radiotherapy.

5- The radioactive radiations are used in two techniques in nuclear medicine other than radiotherapy. Give the names of these techniques.

Third exercise (6 ½ pts) The Earth , a planet of the solar system

Read carefully the following text then answer the questions that follow

« Our corner of the universe is the solar system, a region of the cosmos arranged around a star, the Sun, and governed by its attraction. There are nine planets, their moons, asteroids, meteorites and comets.
One of these planets, the Earth , is a rocky ball of about 13000 kilometers in diameter, found at 150 millions of kilometers from the Sun. It rotates around this star in 365.25 days, with a speed of 108000 kilometers per hour.
It performs around itself a rotation in a little less than 24 hours, thus resulting in the day-night rhythm.
The Earth differs from the neighboring planets ,Venus and Mars , by the nature and the constituents of its atmosphere and the presence of liquid water.

Questions

1- Pick up from the text the set of celestial objects forming the solar system.

2- What is an asteroid ? The asteroids of the solar system form a belt . Specify its position.

3- In the text , we read about two motions of the Earth. Give the names of these two motions and specify the two natural phenomena that are due to these two motions .

4- The text includes the statement : « region of the cosmos …, the Sun , and is governed by its attraction ».

a- To what attraction does the statement refer?

b- Give the statement of the law that interprets this attraction.

5- Pick up from the text an indicator showing that no life is possible neither on Venus nor on Mars.

6- The atmosphere of Venus and that of Mars are mainly formed of a certain gas. What is that gas?

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First exercise (7 pts)

1-

a) Air resistance is neglected (no friction) during the down ward motion from A to B; therefore the mechanical energy is conserved. **(1/2pt)**

b) The potential energy is transformed into kinetic energy. **(3/4pt)** .

2- **a)** $(M.E)_B = \frac{1}{2}MV_B^2 + Mgh_B$ **(1/2 pt)**

$$(M.E)_B = \frac{1}{2}\times 50\times 100 + 50\times 10\times 45 = 25000J$$

(1 pt)

$[Or\ (M.E)_B = (M.E)_A = Mgh_A = 50\times 10\times 50 = 25000J\ ]$

.

$(M.E)_C = \frac{1}{2}MV_C^2 + (P.E)_C$ where $(P.E)_C = 0$

$\Rightarrow (M.E)_C = \frac{1}{2}\times 50\times 100 = 2500J$ **(1 pt).**

$E = (M.E)_B - (M.E)_C = 25000 - 2500 = 22500$ J **(1/2 pt)**

b) It appears in the form of thermal heat **(3/4pt).**

3- $(M.E)_A = (M.E)_C$ **(1/2 pt)**

$\Rightarrow 25000 = \frac{1}{2}MV_C^2 \Rightarrow V = 31.6$ m/s **(1 pt).**

4- The parachute reduces the speed of the box upon impact with the ground. **(1/2pt).**

Second exercise (6 ½ pts)

1- 192 = A = mass number = number of nucleons = number of proton and of neutrons. **(1/2pt)**

77 = Z = charge number = number of protons **(1/2pt)**

2-a) conservation of mass number give :

$192 = a + 192 \Rightarrow a = 0$ **(3/4 pt)**

Conservation of charge number give :

$77 = b + 76 \Rightarrow b = 1$ **(3/4 pt)**

b) It is β^+ emitter **(1/2pt)**

3-

a) $1g \xrightarrow{T} 0.5g \xrightarrow{T} 0.25g \Rightarrow t = 2\ T$

$\Rightarrow t = 2\times 74 = 148$ days **(1 pt)**

b) - Activity : is the number of disintegrations in 1 second (or in a unit time) **(3/4 pt)**

- absorbed dose : is the energy absorbed by a body per unit mass **(3/4 pt)**

4- fatigue ; lack appetite ; vomiting **(1/2pt)**

5- Scintigraphy **(1/4pt)**

Tomography **(1/4pt)**

Third exercise (6 ½ pts)

1- The Sun, nine planets, moons, asteroids, meteorites, comets. **(1/2pt)**

2- - Asteroids are rocky objects that orbit the Sun **(1/2pt)**

- is between the orbits of Mars and Jupiter **(1/2pt)**

3 – Motion: around the Sun and around itself (**1pt)**

- alternation of seasons ; alternation of day and night **(1pt)**

4- a) Universal gravitational attraction **(1/2 pt)**

b) Two bodies attract each other with a force that varies with the inverse of the square of the distance between them and with the product of their masses **(1pt)**

5- Water does not exist on Mars and Venus **(3/4 pt)**

6- The atmosphere of Mars and Venus is mainly made of carbon dioxide gas. **(3/4 pt)**