وزارة التربية والتعليم العالي
المديرية العامة للتربية
دائرة الامتحانات

امتحانات الشهادة الثانوية العامة
فرعا الآداب والإنسانيات
والاقتصاد والاجتماع

دورة سنة ٢٠٠٤ العادية

مسابقة في الفيزياء
المدة : ساعة واحدة

الاسم :
الرقم :

This exam is formed of three exercises in two pages
The use of non-programmable calculators is allowed

<u>First exercise</u> (6 pts) Electric power plants in Lebanon

The « Karaoun » lake feeds the hydro-electric power plant of « Markaba » with water whose rate of flow is 22×10^3 kg per second. Water falls a height h = 197 m.

The electric energy furnished is 34×10^6J in each second.

The level of the turbine in « Markaba » is taken as a gravitational potential energy reference.

Take g =10 m /s^2

1. Specify the form of energy stored in the system (lake water - Earth).

2. Water is a renewable source of energy .Why?

3. Determine the amount of energy provided by the falling water (received by the turbine) in each second.

4. Specify the conversion into useful energy that takes place in the power plant of « Markaba ».

5. Calculate the ratio of the energy furnished by the turbine to the energy it received, during the same time.

6. In « Jieh » thermal power plant, a part of the energy resulting from the combustion of fuel is converted into electric energy. The ratio of the energy furnished to the energy received, during the same time is 40%.
Give three advantages of « Markaba » power plant on «Jieh » power plant.

<u>Second exercise</u> (6.5 pts) A new planet

Read the following selection carefully, and then answer the questions that follow

« Sedna is a name given temporarily to an astronomical object discovered on November 14th 2003 and announced on March 15th 2004.

Few days later, its existence was confirmed by many teams.
Recently, the Hubble telescope has been directed towards Sedna looking for a moon, but with no results so far.
Sedna could be the largest object discovered in the solar system since the discovery of Pluto in 1930.
Sedna is farther than Pluto from the Sun.It has an elliptical orbit….
Scientists estimate that Sedna is the reddest planet after Mars… »
The adjacent table gives some of the so far known characteristics of Sedna. **Given:** 1 AU = 150×10^6 km

Sedna	
The largest distance from the Sun	860 AU
The shortest distance from the Sun	76 AU
Period of revolution	10500 years
Period of rotation	40 days
Surface temperature	- 270 ^oC
Angle of inclination	23 ^{o}

Questions

1. Sedna belongs to a group of planets that orbit the Sun.
   a. Give the name of this group.
   b. Give the name of two other planets of this group.
2. Draw, from the selection, the statement that expresses Kepler's first law.
3. Draw , from the table, the time needed by Sedna to perform a complete rotation :
   a. around itself.
   b. around the Sun.
4. Give one possible reason for the low temperature of the surface of Sedna.
5. Calculate, in km, the largest distance of Sedna from the Sun.
6. The orbit of Sedna is found to be inclined by 23^o with respect to the ecliptic plane. Give the definition of this plane.
7. Sedna orbits the sun according to the law of universal gravitation .
   a. Give the name of the scientist who formulated this law.
   b. Give the statement of this law.

Third exercise (7.5 pts) The effects of radioactivity

Read the following selection carefully, and then answer the questions that follow

"Few of the atomic nuclei tend to transform spontaneously into other nuclei by emitting different types of radiations… Although these radiations may damage seriously the living organisms, they are used to treat cancerous tumors. These effects depend, however, on the dose absorbed and on the exposure time…

In the museum, irradiation with gamma rays allows to sterilize and identify ancient objects. In industry, this irradiation is used to modify the structure of materials and to provoke some chemical reactions allowing the production of lighter and more resisting materials…"

Questions

A. About the text

1. Three factors determine the physiological effect of a radioactive radiation: two of them are mentioned

in the text and the third is not. Give the name of these three factors.

2. Give the names of the different radioactive radiations

3. Radioactive radiations are not always harmful.

Draw from the text three useful applications of radioactivity.

B. Biological effect

In a laboratory session of one hour, a student of mass 72 kg uses an α emitter source of radiation. The energy liberated by this source is 10^{-4}J per second.

The student absorbs 10% of the energy emitted by the source.

1. Determine, after one hour :

a. the energy liberated by the source.

b. the energy absorbed by the student.

c. the dose absorbed by the student.

2. The relative biological effectiveness of α radiation is 20. Using the table below, deduce the effects of this irradiation on the student .

Physiological equivalent of dose in Sv	**Effects**
> 10	100 % mortality
5	50 % mortality ; cancer, blood troubles , …
2	10 % mortality ; cancers, diarrhea, vomiting, …
1	Digestive troubles, sterility, increasing risk of cancer,…
0.05	Modification of the blood formula
< 0.05	No observable effect

أسس التصحيح لمسابقة الفيزياء لفرعي الانسانيات والاقتصاد والاجتماع . دورة ٢٠٠٤ العادية

First Exercise (6 points)	Second Exercise (6.5 points)	Third Exercise (7.5 points)
1. Gravitational potential energy **(1/2)** **2.** The water always reproduced (or water cycle) **(1)** **3.** $E_{received} = mgh$ **(1/2)** $E_{received} = 22 \times 10^3 \times 10 \times 197 = 4334 \times 10^4 J$ **(1/2)** **4.** Kinetic energy to electric energy **(1)** **5.** $r = \frac{E_{furnished}}{E_{received}}$ **(1/2)** $r = \frac{34 \times 10^6}{4334 \times 10^4} = 0.78$ or 78 % **(1/2)** **6.** - The efficiency of the power plant «Markaba » is greater. **(1/2)** - The power plant of « Markaba » is not polluting **(1/2)** - Water costs less than fuel in Lebanon **(1/2)**	**1 . a.** Outer planets **(1/2)** **1 . b.** Jupiter ; Saturn ; Uranus ; Neptune ; Pluto **(1)** **2.** Sedna possesses elliptic orbit **(1/2)** **3. a.** 40 days **(1/2)** **3. b.** 10500 years **(1/2)** **4.** Far from the Sun **(1)** **5.** $d = 860 \times 150 \times 10^6 = 129 \times 10^9$ km **(1/2)** **6.** The plane where most planets of the solar system **(1)** **7. a.** Newton **(1/2)** **7. b.** Two material particles attract each other by a force, proportional to the product of their masses and inversely proportional to the square of the distance between them . **(1)**	**A. 1.** Absorbed dose ; the time of exposure ; the nature of the radiation **(1.5)** **A. 2.** α ; β^- ; β^+ ; γ **(1.5)** **A. 3.** Exploration of organs ; identification of ancient objects ; modification of the material structure **(1.5)** **B. 1. a.** $E_1 = 10^{-4} \times 3600 = 0.36$ J **(1/2)** **B. 1. b.** $E_2 = \frac{E_1 \times 10}{100} = 0.036$ J **(1/2)** **B. 1. c.** absorbed dose $= \frac{E_2}{M}$ **(1/2)** absorbed dose $= \frac{0.036}{72} = 0.0005$ J / kg **(1/2)** **B. 2.** Phy.equ.dose = absorbed dose × R.B.E Phy.equ.dose = $0.0005 \times 20 = 0.01$ Sv $0.01 < 0.05 \Rightarrow$ No effect **(1)**