وزارة التربية والتعليم العالي المديرية العامة للتربية دائرة الامتحانات	امتحانات الشهادة الثانوية العامة الفروع : إجتماع و إقتصاد و آداب و إنسانيات	الدورة الإستثنائية للعام 2012
	مسابقة في مادة الفيزياء المدة ساعة	الاسم: الرقم:

This exam is formed of three exercises in two pages.
The use of a non - programmable calculator is recommended.

First exercise: (7 ½ points)

Solar water-heater

In a solar water-heater, a thermal captor has a transparent plate that traps the radiant energy of the Sun due to green house effect. Thus, the water, circulating in a darkened metallic tube inserted in the captor, heats up and serves the needs of an apartment.

Given :

- the average duration of solar energy received by the captor is 9 hours per day;
- the solar energy reaching the Earth in 1s has an average value of 600 J/m^2 ;
- the surface of the captor is 1.5 m^2 .

1) How does the green house effect take place in the thermal captor?

2) What is the form of the energy:
- **a)** stored in the Sun?
- **b)** received by the captor?
- **c)** transferred by the captor to the water?

3) Calculate the average solar energy received by the captor:
- **a)** during 1s;
- **b)** during 1 day.

4) Knowing that 30% of the energy received by the captor is transferred to water, show that the energy received by water in 1day is 8.75×10^6 J.

5) A solar water-heater costs 1.5×10^6 L.L. and functions normally for 5 years only.
On the other hand, in Lebanon, the cost of 1 kWh of the electric energy is 120 L.L.
(1 kWh = 3.6×10^6 J ; 1year = 365days).
- **a)** Supposing that the energy E received by water from the captor in 5 years is supplied from the electric mains.
  Determine the cost of the electric energy E.
- **b)** Deduce which of the two energies, solar or electric, is more economical.

6) From the environmental point of view, what is the advantage of the solar energy?

Second exercise: (6 points)

Advantages and disadvantages of radioactivity

Read carefully the following text then answer the questions.

Henri Becquerel discovered natural radioactivity in 1896.

Natural radioactivity exists in four types: α, β^- , β^+ and γ. These types may also exist in nuclear reactions in nuclear power plants that produce inexpensive electric energy. Small doses of radioactivity are also used in medicine to treat illnesses.

Nuclear power plants produce nuclear wastes that are very harmful to the environment and that should be disposed of in an appropriate manner.

Questions:

1) Define radioactivity.
2) The text mentions the four types: α, β^- , β^+ and γ.
   a) Give the name of each of the three particles: α, β^- and β^+ .
   b) Due to what is the emission of γ ?
   c) Which one of these four types of radiations is the:
      i) most penetrating?
      ii) least penetrating?
3) One of the techniques used in medicine is scintigraphy. Explain briefly this technique.
4) Pick up from the text one advantage and one disadvantage of the liberated nuclear energy.
5) The text talks about nuclear wastes.
   a) Define nuclear wastes.
   b) Name the two types of nuclear wastes.
   c) Tell how we can get rid of the nuclear wastes.

Third exercise: (6 ½ points)

Solar system

Read the following text then answer the questions.

"Before 1686, a large amount of data had been collected on the motions of Moon and planets. But clear understandings of the forces that compel these celestial bodies to move with the way they do were not yet available in this year. However, Isaac Newton provided the key that opened the secrets of heaven. He knew that a force had to act on the Moon, otherwise, it would move on a straight path instead of moving on its nearly circular orbit. Newton reasoned that this force occurs as a result of gravitational attraction that the Earth exerts on the Moon. He also concluded that this force is also of the same nature as the forces exerted by the Sun on the planets and other constituents of the solar system to keep them in their orbits."

Questions:

1) Give the names of four constituents of the solar system.
2) The planets in the solar system are classified into two groups.
   a) Give the name of each group.
   b) The two groups are separated by a belt of solid objects. Give the name of these objects.
   c) How does the year of a planet vary as its distance from the Sun varies?
3) In the text we read: "Isaac Newton provided the key that opened the secrets of heaven." What is this key?
4) a) What do we call the forces exerted by the Sun on the planets?
   b) State the law corresponding to these forces.
   c) Give the form of the trajectory of the motion of the Earth around the Sun according to:
      i) Kepler;
      ii) Copernicus.
5) Referring to the text, what would be the trajectory of the motion of the Earth, if the force exerted by the Sun on the Earth does not exist?

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First exercise: Solar water-heater		7 ½
Part of the Q	**Answer**	**Mark**
1	The green house effect takes place by a transparent plate that allows the solar rays to pass and captures (traps) the infrared radiations inside, producing thus a considerable heating.	**1**
2.a	Nuclear energy (fusion).	½
2.b	Radiant energy (radiation).	½
2.c	Thermal energy (heating)	½
3.a	Energy received by the captor in 1 s: $600\times1.5 = 900$ J.	¾
3.b	Energy received by the captor in 1day: $900\times9\times3600 = 2.916\times10^{7}$ J.	¾
4	Energy received by water in 1 day: $2.916\times10^{7}\times\frac{30}{100} = 8.75\times10^{6}$ J	**1**
5.a	Energy received by water in 5 years : $8.75\times10^{6}\times5\times365 = 1.6\times10^{10}$ J Energy received by water in kWh: $E = \frac{1.6\times10^{10}}{3.6\times10^{6}} = 4.44\times10^{3}$ kWh The cost of the electrical energy E is $4.44\times10^{3}\times120 = 0.533\times10^{6}$ L.L.	½ ½ ½
5.b	The electric energy is more economical since the price of the water heater is greater than that of the cost of the electrical energy.	½
6	The solar energy is not polluting.	½

Second exercise: Advantages and disadvantages of radioactivity		6
Part of the Q	**Answer**	**Mark**
1	The radioactivity is a spontaneous nuclear transformation during which a nucleus is transformed into another nucleus with the emission of radioactive radiations.	¾
2.a	α: Helium, β^- : electron , β^+ :positron	¾
2.b	this emission is due to the drop of the obtained daughter nucleus from an excited state to a lower state.	½
2.c.i	γ: most penetrating	¼
2.c.ii	α: least penetrating	¼
3	The scintigraphy is the injection of radioactive elements of small amount in the human body, it permits to visualize, localize, study and control the working of the organs, thanks to the detection of radioactive γ rays.	¾
4	Advantage: producing electrical energy – used in medicine Disadvantage: produce nuclear wastes	**1**
5.a	The unused fuel and products of fission in nuclear power plants.	¾
5.b	Wastes of short radioactive period Wastes of long radioactive period	½
5.c	These wastes are shut in concrete containers underground.	½

Third exercise: Solar system		**6 ½**
Part of the Q	**Answer**	**Mark**
1	The Sun, the planets, the satellites and the asteroids (or comets, meteorites)	**1**
2.a	Inner Planets and outer planets.	½
2.b	The asteroids.	½
2.c	Increases with the distance from the Sun.	½
3	A force exerted by the Earth on the Moon .	½
4.a	Force of gravitational attraction.	½
4.b	Statement of the law of universal gravitation: Two bodies attract each other with force that varies with the inverse of the square of the distance between them and with the product of their masses.	**1**
4.c.i	Ellipse	½
4.c.ii	Circle	½
5	The trajectory is a straight path, because according to the text: "He knew that a force had to act on the Moon, otherwise it would move on a straight path.	**1**