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

First exercise: (6 pts)

Solar energy for the contribution of the settlement of electricity in Lebanon

Read carefully the following selection then answer the questions that follow.
« The development of alternative forms of energy constitutes one of the solutions considered to settle the problem of electricity in Lebanon. In this perspective, the Ministry of Energy and Water launched a media campaign to increase public awareness of using alternative forms of energy. This campaign puts an emphasis, in the first place, on the advantages of solar energy in heating water…   The source of solar energy is free, inexhaustible, clean and respectful for the environment…

The rapid changes on the ecological and economic level, as the pollution of air in cities, the Global warming, the rise in the price of fuels, urge the governments to turn to alternative sources of energy. The ministry confirms that it is possible to reduce by 10% the demand of electricity for the needs of hot water, which is not a negligible percentage ».

L'orient Le jour (july 12th 2006)

Questions:
1) Specify the origin of the energy provided by the Sun.
2) Pick up, from the text, the statement showing that:
   a) the Sun is a renewable source of energy.
   b) the solar energy is non-polluting.
3) The solar energy may be collected and converted into electric or thermal energy.
   Give, for each of these transformations, the name of the corresponding energy converter.
4) Give the name of the main source of electric energy presently used in Lebanon.
5) The Ministry of Energy and Water talks about alternative energy sources to produce electricity.
   a) Pick up, from the text, three reasons for which the turn to alternative sources of energy is needed.
   b) Name two non-polluting alternative energy sources that may be used in Lebanon.

Second exercise: (7pts)   Iodine and the thyroid gland

Iodine is indispensable for the human organism. The assimilation of iodine takes place in the thyroid gland. Iodine has only one non-radioactive natural isotope: the iodine $^{127}_{53}$I. On the other hand, its artificial isotope, the iodine131 is radioactive, a β^- emitter of period (half-life) 8 days. During its decay, it gives xenon ^A_ZXe . During nuclear accidents, iodine 131 is emitted to the atmosphere. This iodine is used in medicine for the examination, by scintigraphy, of the adrenal glands (glands that are above the kidneys).

Questions:

1) What is meant by the term "*isotopes*"?
2) Write down the equation of the decay of iodine 131 and calculate A and Z specifying the laws used.
3) The text refers to a technique used in nuclear medicine. Give the name of two other techniques.
4) What gland fixes iodine in the human body?
5) In an examination of adrenal glands, we inject 8×10^{-9} g of iodine 131.How long does it take the mass of this iodine to become 2×10^{-9} g?
6) The people living in the neighborhood of nuclear power plants take tablets of the non-radioactive iodine 127.These tablets must be taken in the case of radioactive leakage of iodine 131. Why?

Third exercise: (7pts)   The solar system

Read carefully the following selection then answer the questions that follow.
« …..for a long time, astronomy, the *head* of sciences, « *rested on* » its laurels (glories) due to the lack of instruments of observation. Many revolutions must have turned it upside-down.
First of all the « astrophysical revolution » then the « cosmological revolution »……
In the 16th century, the astronomer Copernicus replaced the system of Ptolemy by another in which the Sun occupies the center of the solar system.
Although the model of Copernicus enables to describe correctly the motion of planets, it has some disagreements: this is the case of the planet Mars, for example, whose orbit was calculated precisely by the astronomer Tycho Brahé. The problem was solved by the astronomer Kepler who published that the trajectories of their planets are elliptical and that the speed of a planet increases as its distance from the Sun decreases and vice versa… ».

Questions:
1) The development of astronomy is related to the progress in the instruments of observation.
   a) Define astronomy.
   b) Pick up, from the text, the statement that shows the importance of the instruments of observation in the development of astronomy.
   c) Give the name of the physicist who invented the first telescope made for astronomical observations.
2) Two theories describe the structure of the universe and the laws governing the motion of celestial bodies.
   a) Name these two theories;
   b) Pick up, from the text, the statement:
      i) that refers to one of these two theories.
      ii) that shows the contribution of Tycho Brahé to the development of this theory.
3) Specify the shape of the trajectories described by the centers of the planets:
   a) according to Ptolemy;
   b) according to Kepler.
4) Pick up, from the text, the statement that expresses Kepler's 2nd law.
5) The average distances of Mercury and Mars from the Sun are 57×10^{6} km and 228×10^{6} km respectively. We know that the period of revolution of one of these planets is 687days and that of the other is 88 days. Which one is the period of Mars? Justify by stating the corresponding law.

First exercise: (6 pts)	Second exercise : (7 pts)	Third exercise: (7 pts)
1) Nuclear fusion reaction in the Sun. (**½ pt**)	**1)** Same charge number **Z** but of different mass number **A** (**1 pt**)	**1)** **a)** Astronomy is the science that studies position, motion, structure and the evolution of celestial bodies. (**1 pt**)
2) **a)** The solar energy is inexhaustible (**½ pt**) **b)** The solar energy is clean and respectful for the environment. (**½ pt**)	**2)** $_{53}^{131}\text{I} \rightarrow {}_{Z}^{A}\text{Xe} + {}_{-1}^{0}\text{e}$ (**½ pt**) The conservation of **Z** gives : $53 = Z + (-1)$; $Z = 54$ The conservation of **A** gives : $131 = A + 0$; $A = 131$ (**2 pt**s)	**b)** Due to the lack of instruments of observation. (**½ pt**) **c)** Galileo. (**½ pt**)
3) From solar energy into electrical energy (solar cells) (**¾ pt**) From solar energy into thermal energy (solar panels) (**¾ pt**)	**3)** Radiotherapy (**½ pt**) Tomography. (**½ pt**)	**2)** **a)** The Geocentric theory and the Heliocentric theory. (**1 pt**) **b)** **i)** « The Sun occupies the center of the solar system » (**½ pt**)
4) Fuel . (**½ pt**)	**4)** The thyroid (**½ pt**)	**ii)** - Construct a large observatory which allowed him to obtain precious data about the motion of planets. (**½ pt**)
5) **a)** Pollution of air - global warming – rise of price of fuel. (**1 ½ pt**)	**5)** $2T = 16$ days (**1 pt**)	- invented several measuring instruments (**½ pt**)
b) Wind energy (**½ pt**) Hydroelectric energy (**½ pt**)	**6)** Taking tablets of iodine 127, makes the thyroid saturated by non radioactive isotope, thus avoiding fixing the radioactive iodine. (**1 pt**)	**3)** **a)** Circular (Ptolemy) ; (**½ pt**) **b)** Elliptic (Kepler). (**½ pt**)
		4) « the speed of a planet increases as the distance from the Sun decreases » (**½ pt**)
		5) $T = 687$ days, according to the 3rd law of Kepler : the period of revolution of a planet increases with its average distance from the Sun. (**1 pt**)