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

First exercise   (7 pts)   S.O.S Lebanon

Read carefully the following selection then answer the questions that follow:

"The state of the environment in Lebanon is alarming… Lebanon is overexploiting its resources, and the profitable and simple activities, like recycling, are very limited and even not known …

More than 4000 tons of domestic wastes are produced every day in Lebanon, most of which are thrown in the open air or driven to the sea. Forests are shrinking rapidly due to fires, to the rapid urban development and to the illegal exploitation of wood…The catastrophe also affects the rare resources of drinking water because of the so many sources of pollution such as used water, wastes…

The pollution also affects air, especially in the industrial regions as in Chekka, Selaata and Sibline and in the urban concentrations around the Great Beirut where thousands of vehicles throw off their toxic exhausts in the atmosphere…"

"Green peace   2006"

Questions
1) In the text, we read about one method used to treat some domestic and industrial wastes.
   a) With what name is this method known?
   b) Pick up , from the text, the sentence showing that this method is rarely used in Lebanon.
2) Pollutants are classified into two categories.
   a) Give the names of these two categories.
   b) Specify the difference between these two categories.
3) Pick up three sources of pollution mentioned in the text.
4) When we look at Beirut from one of the surrounding hills, we notice that it is enveloped with a foggy mixture, the "smog". Give the names of three of the gases forming it.
5) The exhaust pipes of vehicles release polluting gases into the atmosphere.
   a) Give the name of one of these gases and specify its effect on the public health.
   b) A device is installed in cars in order to reduce the pollution of the atmosphere.
      Give the name of this device.
   c) It is recommended to use unleaded fuels for cars. Why?
 6) Each car releases to the atmosphere, on the average, 4.3 tons of carbon dioxide per year.
      Trees are planted in order to reduce air pollution.
   a) Specify the effect of pollution by carbon dioxide on Earth.
   b) Trees and plants ensure restoring gaseous equilibrium in the atmosphere. How?

Second exercise   (7 pts)   Radiotherapy by the cobalt $^{60}_{27}Co$

The $^{60}_{27}Co$ nuclide, used in radiotherapy, is radioactive and is a β^- emitter. The daughter nucleus obtained as a result of the disintegration of the cobalt $^{60}_{27}Co$ nucleus is denoted by $^A_Z X$.

1) What is meant by radiotherapy?

2) The equation of the decay is of the form: $^{60}_{27}Co \longrightarrow\ ^A_Z X + \beta^-$

   a) Identify the emitted particle β^- .

   b) Calculate A and Z specifying the laws used.

   c) Identify the daughter nucleus using the following table :

Element	Cobalt	Copper	Iron	Nickel
Symbol	Co	Cu	Fe	Ni
Charge number	27	29	26	28

3) The β^- disintegration is often accompanied with the emission of γ radiation.

   a) Due to what is the γ radiation emitted?

   b) Specify the nature of the γ radiation .

4) Calculate, in joules, the energy liberated by the disintegration of one nucleus of cobalt 60.

   Given: mass of the $^A_Z X$ nucleus is 59.915 u;

       mass of the $^{60}_{27}Co$ nucleus is 59.919 u;

       mass of an electron is 5.49×10^{-4} u;

       1 u = 1.66×10^{-27} kg;

       speed of light in vacuum is c = 3×10^8 m/s.

5) A source of cobalt is used during a radiotherapy session that lasts for 10 minutes.

   a) Calculate the number of disintegrations produced by that source during this session of radiotherapy knowing that this source produces 1.74×10^7 disintegrations per second.

   b) Calculate, in joules, the energy liberated during 10 minutes.

   c) The absorption of the radiations emitted by the disintegration of cobalt becomes dangerous when the energy liberated exceeds 3J.
      Why is this radiotherapy session not dangerous?

Third exercise   (6 pts)   Liquid water on Mars

Read carefully the following selection then answer the questions that follow:

"Mars is the fourth planet according to its distance from the Sun. It has two small moons that are similar to asteroids. The atmospheric pressure on its surface is around 0.6% of that on Earth and its temperature varies between -100°C and 0°C. When Mars approaches Earth, it seems in the form of a reddish body whose brightness undergoes wide variations.

The NASA declared that water was found with large quantities on Mars, which made possible for some kind of life on it. The researchers did reach their conclusion from the actual composition of the rocks that contain especially sulfates and other minerals that were formed in the presence of water ,from the shape of certain rocks containing cavities where some crystals are formed as well as the large amounts of salts found by a robot ".

Questions

1) Mars and other planets belong to one of the two groups of the solar system:

   a) Give the name of this group.

   b) Give the name of the other group.

   c) Give the names of the other planets of the group to which Mars belongs.

2) A moon orbits a planet. Around what does an asteroid rotate?

3) Due to what is the red color of Mars?

4) What is the main gas constituting the atmosphere of Mars?

5) a) Pick up, from the text, one reason showing that liquid water cannot exist today on the surface of Mars.

   b) Draw ,from the text , two indications showing that liquid water existed long ago on the surface of Mars.

First exercise: (7 pts)

1) **a)** Recycling. ($\frac{1}{2}$ **pt**)

 b) It is limited and even not known. ($\frac{1}{2}$ **pt**)

2) **a)** Biodegradable and non biodegradable. ($\frac{1}{2}$ **pt**)

 b) - Biodegradable decomposed quickly. ($\frac{1}{2}$ **pt**)

 - Non biodegradable decompose slowly. ($\frac{1}{2}$ **pt**)

3) **-** Wastes; used water; gases ejected by cars. ($\frac{3}{4}$ **pt**)

4) Carbon monoxide, Nitrogen Oxide, Sulfuric Oxide.($\frac{3}{4}$ **pt**)

5) **a)** The Sulfuric Oxide : cause bronchitis
 The Carbon Monoxide: reduce the capacity of oxygen

 in blood. ($\frac{3}{4}$ **pt**)

 b) Filters. ($\frac{1}{2}$ **pt**)

 c) Because Lead is the major cause of cancer. ($\frac{1}{2}$ **pt**)

6) **a)** Global warming. ($\frac{1}{2}$ **pt**)

 b) The plants absorb carbon dioxide and yield oxygen to

 the atmosphere (photosynthesis) ($\frac{3}{4}$ **pt**)

Second exercise : (7 pt)

1) The radiotherapy is the destruction of cancerous
 cells by irradiating the tumor by the γ radiations.

 ($\frac{3}{4}$ **pt**)

2) **a)** The emitted particle β⁻ is an electron $_{-1}^{0}e$. ($\frac{1}{4}$ **pt**)

 b) $_{27}^{60}Co \rightarrow _{Z}^{A}X + _{-1}^{0}e$
 The law of conservation of the charge number Z gives:
 $27 = Z - 1 \Rightarrow Z = 28$
 The laws of conservation of the mass number A gives:
 $60 = A + 0 \Rightarrow A = 60$ **(1 pt)**

 c) The daughter nucleus is nickel ($\frac{1}{2}$ **pt**)

3) **a)** The nucleus is in the excited state. ($\frac{1}{2}$ **pt**)

 b) Electromagnetic wave (or photon). ($\frac{1}{2}$ **pt**)

4) $\Delta m = m_{before} - m_{after}$ ($\frac{1}{4}$ **pt**)

 $\Delta m = 0.003451$ u. ($\frac{1}{2}$ **pt**)

 Thus $\Delta m = 0.003451 \times 1.66 \times 10^{-27}$ kg

 $\Delta m = 5.73 \times 10^{-30}$ kg ($\frac{1}{2}$ **pt**)

 The liberated energy E $= \Delta m \times c^2$ ($\frac{1}{4}$ **pt**)

 Thus E $= 5.157 \times 10^{-13}$ J. ($\frac{1}{2}$ **pt**)

5) **a)** n $= 1.74 \times 10^7 \times 10 \times 60 = 1.044 \times 10^{10}$ ($\frac{1}{2}$ **pt**)

 b) E' $= n \times E = 5.383 \times 10^{-3}$ J. ($\frac{1}{2}$ **pt**)

 c) E' < 3 J. ($\frac{1}{2}$ **pt**)

Third exercise : (6 pts)

1) **a)** Internal group. ($\frac{3}{4}$ **pt**)

 b) External group. ($\frac{3}{4}$ **pt**)

 c) Mercury ; Venus ; Earth. ($\frac{3}{4}$ **pt**)

2) Asteroides rotates around the Sun.

 ($\frac{1}{2}$ **pt**)

3) Because of the presence of the iron oxide
 on the surface of Mars. **(1 pt)**

4) The carbon dioxide gas ($\frac{3}{4}$ **pt**)

5) **a)** Low temperature

 or Low atmospheric pressure. ($\frac{1}{2}$ **pt**)

 b) - The sulfate present in the rocks
 - The large quantities of salt
 - The cavities in the rocks. **(1 pt)**