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| وزارة التربية والتعليم العالي<br>المديرية العامة للتربية<br>دائرة الامتحانات | امتحانات الشهادة الثانوية العامة<br>فرعا : الإجتماع والإقتصاد والآداب والإنسانيات | الدورة العادية للعام ٢٠١٢ |
| | مسابقة في الثقافة العلمية- مادة الفيزياء<br>المدة ساعة | الاسم:<br>الرقم: |

**This exam is formed of three exercises in two pages.**
**Using of a non-programmable calculator is allowed.**

## First exercise: (7 points) Pollution of the atmosphere of the Earth

**Read carefully the following text and answer the questions**

"…The industrial activities, the means of transport and the domestic heating extract their energy from fossil fuels; while burning, fossil fuels release gases that pollute the atmosphere... The scientific community affirms that the rise in the temperature of the Earth is related to the increase in the greenhouse effect, a natural phenomenon emphasized by the emission of certain pollutants…
During the XXI$^{th}$ century, the rate of atmospheric pollution should continue to increase with the population growth and the industrialization of the developing countries. The use of "clean" energies can reduce in a consequent way the polluting emissions… ".

**Questions:**

**1)** Pick up from the text, two causes responsible for :
   **a)** the pollution of the atmosphere;
   **b)** the increase in the rate of the pollution of the atmosphere.

**2)** In the text, we talk about fossil fuels.
   **a)** Give the name of three fossil fuels.
   **b)** While burning, the fossil fuels release gases that pollute the atmosphere. Give the name of two of these gases.

**3)** The rise in temperature of the Earth is related to the increase in the greenhouse effect.
   **a)** Explain briefly this effect.
   **b)** Give the name of the principal gas responsible for this effect.

**4)** The high concentration of lead in blood due to the inhalation of lead oxides causes a dangerous disease. Give the name of this disease.

**5)** In the text, we talked about energies called "clean".
   **a)** What is meant by a "clean" energy?
   **b)** Mention three "clean" sources of energy.
   **c)** Mention one of the "clean" sources of energy used in Lebanon.

**6)** Suggest three ways to reduce the pollution of the atmosphere of the Earth.

## Second exercise: (7 points) Decay α

Polonium $^{210}_{84}Po$ is a nuclide which gives, by disintegration, an α particle and the lead nucleus $^{A}_{Z}Pb$.

**Given:** Masses of the nuclei: m(Po) = 209.9829 u ; m(Pb) = 205.9745 u ; m (α) = 4.0015 u;
$1u = 1.66\times10^{-27}$ kg ; $c = 3\times10^{8}$ m/s.

**1)** What is meant by "nuclide"?

**2)** A particle α is ejected between two plates P and N: P is charged positively and N is charged negatively. This experiment shows that the α particle is attracted by one of these plates.
- **a)** Deduce that the particle α possesses an electric charge.
- **b)** Specify, with justification, the plate that attracts the α particle.

**3)** The emission of the α particle is sometimes accompanied by the emission of a γ radiation that may be used in medical fields.
- **a)** Due to what is the γ emission?
- **b)** Give the name of a medical technique that uses the γ radiation.

**4)** **a)** Write the symbol of the α particle.
- **b)** Write the equation of the disintegration of polonium $^{210}_{84}Po$, and determine Z and A of $^{A}_{Z}Pb$ specifying the laws used.
- **c)** Determine, in joules, the energy liberated by the disintegration of one polonium $^{210}_{84}Po$ nucleus.
- **d)** Deduce, in joules, the energy liberated by the disintegration of a mass $m = 209.9829\times10^{12}$ u of polonium $^{210}_{84}Po$.
- **e)** The liberated energy appears in two forms. Give the name of these forms.

## Third exercise: (6 points) Mars

**Read carefully the following text and answer the questions**

" … Mars, the red planet, is at an average distance 1.52 AU from the Sun. Mars revolves around the Sun in 687 days and rotates around itself in 24h 37 min. Its temperature varies between $-170^{0}$C and $22^{0}$C. Its atmosphere, hundred times less dense than that of the Earth, is a thin layer of a toxic gas, and a trace of other gases unable to warm it up … The red color of Mars is due to the presence of the oxide of a known metal…".

**Questions:**

**1)** Mars and other planets belong to one of the two groups of planets 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)** Pick up from the text:
- **a)** an indicator that makes life impossible on Mars;
- **b)** the period of revolution and the period of rotation of Mars.

**3)** Specify the name of the metal responsible for the red color of the planet Mars.

**4)** The Earth is closer to the Sun than Mars. Justify this statement by referring to Kepler's third law.

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| **مشروع معيار التصحيح** | مسابقة في مادة الفيزياء<br>المدة ساعة | **الاسم:**<br>**الرقم:** |

| **First exercise : Pollution of the atmosphere of the Earth** | | **7 points** |
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| **Part of the Q** | **Solution** | **Note** |
| 1.a | - industrial activities<br>- the means of transport<br>**or** the domestic heating | ½ |
| 1.b | - the population growth<br>- the industrialization of the developing countries | ½ |
| 2.a | - The Coal<br>- The petroleum (crude oil)<br>- The natural gas | ¾ |
| 2.b | - Carbon dioxide / carbon monoxide<br>- sulfur oxide<br>**or** nitrogen oxide<br>**or** lead oxide | ½ |
| 3.a | Some gases in the atmosphere trap part of the radiation diffused by the Earth<br>**or** : Certain gases, known as green house gases, reduce the escape of heat from the Earth without blocking radiation coming from the Sun.<br>Or: some gases form a layer in the upper atmosphere preventing the heat radiation (IR) diffused by the Earth to traverse the atmosphere and thus resulting in the heating of the Earth surface.<br>**or** …. | ¾ |
| 3.b | The carbon dioxide | ¼ |
| 4 | The cancer | ½ |
| 5.a | It is a non polluting source of energy | ½ |
| 5.b | - wind<br>- water of the dams/ water<br>- The Sun<br>**or** geothermal<br>**or** tides / waves | ¾ |
| 5.c | - water of the dams/ water<br>- The Sun<br>- wind | ½ |
| 6 | - using filters for the vehicles/ electric power stations<br>- Planting trees or increasing the green areas<br>- Using clean sources of energy (Sun light , air , water ….)<br>**or** Using transportation means that don't use fuel (bicycles)<br>**or** Using the public transportation | 1 ½ |

| **Second exercise : Decay α** | | **7 points** |
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| **Part of the Q.** | **Solution** | **Note** |
| 1 | A nuclide is a set of atoms having the same mass number A and the same charge number Z. | ½ |
| 2.a | - because the particle deviates in the electric field between the two plates.<br>**or** if the α particle is not charged, it will not deviated between the two plates. | ½ |
| 2.b | the α particle is attracted by the negative plate N because it is positively charged | 1 |
| 3.a | The obtained daughter nucleus is in an excited state and when it drops to the ground state it emits γ radiation | ½ |
| 3.b | The radiotherapy<br>**or** The scintigraphy<br>**or** The tomography | ½ |
| 4.a | $^{4}_{2}He$ | ½ |
| 4.b | $^{210}_{84}Po \longrightarrow {}^{A}_{Z}Pb + {}^{4}_{2}He$ .<br>Conservation laws of the mass number and of the charge number gives :<br>$210 = A + 4 \Rightarrow A = 206$.<br>$84 = Z + 2 \Rightarrow Z = 82$. | ¼<br>¼ ¼<br>¼<br>¼ |
| 4.c | $E = \Delta m_{X} c^2$.<br>$\Delta m = m(Po) - m(Pb) - m(\alpha) = 0.0069u$<br>$\Delta m = 11454 \times 10^{-33} kg$.<br>$\Rightarrow E = 11454 \times 10^{-33} \times 9 \times 10^{16} = 1.03 \times 10^{-12} J$. | ¼<br>¼<br>¼<br>½ |
| 4.d | $E' = E \times 10^{12} J = 1.03 J$ | ½ |
| 4.e | - Kinetic energy<br>- electromagnetic radiation (radiation). | ¼<br>¼ |

| **Third exercise : Mars** | | **6 points** |
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| **Part of the Q.** | **Solution** | **Note** |
| 1.a | The inner plants or terrestrial | ½ |
| 1.b | The outer planets or Jovian | ½ |
| 1.c | Mercury, Venus and the Earth | ½ ½ ½ |
| 2.a | Low temperature<br>**or** presence of toxic gas in its atmosphere | ½ |
| 2.b | - period of revolution : 687 days<br>- period of rotation : 24h 37 min | ½<br>½ |
| 3 | Iron or Iron oxide | ½ |
| 4 | The period of revolution of the Earth is $T_{Earth} = 365$ days<br>The period of revolution of Mars is $T_{Mars} = 687$ days<br>$T_{Mars} > T_{Earth} \Rightarrow d_{Earth\text{-}Sun} < d_{Mars\text{-}Sun}$ | ¾ ¾ |