وزارة التربية والتعليم العالي المديرية العامة للتربية دائرة الامتحانات	امتحانات الشهادة الثانوية العامة الفروع : إجتماع و إقتصاد و آداب و إنسانيات	الدورة العادية للعام 2013

الأثنين 8 تموز 2013	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: (6 ½ points)

Air pollution

Read carefully the following text then answer the questions

"The industrial activities, the means of transportation and the domestic heating extract their energy from fossil fuels. The large cities of the Third World (Bangkok, Mexico City…) beat records of air pollution because of the oldness of the vehicles and the very bad condition of the installations (power plants using coal). Pollution is extended to the Earth's atmosphere as a whole… The principal causes of pollution are carbon dioxide, methane, the oxides of nitrogen, … emitted by industry and agricultural fertilizers."

1) Pollutants are classified into two types.
- **a)** Give the name of each of these two types.
- **b)** Distinguish between these two types.

2) **a)** Pick up from the text a fossil fuel.
- **b)** Give the name of another fossil fuel.
- **c)** Give the name of a means consuming one of these fuels.
- **d)** Are the fossil fuels renewable or non renewable sources of energy?

3) **a)** Pick up from the text two gases responsible for air pollution.
- **b)** Name:
  - **i)** the phenomenon responsible about the rise in temperature of our planet;
  - **ii)** the principal gas causing this phenomenon.

4) Suggest two methods to reduce the air pollution.

Second exercise: (7 points)

Nuclear power plants

In a nuclear power plant, a nucleus of uranium 235 undergoes fission upon impact with a neutron thus producing a considerable amount of energy. One of these fission reactions is the following:

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{94}_{Z}Sr + ^{A}_{54}Xe + 3\,^{1}_{0}n$$

Given:
- $1\ u = 1.66 \times 10^{-27}$ kg ;
- speed of light in vacuum $c = 3 \times 10^{8}$ m/s;
- $m(^{235}U) = 234.9942$ u;
- $m(^{A}Xe) = 138.8892$ u;
- $m(^{94}Sr) = 93.8945$ u;
- $m(^{1}_{0}n) = 1.00866$ u;

1) Define nuclear fission reaction.

2) Calculate Z and A, specifying the laws used.

3) Show that the mass defect of this nuclear reaction is $\Delta m = 0.19318$ u.
4) Determine the energy liberated, in joules, by the fission of one nucleus of uranium 235.
5) Determine the energy liberated by the fission of 2 kg of uranium 235, knowing that the mass of one nucleus of uranium 235 is 3.9×10^{-25} kg.
6) A major nuclear catastrophe took place, in Fukushima (Japan-2011). Give two of its consequences.

Third exercise: (6 ½ points)

The planet Jupiter

Read carefully the following text then answer the questions

Jupiter is the biggest and the most massive planet of the solar system. The average distance between Jupiter and the Sun is $D = 7.78\times10^{8}$ km. The period of revolution of Jupiter is 11.87 years and its period of rotation is 9 h 55 min. It is a gaseous planet constituted essentially of hydrogen and of helium with a nucleus formed of rocks. Jupiter has 16 moons where the biggest ones are Io, Europe, Ganymede and Castillo; they have the size of the inner planets.
Kepler and Newton proved that the period T of revolution of a moon around a planet at a distance d from it is given by: $\frac{T^2}{d^3} = \frac{4\pi^2}{GM}$ where M is the mass of the planet and G is the gravitational universal constant.

Questions
1) There are two groups of planets:
  a) Give the name of these two groups.
  b) Indicate the group to which Jupiter belongs.
  c) Give the name of two other planets of this group.
2) During its revolution, Jupiter describes an orbit. Indicate the form of this orbit according to:
  a) Kepler;
  b) Copernicus.
3) The orbit of Jupiter, according to Kepler, belongs to a particular plane. Give the name of this plane.
4) What does the period of revolution of Jupiter represent? Indicate its value.
5) Calculate, in astronomical unit (AU), the average distance D separating Jupiter from the Sun, knowing that: 1 AU = 150×10^{6} km.
6) Use the relation: $\frac{T^2}{d^3} = \frac{4\pi^2}{GM}$ to calculate the mass M of Jupiter. Knowing that T = 42.5 hours for the moon Io and the distance between Io and Jupiter is $d = 4.22\times10^{5}$ km. Take $G = 6.67\times10^{-11}\ \frac{Nm^2}{kg^2}$.

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الفروع : إجتماع و إقتصاد و آداب و إنسانيات

الدورة العادية للعام 2013

مشروع معيار التصحيح

مسابقة في مادة الفيزياء
المدة ساعة

الاسم:
الرقم:

First exercise: (6 ½ points)

Part of the Q	Answer	Mark
1.a	Biodegradable ; non-biodegradable	1
1.b	Biodegradable: decompose rapidly by natural processes Non-biodegradable: do not decompose or decompose slowly in the natural environment.	1
2.a	coal	½
2.b	crude oil /natural gas.	½
2.c	Power plant for coal, vehicles for oil.	½
2.d	They are non renewable.	½
3.a	carbon dioxide - methane - oxides of nitrogen	½
3.b.i	Green house effect	½
3.b.ii	carbon dioxide	½
4	filters for industries – planting trees ….	1

Second exercise: (7 points)

Part of the Q	Answer	Mark
1	fission is a stimulated nuclear reaction during which a heavy nucleus is divided into two lighter nuclei under the impact of a neutron	1
2	Conservation of mass number: $235 + 1 = 94 + A + 3 \Rightarrow A = 139$ Conservation of the charge number: $92 + 0 = Z + 54 + 0 \Rightarrow Z = 38$	1 ½
3	$\Delta m = m_{before} - m_{after}$ $\Delta m = (234.9942 + 1.00866) - (138.8892 + 93.8945 + 3\times1.00866)$ $\Delta m = 0.19318$ u	1
4	$E = \Delta mc^2 = 0.19318\times1.66\times10^{-27}\times9\times10^{16} = 2.8861\times10^{-11}$ J	1 ½
5	1 nucleus = 3.9×10^{-25} kg $\rightarrow 2.8861\times10^{-11}$ J 2 kg $\rightarrow$? $\Rightarrow E_{2kg} = 1.48\times10^{14}$ J	1
6	Death of peoples, pollution of surrounding area by dangerous radiations	1

<u>Third exercise</u>: (6 ½ points)

Part of the Q	Answer	Mark
1.a	Inner group ; outer group	**1**
1.b	Outer group	**½**
1.c	Saturn – Neptune – Uranus – Pluto (only two)	**1**
2.a	Ellipse	**½**
2.b	Circle	**½**
3	Ecliptic plane	**½**
4	The period of revolution of Jupiter is the duration of one revolution of Jupiter around the Sun. T = 11.87 years	**1**
5	The average distance between Jupiter and the Sun is : D = $\frac{7.78\times10^{8}}{150\times10^{6}}$ = 5.186 AU	**½**
6	The relation: $\frac{T^2}{d^3}=\frac{4\pi^2}{GM}$ $\Rightarrow M = \frac{4\pi^2 d^3}{GT^2} = \frac{4\pi^2(4.22\times10^5\times10^3)^3}{6.67\times10^{-11}\times(42.5\times3600)^2} = 1.9\times10^{27}$ kg .	**1**