وزارة التربية والتعليم العالي المديرية العامة للتربية دائرة الامتحانات	امتحانات الشهادة الثانوية العامة فرعا: الاجتماع والاقتصاد والآداب والإنسانيات	دورة العام ٢٠١٥ الاستثنائيّة السبت ٢٢ اب ٢٠١٥

مسابقة في الثقافة العلمية ـ مادة الفيزياء — الاسم:
المدة ساعة واحدة — الرقم:

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

First exercise (7 points)

China on the track of renewable energies

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

« With using coal up to 66% of their energy consumption and petroleum up to 23%, China is the grand polluter of the world.
The exploitation of renewable sources of energy is one of the major worries of the government. This alternative sector represents today not more than 1% of the world energy production. China has great potentials; the wind reserves are considerable because the provincial areas exposed to regular wind are wide and of promising power.
The government is trying to reduce 325 million tons of CO_2 of the released gases per year . The efforts are also focused on solar energy to increase it from 3 megawatts to 30 megawatts. **»**

Le Monde: 13 August 2004

Questions

1) The newspaper describes that « China is the great polluter». Justify.
2) Coal and petroleum are two fossil fuels.
a) Name one gas, not mentioned in the text, resulting from the combustion of fuel.
b) Indicate the effect of this gas on health.
3) Pick up from the text two renewable sources of energy.
4) A gas mentioned in the text is responsible for a certain phenomenon on the Earth.
a) Name:
i) this gas;
ii) this phenomenon.
b) Indicate the effect of this phenomenon on the temperature of the Earth.
5) In the text we read about wind energy.
a) Name the source of this energy.
b) This energy may be transformed into another form of energy. Name this form.
c) Pick up, from the text , the statement that shows the importance of wind energy.
6) Suggest two means to reduce air pollution.

Second exercise (7 points)

Absorbed dose by a body

Iodine $^{131}_{53}I$ is a β^- emitter of half-life 8 days and its daughter nucleus is the xenon $^{131}_{54}Xe$.

1. a) Name the emitted particle β^-.
b) Indicate the nature of a γ ray.

2. The equation of disintegration of iodine nucleus $^{131}_{53}I$ is given by :

$$^{131}_{53}I \rightarrow {}^{131}_{54}Xe + {}^{A}_{Z}Y + {}^{0}_{0}\gamma$$

Calculate Z and A, specifying the used laws.

3. A sample of iodine-131, formed of $N_0 = 4\times10^{18}$ nuclei, is placed in a lead box.
a) Calculate the number of iodine nuclei that remain in the box at the end of 16 days.
b) Calculate the number of the disintegrated iodine nuclei during these 16 days.

4. The average kinetic energy of the emitted β^- particle by the disintegration of one iodine nucleus is of the order of 0.16 MeV and that by the emitted γ ray is of the order of 0.36 MeV.
1 MeV = 1.6×10^{-13} J.
Deduce, during these 16 days, in MeV then in joules, the energy of the emitted:
a) γ rays;
b) β^- particles.

5. The lead box, of mass m = 0.4 kg, absorbs all the β^- particles and 50% of the γ radiations.
Determine, in gray (Gy), the absorbed dose by the box during these 16 days.

Third exercise (6 points)

The universal law of Newton

Read the following text then answer the questions that follow.
"By observing, according to a legend, an apple falling on the ground, Newton was encouraged to imagine that perhaps all bodies in the universe are attracted to each other in the same way that the Earth had attracted the apple. Newton proceeded to analyze astronomical data on the motion of the Moon around the Earth. From the analysis of these data, and based on laws proposed by Kepler, Newton arrived at the idea that the force governing the motion of planets has the same mathematical form as the force that attracts an apple falling towards Earth. In 1687, Newton published his work on the law of universal gravitation in his "mathematical principles of natural philosophy."

Questions

1. a) Pick up from the text the name of the law established by Newton.
b) State this law.

2. By analyzing data, Newton discovered the force governing the motion of planets.
a) Name this force.

b) Newton demonstrated that the magnitude of this force is given by: $F = \dfrac{G\ m\ M}{d^2}$.

Calculate the magnitude of the force F exerted by the Earth of mass $M = 6 \times 10^{24}$ kg on the Moon of mass $m = 7.35 \times 10^{22}$ kg ; the average distance between Moon and Earth is d = 380 000 km ; universal constant $G = 6.67 \times 10^{-11}$ SI.

c) Two astronomers Brahe and Galileo have preceded Newton and were famous for their methods of observations.
Indicate the method of observation used by each.

3. Using the observations of Brahe, Kepler established his laws on the motion of planets. State the three laws of Kepler.

First exercise (7 points)

Part of the Q	Answer	Mark
1	89% of the energy consumed by the in China is based on the combustion of coal and petroleum are pollutants	**0.5**
2) a)	Carbon monoxide…	**0.5**
2) b)	It may cause heart troubles…	**0.5**
3	Wind energy; solar energy	**1**
4) a) i)	Carbon dioxide	**0.5**
4) a) ii)	Greenhouse effect	**0.5**
4) b)	Increase of the temperature of Earth	**0.5**
5) a)	The wind	**0.5**
5) b)	Electrical energy;	**0.5**
5) c)	The government is trying to reduce 325 million tons of CO_2 of the released gases per year	**1**
6	Using filters (catalytic exhaust); using unleaded fuel.	**1**

Second exercise (7 points)

Part of the Q	Answer	Mark
1) a)	The particle β^- is an electron.	**0.5**
1) b)	γ is an electromagnetic wave.	**0.5**
2)	$^{131}_{53}I \rightarrow {}^{131}_{54}Xe + {}^{A}_{Z}Y + {}^{0}_{0}\gamma$ Conservation of charge number: $53 = Z+54 \Rightarrow Z = -1$. Conservation of mass number: $131 = A + 131 \Rightarrow A = 0$. $^{131}_{53}I \longrightarrow {}^{131}_{54}Xe + {}^{0}_{-1}e$	**1.5**
3) a)	16 days = 2 half-lives (2 periods), $N \xrightarrow{8d} \frac{N_0}{2} \xrightarrow{8d} = \frac{N_0}{4} = 10^{18}$ nuclei.	**1**
3) b)	The number of disintegrations that take place within 16 days: $n = 4\times10^{18} - 10^{18} = 3\times10^{18}$ disintegrations.	**0.5**
4) a)	$E_\gamma = n \times 0.36 = 3\times0.36\times10^{18} = 1.08\times10^{18}$ MeV $E_\gamma = 1.08\times10^{18}\times1.6\times10^{-13} = 172800$ J	**1**
4) b)	$E(\beta^-) = n\times0.16 = 3\times10^{18}\times0.16 = 0.48\times10^{18}$ MeV $E(\beta^-) = 0.48\times10^{18}\times1.6\times10^{-13} = 76800$ J	**1**
5)	$E = \frac{50}{100} E\gamma + E\beta^- = \frac{172\,800\times50}{100} + 76\,800 = 163\,200$ J Dose : D = E/m = 163 200 / 0.4 = 408 000 Gy	**1**

Third exercise (6 points)

Part of the Q	Answer	Mark
1) a)	Law of universal gravitation	**0.5**
1) b)	Statement of the law…..	**1.5**
2) a)	Force of gravitational attraction	**0.5**
2) b)	$F = G\frac{mM}{d^2} = 6.67\times10^{-11}\times\frac{7.35\times10^{22}\times6\times10^{24}}{(380\ 000\ 000)^2} = 2.04\times10^{20}\,N$	**1**
2) c)	Brahe: observation with the naked eye Galileo: observing through a telescope	**1**
3)	Statement of one Kepler's law. • **First law**: The planets move along ellipses around the Sun that is at one of the foci. • **Second law**: The planets speed to its distance from the Sun. The speed decreases as the distance increases and vice versa. • **Third law**: Links the period of revolution of the planet to its average distance from the Sun. The period increases along with the average distance	**1.5**