


<p>المادة: الفيزياء – لغة إنكليزية الشهادة: الثانوية العامة الفرع: الآداب والانسانيات والاجتماع والاقتصاد نموذج رقم: 1 / 2019 المدة: ساعة واحدة</p>	<p>الهيئة الأكاديمية المشتركة قسم: العلوم</p>	 <p>المركز التربوي للبحوث والإنماء</p>
---	--	--

This test includes three mandatory exercises. The use of non-programmable calculators is allowed.

Exercise 1 (6½ points) Lebanon's beaches, an environmental disaster in the making

Witnessing tourists and locals alike flock to Beirut's beaches in large swathes has become a thing of the past, for many reasons.

The most obvious one is pollution and the ever-increasing bacteria levels in the water as a result of the country's inability to properly manage its waste.

It's sewage waste specifically, and one of its sources stands right next to the public beach in Ramlet-El-Bayda, a dismal complex of submarine pipes which pumps untreated waste directly into the sea.

A toxicology report, put together by the Lebanese Agricultural Research Institute, found alarmingly high concentrations of chemical and bacterial contamination, including large levels of mercury, copper, lead, and cadmium.

"By Georgi Azar and Zeina Nasser, Source: Annahar 8 July 2018"

Questions:

- 1) Wastes are the origin of a phenomenon called "pollution". Define pollution.
- 2) There are two types of pollutants.
 - 2-1) Give the name of each of these two types.
 - 2-2) Specify the type that is more dangerous.
- 3) The sewage waste is the main source of water pollution in Ramlet-El-Bayda.
 - 3-1) Pick up, from the text, the names of two pollutants and specify their harmful effect on the human health.
 - 3-2) Indicate the effect of these pollutants on the aquatic life.
- 4) According to the text, human health is in danger. The seriousness of the situation requires to reduce the pollution that affects air, water and the soil. Give a way in order to limit pollution in each medium.

Exercise 2 (7 points) Radioactivity of cadmium 113

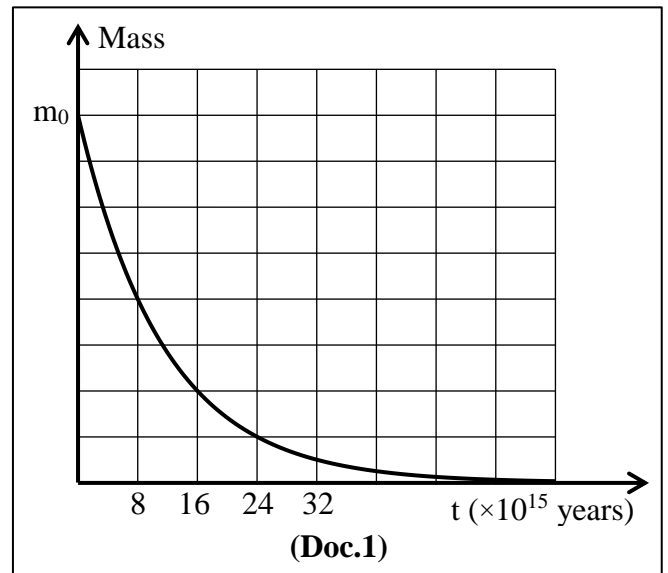
Cadmium is a heavy metal present in soil, air, and water and is listed as a priority pollutant. Cadmium toxicity in humans is caused by smoking, inhalation of dust and fumes, and by contaminated food. Naturally occurring, cadmium ($_{48}\text{Cd}$) is composed of 8 isotopes, the ^{113}Cd being a beta minus (β^-) emitter.

Given:

$$1 \text{ keV} = 1.6 \times 10^{-16} \text{ J};$$

$$\text{Speed of light in vacuum } c = 3 \times 10^8 \text{ m/s.}$$

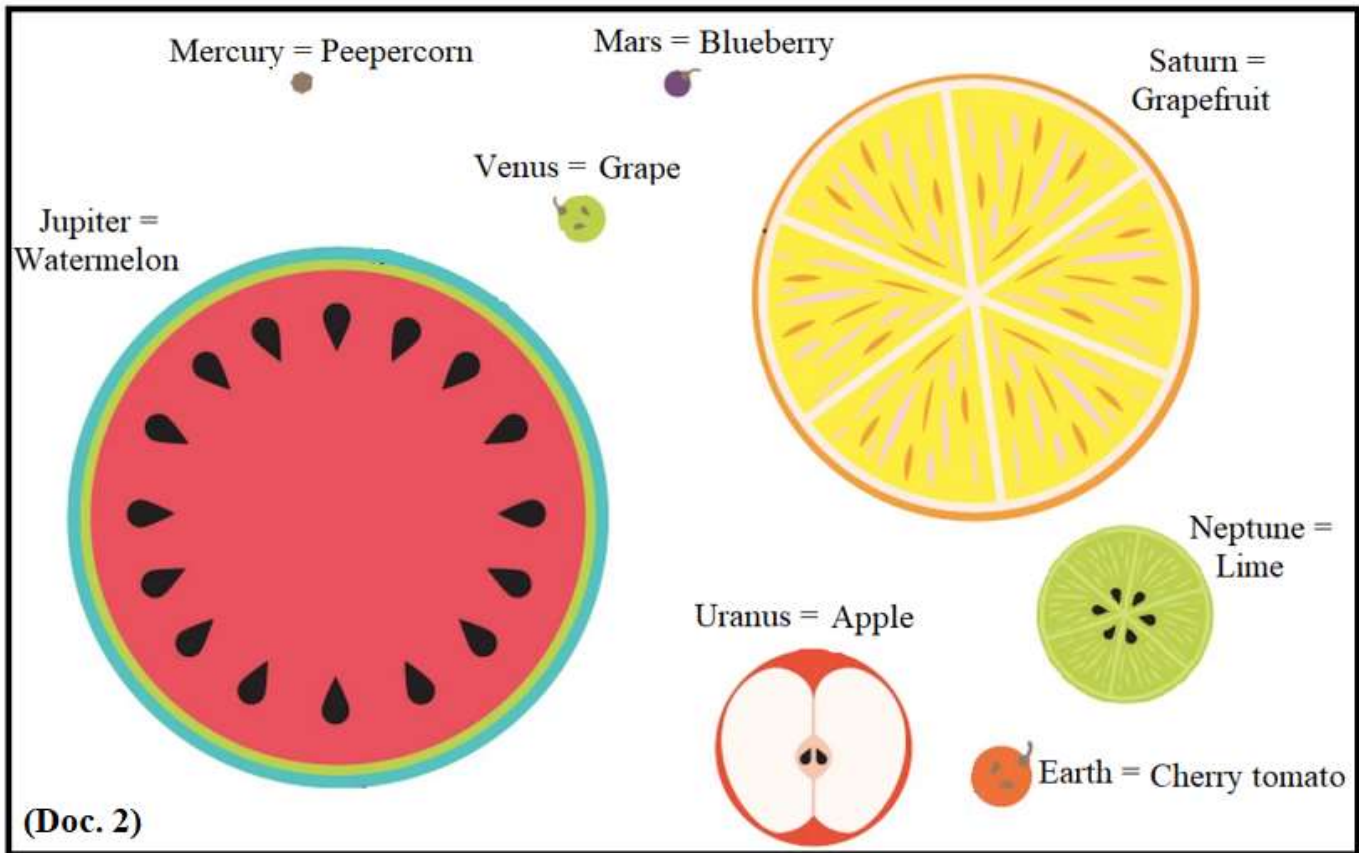
- 1) Define the isotope of an element.
- 2) The β^- radiation, a type of radioactivity, is associated to a particle.
 - 2-1) Give the name of this particle.
 - 2-2) Give a reason why this radiation is dangerous.
- 3) The decay of ^{113}Cd is represented in (Doc. 1).
 - 3-1) Define the half-life T of a radioactive substance.
 - 3-2) Determine, referring to (Doc. 1), the value of the half-life T of ^{113}Cd .



- 3-3) A sample of $^{113}_{48}\text{Cd}$ has a mass $m_0 = 8 \text{ g}$ at the instant $t_0 = 0$. Find the remaining mass of this sample at the instant $t = 3T$.
- 4) The radio-nuclide $^{113}_{48}\text{Cd}$ decays into Indium (In) according to the equation: $^{113}_{48}\text{Cd} \rightarrow \frac{A}{Z}\text{In} + \dots$
Complete the equation, indicating the used laws.
- 5) The decay of a ^{113}Cd nucleus liberates an amount of energy of 320.34 keV.
- 5-1) Convert, in joules, the value of this energy.
- 5-2) Calculate the corresponding mass lost.


Exercise 3 (6½ points) If the planets were fruits

The solar system is composed of the Sun and the group of celestial bodies that orbit around it due to its gravitational pull. The planets were compared, in relative size, using pieces of fruit in an image using data from an episode of the BBC's "Stargazing Live". The Earth is a cherry tomato compared to massive Jupiter's watermelon.



- 1) The planets of the solar system are classified into two groups.
- 1-1) Give the name of each of these two groups.
- 1-2) Name two planets of each group.
- 2) Jupiter has 16 moons 4 of which can be observed clearly by a medium sized telescope.
- 2-1) Name the scientist who made the first telescope designed for astronomical observation.
- 2-2) Indicate a way to observe the other 12 moons of Jupiter.
- 3) The asteroids of the solar system form a belt.
- 3-1) Define an asteroid.
- 3-2) Indicate the position of the asteroids belt.
- 4) The table below shows the radii of the planets of our solar system.
Complete the table below, referring to (Doc. 2), to match each planet to its corresponding radius.

Radius (km)	6378	6052	2440	60330	71400	25560	3397	24764
Planet								

المادة: الفيزياء – لغة إنكليزية الشهادة: الثانوية العامة الفرع: الآداب والانسانيات والاجتماع والاقتصاد نموذج رقم: 1 / 2019 المدة: ساعة واحدة	الهيئة الأكاديمية المشتركة قسم: العلوم	 المركز التربوي للبحوث والإنماء
--	---	---

أسس التصحيح

Exercise 1 (6½ points) Lebanon's beaches, an environmental disaster in the making

Part	Answer	Mark
1	Pollution is the contamination of the earth's environment with materials that interfere with human health, the quality of life, or the normal functioning of the living organisms.	1
2-1	Biodegradable pollutants and non-biodegradable pollutants.	1
2-2	Non-biodegradable pollutants are more dangerous because they do not decompose, and it is difficult or impossible to remove them from the environment.	1
3-1	Mercury and lead are responsible for a significant portion of the cancer observed in humans.	1
3-2	Pollution in water causes the death of fish and other aquatic life.	1
4	We can limit pollution: of air, using filters in cars and factories; of water, by preventing the disposal of sewage waters in rivers, seas and lakes; of the soil, by decreasing the use of pesticides and toxic chemical products.	½ ½ ½

Exercise 2 (7 points) Radioactivity of Cadmium-113

Part	Answer	Mark
1	The isotopes of an element are nuclides that have the same charge number but different mass numbers.	½
2-1	The particle associated to the β^- radiation is an electron ${}_{-1}^0e$.	½
2-2	β has a very large penetrating factor and it may cause cancer.	½
3-1	The half-life T (radioactive period) of a radioactive substance is the time it takes for half of the radioactive substance to decay.	½
3-2	For $t = T$, $m = m_0/2$; referring to the graph, we get: $t = T = 8 \times 10^{15}$ years	1
3-3	$8 \text{ g} \xrightarrow{T} 4 \text{ g} \xrightarrow{T} 2 \text{ g} \xrightarrow{T} 1 \text{ g}$ then the remaining mass after 3 T is 1 g.	1
4	Soddy's laws: The conservation of the mass number: $113 = 0 + A$, then: $A = 113$ The conservation of the charge number: $48 = -1 + Z$, then $Z = 49$ We get: ${}_{48}^{113}\text{Cd} \rightarrow {}_{49}^{113}\text{In} + {}_{-1}^0e$	½ ½ ½
5-1	$E = 320.34 \times 1.6 \times 10^{-16} = 51.254 \times 10^{-15} \text{ J}$	½
5-2	$E = \Delta m \times c^2$ then $\Delta m = E/c^2 = 51.254 \times 10^{-15} / (3 \times 10^8)^2 = 5.694 \times 10^{-31} \text{ kg}$.	1

Exercise 3 (6½ points) If the planets were fruits

Part	Answer	Mark																		
1-1	The inner planets and the outer planets.	1																		
1-2	(2 of each group) Inner: Mercury, Venus, Mars, Earth Outer: Jupiter, Saturn, Neptune, Uranus	½ ½																		
2-1	Galileo	½																		
2-2	Using a big telescope, or a space telescope like Hubble telescope, the Extremely Large Telescope ELT, the Very Large Telescope VLT...	½																		
3-1	An asteroid is a rocky object with an irregular shape that orbits around the Sun.	1																		
3-2	The asteroids belt lies between the orbit of Mars and that of Jupiter.	½																		
4	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Radius</td> <td>6378</td> <td>6,052</td> <td>2,440</td> <td>60,330</td> <td>71,400</td> <td>25,560</td> <td>3,397</td> <td>24,764</td> </tr> <tr> <td>Planet</td> <td>Earth</td> <td>Venus</td> <td>Mercury</td> <td>Saturn</td> <td>Jupiter</td> <td>Uranus</td> <td>Mars</td> <td>Neptune</td> </tr> </table>	Radius	6378	6,052	2,440	60,330	71,400	25,560	3,397	24,764	Planet	Earth	Venus	Mercury	Saturn	Jupiter	Uranus	Mars	Neptune	2
Radius	6378	6,052	2,440	60,330	71,400	25,560	3,397	24,764												
Planet	Earth	Venus	Mercury	Saturn	Jupiter	Uranus	Mars	Neptune												