This Exam Includes **Two Exercises**. It Is Inscribed on 2 Pages Numbered From **1** to **2**. The Use of a Non-programmable Calculator Is Allowed.

Answer The Following Two Exercises:

First Exercise (10 points)
Antibiotics

The Antibiotics Soon Inefficient

According to the Health World Organization, certain available antibiotics may not be efficient for10 to 20 years from now. Bacteria have learned how to defend themselves against our favourite medicinal drugs, and we are not sure if scientists will win the battle.

Are we just before the turn back of great epidemic diseases? …

Spectrum Action

Antibiotics could be divided according to their spectrum action and the range of this spectrum. Penicillin, of a narrow spectrum action, destroys Gram-positive bacteria (whose wall is composed of a thick layer of peptidoglycan) and the aminosides, of narrow spectrum action, attack the Gram-negative bacteria (with thin layer wall). On the other hand, tetracycline and chloramphenicols are substances of broad spectrum, efficient at the same time against the Gram-positive and the Gram-negative bacteria.

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Fusidic acid

Fusidic acid, a compound obtained from the fermentation of the mushroom *Fusidium coccineum*, proves to be active against staphylococci …

Its general structure is so close to that of steroidal hormones. The previous antibiotic is completely without hormonal effect.

Fusidic acid proves to be bacteriostatic* at low dose and bactericidal at high dose…

Its activity spectrum covers the Gram –positive only, especially *Staphylococcus aurous*, and its therapeutic indications, by association with an aminoside or a β-lactamine, are related to the treatment infections of multi resistant staphylococci.

* Bacteriostatic stops the development of bacteria

Questions:

1- Define an antibiotic. Indicate the two ways to obtain an antibiotic.
2- Antibiotics are classified into fungicidal and bactericidal.
   a) Give the meaning of each of the two terms: fungicidal and bactericidal.
   b) Indicate the class of fusidic acid.
3- By referring to the passage:
   a) Distinguish between a narrow spectrum antibiotic and a broad spectrum antibiotic.
   b) Specify if fusidic acid is a narrow spectrum or a broad spectrum antibiotic.
4- Give the benefit of the association of an aminoside to fusidic acid.
5- *˝According to the Health World Organization the antibiotics become soon inefficient, certain available antibiotics may not be efficient for 10 to 20 years from now˝*. Justify this hypothesis.

Second Exercise (10 points)
The Benefits of Almonds

Zoom on Almond
Origin
The origin of an almond tree is from the irano-afghan region. Its culture is very ancient (antiquity)…

Economy
About 450 000 tons (t) of shelled kernels are produced in the world. California is the first producer in the world with 250 000 t, Spain: 60 000T, Italy: 40 000 t, Greece: 16 000 t. Among other producers, there are Iran, Portugal, and Morocco….

Excellent for Health
Almond is rich in iron, magnesium, calcium, phosphorous, potassium, vitamins (E, B1, B2) and it does not contain sugar. It is recommended for diabetic, cardiac, and recovering persons.

To reduce the bad cholesterol
A new study in the *American Journal of Clinical Nutrition*, on February 2005, is added to many existing studies showing that kernels can contribute to reduce the amount of LDL cholesterol, the "bad" cholesterol, within the frame of a food diet …
Kernel is the most dense in nutrients among husky * fruits. A handful of kernels supplies nearly three quarters of the recommended daily needs in vitamin E and provides also great amounts of proteins, fibres, calcium, magnesium, iron, potassium….
According to another American study, within the frame of a hypo caloric diet, a daily portion of kernels favours the loss in weight and decreases the risks of cardiac diseases in a significant way.

To Favour the Supply of Vitamin E
A third study, published in March 2005 in the *Journal of the American Dietetic Association,* confirms that the consumption of kernels leads to a considerable increase of vitamin E
 « Vitamin E is a strong antioxidant that protects cells against daily attacks and prevents the oxidation of cholesterol… » .
*
* Husk: The outer covering of kernel and other similar fruits

Extracted from « Santé » N ^{0} 25 - 2005

Given: The average daily needs in minerals

Minerals	Ca	P	NaCl	K	Mg	Fe	Cu	Zn	I
Units	mg	mg	g	mg	Mg	mg	mg	mg	µg
Needs	600-1000	600-1000	8-10	3000-4000	300-400	10-20	2.5-5	10-20	100-150

Questions:

1- Indicate the main minerals that exist in kernels. Classify them as macro and trace minerals.

2- State the five nutrients. Indicate the nutrient that does not exist in kernels. Write its general formula.

3- ‴The kernel is rich in iron, magnesium, calcium, phosphorous, potassium, vitamins (E, B1, B2) and it does contain sugar‴. Explain how this information show that water and lipids are constituents of kernel.

4- Draw a bar graph to represent, in percentage by mass, the word production of shelled kernels.

Marking Scheme of Chemistry
First Exercise (10 points)
Antibiotics

Expected Answers	Mark	Comment
1- An antibiotic is a substance used to kill or to inhibit the development of certain micro-organisms.	1	
Antibiotics could be obtained by culture of microorganism (natural antibiotic) or by chemical synthesis.	1	
2-		
a) Antibiotics used to kill fungi are fungicidal and those that are used to kill bacteria are bactericidal.	2x0.5	
b) Fusidic acid is a bactericidal antibiotic when used in high doses.	1	
3-		
a) An antibiotic of a narrow spectrum is efficient against Gram- positive bacteria or of Gram-negative bacteria.	1	An antibiotic of a narrow spectrum is efficient against a specific micro-organism
An antibiotic of a broad spectrum is efficient against Gram- positive bacteria and Gram-negative bacteria.	1	
b) Fusidic acid is a narrow spectrum antibiotic because it covers the Gram-positive bacteria only.	1	
4- The association of an aminoside with fusidic acid permits the treatment of infections of multi resistant staphylococci.	1	An antibiotic of a broad spectrum is efficient against a wide variety of micro-organisms
5- This hypothesis is justified as follows: The bacteria develop a resistance against antibiotics. Bacteria have learned how to defend themselves. They are no more killed by known antibiotics. Other medicinal drugs have to be found within 10 to 20 years from now to kill this bacteria.	2	

Second Exercise (10 points)
The Benefits of Almonds

Expected answers	Note	Comments
1- The minerals that exist in kernels are :		
Iron, magnesium, calcium, phosphorus, and potassium.	1	
Magnesium, calcium, phosphorus and potassium are macro minerals because the average daily needs of each are greater than 100mg per day.	1 1	
Iron is a trace mineral because the daily need is less than 20mg.		
2- The five nutrients are: carbohydrates, lipids, proteins, minerals, and vitamins.	1.5	
Sugar is the nutrient that does not exist in kernels. Its general formula is $C_n(H_2O)_m$	2x0.5	
3-Minerals and vitamins B1 and B2 are soluble in water, so water is a constituent of almonds.	1	
Vitamin E is soluble in lipids, so lipids are also constituents of almonds.	1	
4-		
The percentage by mass of:		
California $\frac{250000}{450000}$ x100 = 55.55 %; Spain = 13.33 %; Italy = 8.89 % ;	1	
Greece = 3.55 % and other countries = 18.68 %.		
The bar graph is:		
	1.5	

The world production of shelled kernels