الاسم: الرّقم: مسابقة في مادّة علوم الحياة المدّة: ساعة واحدة

Answer the following four exercises

Exercise 1 (5 points)

Cystic Fibrosis

Cystic fibrosis is a serious genetic disease. It is characterized by respiratory and digestive disorders. The gene responsible for the disease is carried on chromosome no 7. The pedigree represents a family whose certain members are affected by this disease.

The pedigree shows three generations:

- Generation I is composed of a mother I_1 , and the father I_2 who are normal.
- Generation II is composed of an affected daughter II_1 , an affected boy II_2 , a normal daughter II_3 and Lama who is normal with her husband II_5 who is normal.
- Generation III is composed of the children of Lama: a daughter III_1 , a boy III_2 who are normal and a fetus III_3 .

1-1. Specify if the allele responsible for this disease is dominant or recessive.

1-2. Designate by symbols the corresponding alleles.

2. Indicate the possible genotypes of Lama (II₄). Justify the answer.

Lama, whose certain members of her family are affected by this disease, is pregnant. Her doctor demanded a specific test that reveals the types and the number of alleles of the studied gene. The obtained results of Lama and the fetus are represented in the document.

3. Determine the real genotype of Lama.

4. Is Lama's fetus phenotype affected? Justify your answer.

Lama II4FetusNormal allele10Affected allele12

Document

Exercise 2 (5 points) Kidney Disease, the Gout

Urea, eliminated by the kidneys in the urine, is a toxic substance. The elevated level of urea in blood provokes a disease that affects the kidneys and the joints: the Gout.

1. Pick out from the text the effect of the high amounts of urea in blood.

In order to determine the origin of urea in the blood a study is performed on healthy individuals showing the relation between the quantity of consumed proteins and the concentration of urea in plasma. The obtained results are represented in the document below.

Quantity of consumed protein (in g/Kg of Body mass)	0.5	1.5	2
Concentration of Urea in plasma (in g/L)	0.20	0.40	0.45

- **2.** Describe the variation in the concentration of urea in the plasma as a function of the quantity of consumed protein.
- **3-1**. Analyze the obtained results.
- **3-2.** Draw out the origin of urea in plasma
- **4.** Explain the cause of the Gout.

Exercise 3 (5 points) Passive smoking

Passive smoking is defined as involuntary inhalation of the cigarette smoke produced by one or more smokers found in the same area along non-smokers. Every year, 3000 to 6000 individuals who are non-smokers die because of passive smoking.

1. Pick out, from the text, the definition of passive smoking.

The document below represents the frequency of the respiratory troubles in two groups of nonsmokers:

- Group A, not exposed to cigarette smoke for long periods of time in their environment.

- Group B, exposed to cigarette smoke in their environment.

Frequency of respiratory	Coughing	Chronic bronchitis	
troubles (in%)			
A: without cigarette smoke	7	4.8	
B : with cigarette smoke	10.5	7	

- **2**. Describe the table showing the variation in the frequency of different respiratory troubles in both groups A and B.
- **3**. Justify the following statement: "Inhibition of smoking in closed public areas is a major action that protects non-smokers.

Exercise 4 (5 points) Celiac disease

The intestinal villi are small finger-like projections that line up the inner intestinal walls of the small intestine and increase its surface area.

- **1-1.** Indicate the role of the intestinal villus.
- **1-2**. List the three characteristics of the intestinal wall which favor this role.

Certain individuals are affected by celiac disease. In these individuals, the ingestion of food containing gluten provoke fatigue, diarrhea, slimming and anemia.

The document below shows the differences in the inner walls of the small intestine of a normal individual and that of an individual affected by celiac disease.

In normal individual	In individuals affected by this disease
 Normal villi 	- Damaged villi
 Normal epithelial cells 	- Damaged epithelial cells

2-1. Transform the above table into a text.

2-2. Draw out the characteristic (s) of the inner wall in the individual affected by this disease.

3. Justify why this disease can stop the growth of the infant although he consumes a balanced food diet.