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	الاسم: الرقم:	مسابقة في الثقافة العلمية مادة علوم الحياة	معدّلة	
		المدة: ساعة واحدة		

Answer the following exercises

Exercise 1 (5 points)

Iron... For What?

As vitamins,minerals and oligo-elements are indispensibleforourbody. Among these substances, iron is an essential component of hemoglobin.It allows the red blood cells to transport oxygen which is indispensiblefor our cells...

The adjacent table shows the recommended iron intake for different persons.

In case of insufficient diets, iron requirements are not satisfied. This iron deficiency can lead to numerous consequences on health; the most common one is anemia.

- 1- Pick out the molecule which necessitates the presence of iron and the consequence of iron deficiency.
- 2- Justify that the recommended intake of iron depends on sex and age.
- **3-** Name two types of food rich in iron.
- 4- Name another mineral and indicate its role.

Exercise 2 (5 points) A Cause of Obesity

Many studies performed on animals suggest the existence of a link between the increase in the ratio of dietary omega-6/omega-3 and the development of obesity.

To verify this hypothesis, researchers have divided 160 voluntary obese persons (average BMI of 31 kg/m^2) into two groups recruited for an8 months study.

During the first period of three months, these persons have followed two types of food diets, isocaloric and

isolipidic, that differ in their composition in fatty acids. The average consumption of fatty acids (FA) suggested to the volunteers (in grams of FA per volunteer and per day) is represented in the above table. At the end of this period, a loss of weight in the persons of the two groups is noticed.

Average consumption of fatty acids (in g/day)	Control Group A	Experimental Group B
Total omega6	20	5
Total omega3	1	2
Saturated fatty acids (SFA)	24	30
Polyunsaturated fatty acids (PUFA)	17	9

- **1-** Pick out the hypothesistested in this study.
- 2- Calculate the ratio of SFA/ PUFA and that of omega 6/omega 3 for each of the food diets adopted by the groups A and B. Draw out the characteristics of each of these food diets.

During a **second period** of five months, the volunteers didn't get any nutritional advice. At the end of this period, the results showed that the persons of group B didn't regain weight while the body weight and the BMI of persons in group A increased.

- **3-** Is this hypothesis validated by this study? Justify the answer.
- 4- Indicate a side effect of the food dietadopted by group B. Justify the answer.

Persons	Daily recommended intake of iron (in mg/day)
Infant 1 to 3 years	7
Infant 10 to 12 years	10
Teenager 13 to 16 years	16
Adult man	9
Adult woman	16
Woman older than 55 years (at menopause)	9
Man older than 55 years	9

Exercise 3 (5 points)

Effect of Cocaine

Pleasure sensation is related to the activity of dopaminergic neurons in "reward system". Cocaine, just like most drugs, affects this activity. In order to understand its mode of action, the following experimentsare performed.

Experiment 1:

Two lots of rats, lot 1 and lot 2, are considered.Rats of lot 2 are injected with cocaine. In both lots, the concentration of dopamine is measured in the liquid surrounding the neurons in a specific region of the cerebrum.

	Concentration of extracellular dopamine(relative unit)		
Time (min)	in lot 1	lot 2	
0	1	1	
60	1	2.5	
	•	-	

Document 1

The results of measurements done at 0 min and at 60 min following the injection are presented in, document 1.

Experiment 2:

1- Justify the following statement: "cocaine increases the pleasure sensation".

Stimulations are applied on a presynaptic excitatory neuron connected to a dopamine neuron. At T1,the frequency of AP of this dopamine neuron, thequantity of dopamine released as well as that recaptured ismeasured. The obtained results are presented in document 2.

- **2-** Explain the links existing between the different parameters measured in lot 1.
- **3- 1-**Compare the results of each of the parameters obtained at T1for the two lots.
- **3- 2-** What can you draw out concerning the mode of action of cocaine?
- **4-** Explain why the use of drugs is forbidden and not recommended.

Exercise 4 (5 points)

One Nervous Structure

A part of the nervous system consists of a nerve center, nerve, ganglion, and effector organ. The nerve center is connected to the ganglion by a nerve and the ganglion is connected to the effector organ by a nerve. In order to determine the direction of conduction of the nervous message and the neuronal circuit involved in this part of the nervous system, the following experiments are performed.

Experiment 1:

Two recording electrodes O1 and O2 and two stimulating electrodes S1 and S2 are connected at the level of the above part of the nervous system as such:

- O1 on the nerve between the nerve center and the ganglion and O2 on the nerve between the ganglion and the effector organ

- S1 on the nerve between the nerve center and the O1 and S2 on the nerve between the ganglion and O2. An effective stimulation is applied at S1, responses are recorded at the level of O_1 and O_2 .

An effective stimulation is applied at S2, a response is recorded at the level of O_2 but not at O_1 .

1- Indicate the direction of conduction of the nervous message in this part of the nervous system. Justify the answer.

Experiment 2:

The nerve is sectioned at the level of M, between the nerve center andthe ganglion, or at the level of N, between the ganglion and the effector organ. The obtained results are presented in document 2.

- **2-** Knowing that only the sectioned part of a cell that doesn't contain the nucleus degenerates, interpret the results of experiment 2.
- **3-** Explain why the nerve message was not recorded at O_1 in the case where the stimulation was applied at S2(experiment 1).

Level of the performed section	Observeddegeneration
М	only between M and the ganglion
Ν	only between N and the effector organ

Document 2

Lots at T1	Lot 1	Lot 2
Measured parameters		
Frequency of AP in the	3	3
dopamine neuron (a.u)	5	5
dopamine (a.u)	3	3
Quantity of recaptured		
dopamine by the dopamine neuron (a.u)	2	2

Document 2

امتحانات الشهادة الثانوية العامة فرع الاداب والانسانيات وزارة التربية والتعليم العالي المديرية العامة للتربية دائرة الامتحانات

مسابقة في الثقافة العلمية مادة علوم الحياة اسس التصحيح

Part	Answer key	Grade
	Exercise 1	
1	Molecules: hemoglobin½ ptConsequence: anemia. ½ pt	1
2	Recommended daily intake of iron in different persons	2,5
3	The recommended daily intake depends on age since the recommended intake for a teenager is 16mg higher than 7 mg which is that roommended for a 3-years-old child. ³ / ₄ pt The recommended daily intake depends on the sex of the individual since the recommended intake for an adult man is 0 mg inferior to 16mg which is that	1,5
	recommended intake for an adult woman. ³ / ₄ pt	

Part	Answer key	Grade
	Exercise 2	
1	Hypothesis: the existence of a link between the increase in the ratio of dietary omega-	0.75
	6/omega-3 and the development of obesity.	
2	Group A : SFA/PUFA = $24/17$ = 1,4 omega6/omega3 = $20/1$ = 20	2
	Group B : SFA/PUFA = $30/9$ = $3,3$ omega6/omega3 = $5/2$ = 2.5	
	(1pt)	
	The diet adopted by persons of group A is characterized by a SFA/PUFA lower than that	
	adopted by persons of group B and by an omega6/omega3 ratio higher than that adopted	
	by persons of group B (1pt)	
3	The hypothesis is validated (1/4pt) since persons of group B having a low ratio	1
	omega6/omega3 (the diet is rich in omega 3) didn't gain back weight while the body	
	weight and the BMI of persons of group A having a high ratio omega6/omega3 (the diet	
	is poor in omega 3 and rich in omega 6) increased. This shows that the increase of the	
	ratio of dietary omega6/omega3 favors the development of obesity. (3/4pt).	
4	A side effect of the diet adopted by the group B is being rich in SFA (1/2 pt) since SFA	1,25
	can increase hypercholesterolemia and the risk of cardiovascular diseases (3/4pt).	