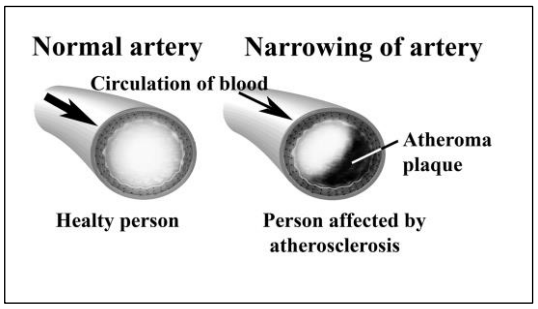
مسابقة في الثقافة العلميّة – مادة علوم الحياة
المدة: ساعة واحدة

الاسم:
الرقم:

Exercise 1 (7 points) **Atherosclerosis**

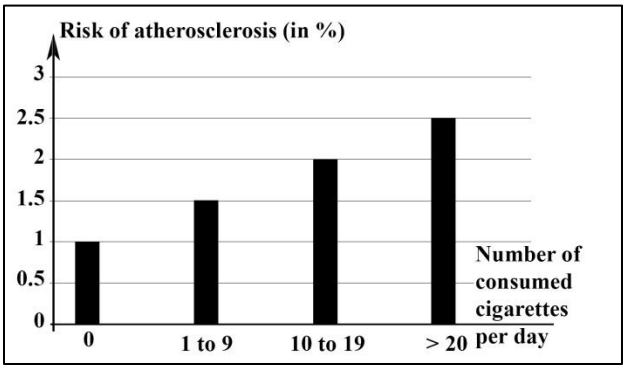
A food diet rich in lipids favors an increase in the concentration of cholesterol in blood. Consequently, lipids deposit on the walls of arteries causing the formation of atheroma plaque which is at the origin of atherosclerosis disease.
Document 1 shows a cross section of the coronary artery of a healthy person and that of an individual affected by atherosclerosis.



Document 1

1- Draw out the consequence of the formation of atheroma plaque on blood circulation.
2- Justify the following statement: LDL is a"bad cholesterol".

Document 2 represents the results of a study showing the relation between smoking and the risk of atherosclerosis development.

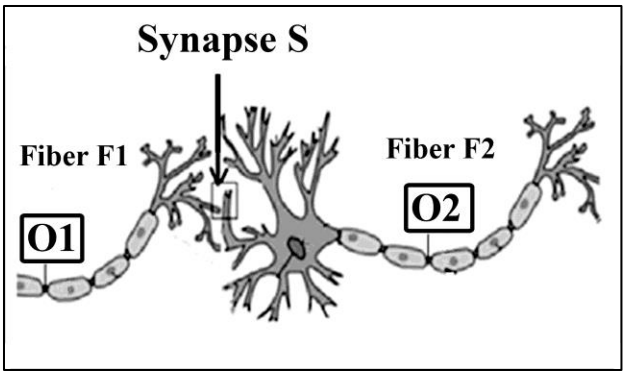


Document 2

3- Draw a table representing the results of document 2.
4.1- Analyze the obtained results.
4.2- Derive a conclusion.
5- Suggest two actions that the government would take to prevent the atherosclerosis development in the population.

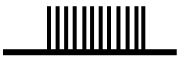
Exercise 2 (7 points) **Nerve Message**

Sensory cells for taste are sensory receptors situated on the surface of the tongue. These receptors are involved in the detection of taste: salty, sour, bitter, and sweet.
In order to determine the characteristics of the nerve message, NaCl solutions of increasing concentrations are applied on a taste receptor.
Two oscilloscopes O1 and O2 are connected to the nerve fibers F1 and F2 respectively (document 1). F1 belongs to the sensory neuron issued from the sensory taste receptor, and F2 belongs to the neuron synapsing with this sensory neuron.



Document 1

The conditions and the recordings registered at the level of O1 are shown in document 2.

Concentration of NaCl solution (mmol/L)	1	3	10	30	100
Recordings registered at the level of O1					

Document 2 **A.P: Action Potential**

1- Specify the threshold intensity of fiber F1.
2- Show that the nerve message at the level of fiber F1 is coded by frequency of action potential and not by amplitude.

Oscilloscope O2 records a nervous message for a concentration of the NaCl solution which is equal or above 10 mmol/L.

3- Indicate if synapse S is excitatory or inhibitory. Justify the answer.
4- List the steps of the transmission of the nerve message at the level of the synapse.

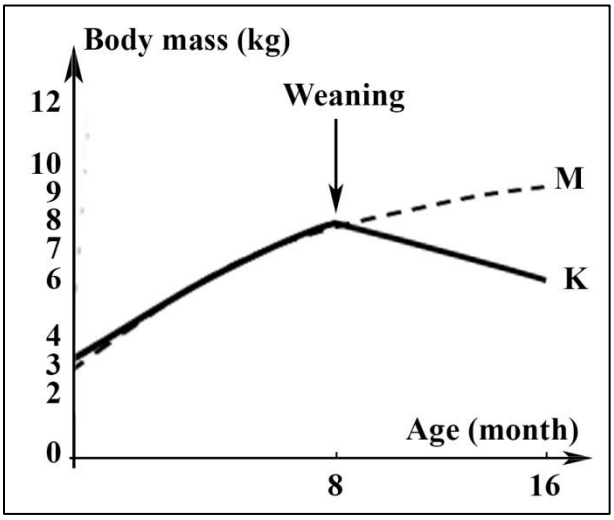
Exercise 3 (6 points)

Kwashiorkor Disease

Kwashiorkor is a disease which affects infants post weaning (arrest of breast feeding) in poor countries.
Document 1 represents the variation of the body mass of an infant (K) affected by kwashiorkor and that of the normal average mass (P).
1.1- Analyze document 1.
1.2- Draw out a symptom associated with this disease.
2- Formulate a hypothesis which explains the origin of this disease.
This disease affects infants which are nourished mainly by sweet potato and manioc, post weaning.

Document 2 represents the composition of maternal milk and manioc in organic material.

3- Indicate, by referring to document 2, the food which is the richest in each of these components: proteins, carbohydrates and lipids. Justify the answer.
4- Explain the variation of the body mass of infant (K) post weaning**.**



Document 1

Value (g per 100 g)	Proteins	Carbohydrates	Lipids
Maternal milk (dry mass)	11	55	30
Manioc	1	86	1

Document 2

مسابقة في الثقافة العلميّة – مادة علوم الحياة

اسس التصحيح

Exercise 1 (7points) **Atherosclerosis**

Q.	Answer	Mark
1	Atheroma plaque slows down the blood circulation.	**1**
2	LDL transports lipids to the body cells. However, under abnormal conditions, it deposits cholesterol on the inner walls of arteries, where it accumulates causing the formation of atheroma plaque.	**1**
3	<table><tr><td>Number of consumed cigarettes per day</td><td>0</td><td>1 to 9</td><td>10 to19</td><td>>20</td></tr><tr><td>Risk of atherosclerosis (%)</td><td>1</td><td>1.5</td><td>2</td><td>2.5</td></tr></table> Table showing the variation of the risk of atherosclerosis as a function of the number of consumed cigarettes per day.	**2**
4-1	The risk of atherosclerosis increases from 1% in the absence of smoking, to 2.5% when the rate of smoking exceeds 20 cigarettes per day.	**1**
4-2	Smoking favors the development of atherosclerosis.	**0.5**
6	− Anti-smoking actions: taxes on tobacco, inhibition of smoking in public places… − Awareness campaigns for sensitizing healthy life style.	**1.5**

Exercise 2 (7 points) **Nerve Message**

Q.	Answer	Mark
1	The threshold intensity is 3 mmol/L since it's the minimal intensity (concentration) that provokes a response at the level of the nerve fiber (1A.P).	**1.5**
2	The frequency of AP increases from 1 to 12 A.P while the amplitude stays constant, as the concentration of salt solution increases from 3 to 100 mmol/L. This shows that the nerve message is coded, at the level of the nerve fiber, in frequency of AP but not in amplitude.	**2**
3	This synapse is excitatory since a nerve message is recorded at the level of the postsynaptic fiber after the stimulation of the presynaptic neuron.	**1.5**

4	The steps of the synaptic transmission: - The nerve message arrives at the terminal buds. - It triggers the liberation (exocytosis) of neurotransmitters to the synaptic cleft. - The liberated neurotransmitters bind to the receptors. - This binding launches a nerve message. - The neurotransmitters are recaptured / degraded by the enzymes in the synaptic cleft.	**2**

Exercise 3 (6 points) **Kwashiorkor Disease**

Q.	Answer	Mark
1.1	Before weaning, the body mass of infant (K), similar to the normal average body mass (M), increases from 3 to 7 kg between 0 and 8 month. Post weaning, the body mass continues increasing 9 kg at the age of 16 months. However, it decreases from 7 to 6 kg between the 8^{th} and the 15.5^{th} month in affected infant (K).	**1**
1.2	Loss of body mass.	**0.5**
2	The origin of this disease is : - a deficiency in proteins - under nutrition - malnutrition - …….	**1**
3	The food which is the richest in proteins, is the maternal milk since it contains 11% of proteins, greater than that in manioc (1%) The food which is the richest in carbohydrates is manioc since it contains 86% of proteins, greater that in maternal milk (55%) The food which is the richest in lipids is maternal milk because it contains 30% of lipids which is greater that in manioc (1%)	**2.25**
4	Since infants, post weaning, are nourished mainly by manioc which is poor in proteins, and since proteins are indispensable for growth, the organism will not show any growth and its body mass decreases.	**1.25**