

Exercise 1 (7 points)

Scurvy

Scurvy is a disease characterized by bone lesions, swelling of joints and gums, tooth loss and serious bleeding leading to death. Animals presenting the clinical signs of scurvy are cured by adding to their diet food like lemon, orange and cabbage.

- 1- Pick out two clinical signs of scurvy.

In order to determine the cause of this disease, an experiment was performed on two lots A and B of young guinea pigs.

Lot A receives a diet containing vitamin C and lot B receives a diet deficient in this vitamin. The mass of these guinea pigs was followed up during 16 days. The obtained results are presented in the adjacent document.

	Mass of guinea pigs (g)				
	0 day	4 days	8 days	12 days	16 days
Lot A	210	220	250	260	280
Lot B	210	220	240	230	220

Moreover guinea pigs of lot B show the following clinical signs: bone lesions, swelling of joints and gums and tooth loss. These clinical signs don't appear in guinea pigs of lot A.

- 2- Draw, on the same graph, two curves showing the variations of the mass of the guinea pigs of the two lots A and B as a function of time.
- 3- Deduce the effect of vitamin C on the growth of guinea pigs.
- 4- Determine, referring to all what preceded, the cause of scurvy.

Exercise 2 (7 points)

Addiction and Pollution

The faculty of medicine at the Lebanese University conducted a study where they measured the level of pollutant gases from tobacco smoke in 28 coffee shops and restaurants in Beirut. This study showed that the average concentration of these pollutant gases is $306\mu\text{g}/\text{m}^3$, when the standard concentration admitted by the World Health Organization (WHO) is $15\mu\text{g}/\text{m}^3$. In certain coffee shops where there are two zones, the first one is for smokers and the second one is for non-smokers, the level of pollutant gases from tobacco smoke in the second zone was lower than that in the first one, but still above the standard concentration admitted by WHO. The non-smokers or passive smokers are thus exposed, just like the addicted smokers, to 172 harmful chemical substances 67 of which are carcinogenic.

- 1- Show that certain places in Lebanon are highly polluted by tobacco smoke.
- 2- Specify if dedicating "non-smokers" zones is sufficient to protect the non-smokers against the negative effects of tobacco.

Nicotine found in tobacco stimulates directly the production of dopamine. The latter is the neurotransmitter of certain neurons involved in the control of movements, the emotional behavior and pleasure. Hence, nicotine induces a flow of this neurotransmitter in the cerebrum. Consequently, the smoker becomes a slave to tobacco: it becomes difficult for him to quit smoking despite its dangers on health.

- 3- Formulate a hypothesis explaining the mode of action of nicotine.
- 4- Determine the origin of the pleasure sensation in a smoker.
- 5- Explain how a young adolescent becomes addicted to nicotine.
- 6- Suggest two measures to be adopted in Lebanon in order to reduce the problem of tobacco addiction.

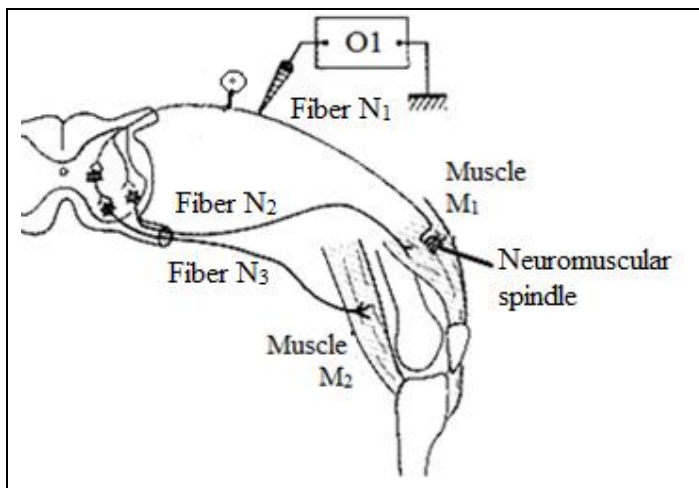
Exercise 3 (6 points) Sensory Nervous Message

In all striated muscles there exist receptors sensitive to stretching. They are called neuromuscular spindles.

The neuronal circuits connected to one of these neuromuscular spindles are shown in document 1.

In order to study the characteristics of the sensory nervous message, the following experiment is performed.

Muscle M1 of a cat is stretched by objects of increasing masses. Using the oscilloscope O1, the activity of the nerve fiber N1 issued from the neuromuscular spindle of muscle M1 is recorded and the state of this muscle is also registered. The obtained results are shown in document 2.



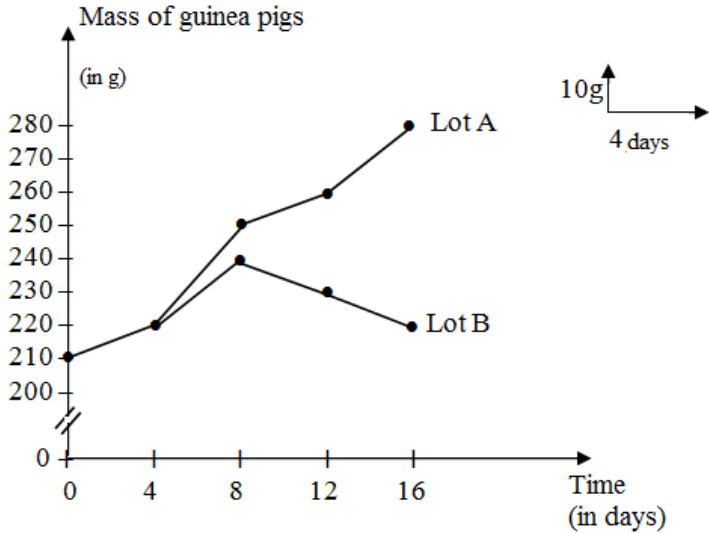
Document 1

Mass of object (a.u)	3	4	5	6
Recording in O1 (number of AP/0.1s)				
State of muscle M1	No contraction	Contraction	Contraction	Contraction

Document 2

- 1- Specify for each of the fibers, N1, N2 and N3 (doc.1), if it is sensory or motor.
- 2- Indicate two characteristics of the nervous message at the level of a nerve fiber revealed by document 2. Justify the answer.
- 3- State, by referring to document 1 and to acquired knowledge, the different elements involved in the activity of muscle M1.
- 4- Draw a labeled figure of an action potential.

مسابقة في الثقافة العلمية: مادة علوم الحياة
اسس التصحيح

Q.	Exercise 1 (7 points)	Grade
1	The clinical signs are: bone lesions, swelling of joints and gums, tooth loss and serious bleeding.	1
2	The variations of the mass of the guinea pigs of the two lots A and B as a function of time. 	3
3	The mass of guinea pigs of lot B that receives a diet deficient in vitamin C decreases from 240g to 220 g instead of increasing from 240g to 280 g like the guinea pigs of lot A that receives a diet containing vitamin C between day 8 and day 16. Thus, vitamin C is indispensable for the growth of guinea pigs.	1 1/2
4	We observe in lot B bone lesions, swelling of joints and gums, tooth loss and serious bleeding which are signs of scurvy, and that following the deficiency in vitamin C. on the contrary, there are no such signs in lot A receiving a diet containing vitamin C. Thus, the cause of scurvy is the deficiency in vitamin C.	1 1/2

Q.	Exercise 2 (7 points)	Grade
1	The level of pollutants from tobacco smoke in some coffee shops and restaurants in Beirut is $306\mu\text{g}/\text{m}^3$ which is 20 times higher than the standard admitted by World Health Organization, $15\mu\text{g}/\text{m}^3$. This shows that certain places in Lebanon are highly polluted by tobacco smoke.	1
2	Dedicating “non-smokers” zones is not sufficient to protect the non-smokers against the negative effects of tobacco since the study shows that the level of pollutant gases from tobacco smoke in these zones is always superior to the WHO standards. The non-smokers or passive smokers are exposed to 172 harmful chemical substances 67 of which are carcinogenic.	1
3	Hypothesis: Nicotine stimulates the exocytosis of dopamine. Or Nicotine stimulates the neuron that releases dopamine in a synapse.	1

4	The origin of the pleasure sensation in a smoker is the flow of dopamine in the cerebrum which is provoked by nicotine, and dopamine is the neurotransmitter responsible for the emotional behavior and pleasure.	1
5	The young adolescent starts smoking influenced by his environment. He gets used to smoking and searching for tobacco, this is psychological dependency . Then he will pass through a phase of physical dependency characterized by a state of withdrawal; he can't quit smoking anymore despite its dangers on health. When the desired sensation isn't reached anymore by the smoked quantity, the young adolescent increases the dose; this is tolerance .	1 1/2
6	<ul style="list-style-type: none"> - Implement the law that forbids smoking in public places. - Forbid selling tobacco to teenagers. - Organize anti-smoking campaigns. - Forbid tobacco advertising. - Increase the price of tobacco. 	1 1/2

Q.	Exercise 3 (6 points)	Grade
1	Fiber N1 is sensory since it is connected to a sensory receptor and transmits messages toward the spinal cord (centripetal conduction). Fibers N2 and N3 are motor since each one is connected to an effector organ, the muscle: N2 is connected to M1 and N3 is connected to M2 and transmit the messages from the spinal cord to the effector muscles respectively M1 and M2 (centrifugal conduction).	1
2	<ul style="list-style-type: none"> - The fiber responds only starting from threshold intensity since there's always a resting potential with an intensity of 3 a.u whereas there are a series of action potentials when the stimulation intensities are superior or equal to 4 a.u. - The nervous message in a fiber is modulated in frequency of Aps and not in amplitude, since the frequency of 11 AP /0.1s increases up to 20 AP/0.1 sec keeping the same amplitude 100 mV when the stretching increases from 4 a.u to 6 a.u. 	2 1/2
3	The elements involved in this activity are : Receptor: the neuromuscular spindle Sensory fiber: N1 Nervous center: the spinal cord Motor fiber: N2 Effector organ: muscle M1.	1 1/4
4	<p>Scheme of an action potential</p>	1 1/4