This is a Class 1 exam

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Stage Exam 04

12FEB2024

Do NOT write in this box. Your MARK will be placed here.

Subject :	Biology
Class :	10B and 10C
Teacher :	Christine Khalil
Duration :	1 hour

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

1 point for good presentation.

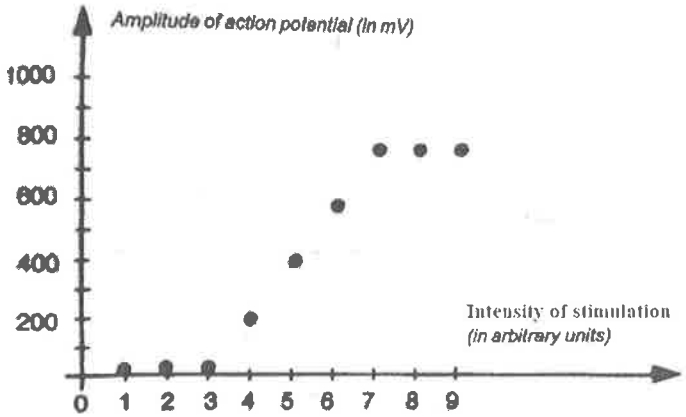
Exercise 1 (3 points)

Indicate if the following statements are true or false and correct the false ones.

1. The resting potential is due to an unequal distribution of ions between the intracellular and extracellular medium of a nerve fiber.
2. During depolarization, the intracellular medium of a nerve fiber is negatively charged with respect to the extracellular medium.
3. An efficient stimulus reduces the positivity of the membrane of the neuron.

Exercise 2 (3.25 points)

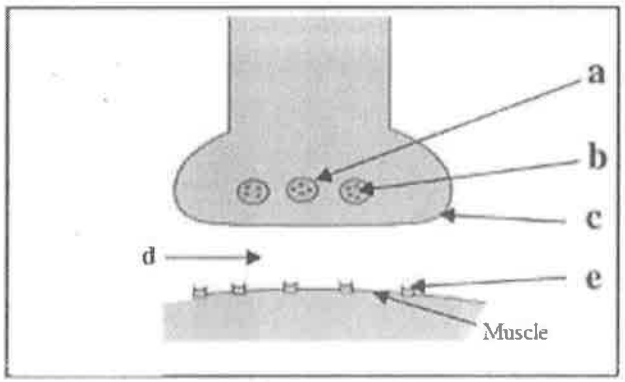
A nervous structure was subjected to a series of stimulations of increasing intensities. The document below shows the amplitude of the response obtained.



1. What is the type of the nervous structure used? (0.75)
2. Explain the results obtained. (2.5)

Exercise 3 (7.25 points)

A synapse is a junction between a neuron and another structure. Its role is to transmit messages between these structures. Document 1 shows a synapse.

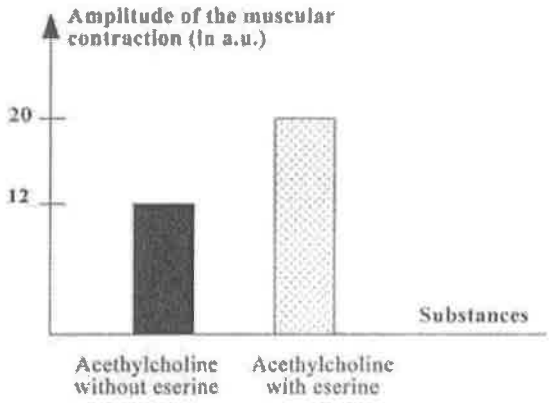


Document 1

1. Label the structures from a to e. (1.25)
2. List the steps of synaptic transmission (as bullet points). (2)

In the framework of studying the effect of 2 drugs (eserine and curare) on the functioning of this synapse, the following 2 experiments were performed.

Experiment 1: The amplitude of muscular contraction was measured once without eserine and once after injection of eserine at the level of d. The results are shown in document 2.



Document 2

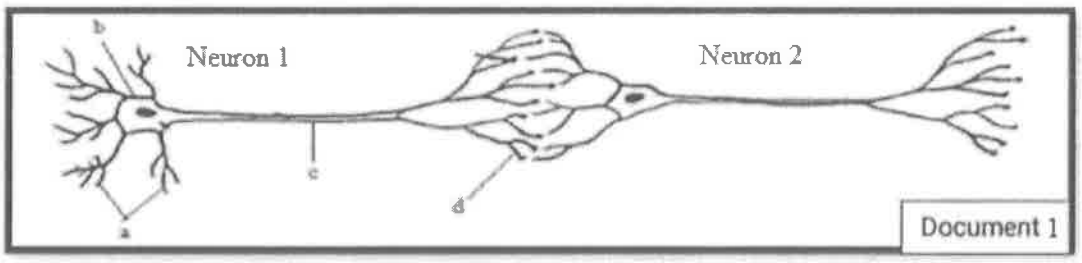
3. a. Compare the results of document 2. (1.5)
   b. What can you conclude? (1)

Experiment 2: The amplitude of muscular contraction was measured once without curare and once after injection of curare at the level of d. Normal contraction was observed without curare however, no contraction was observed after the curare injection.

4. Explain the absence of contraction following curare injection. (1.5)

Exercise 4 (10.5 points)

An experiment was done in order to know the form of coding of the nervous message in a nerve fiber. For this reason, a neuro-neuronal synapse was taken from a spinal cord. (document 1)



Six stimulations of increasing intensities were applied on neuron 1; the amplitude and the frequency of AP were recorded on neuron 2 with the help of an oscilloscope. The results are shown in the following tables (documents 2 and 3).

Intensity of stimulation (a.u.)	1	2	3	4	6	10
Amplitude of AP (mV)	0	0	100	100	100	100

Document 2

Intensity of stimulation (a.u.)	1	2	3	4	6	10
Frequency of AP (/s)	0	0	1	10	35	65

Document 3

1. Indicate the type of the synapse represented in document 1. Justify your answer. (1)
2. Is this synapse excitatory or inhibitory? Justify your answer. (1)
3. Indicate the threshold intensity. Justify your answer. (1)
4. Interpret the results of document 2. (1.5)
5. Transform the table of document 3 into a graph. (2)
6. Analyze the results of document 3. (1)
7. According to the analysis of documents 2 and 3, deduce the mode of coding of the nervous message transmitted through a nerve fiber. (1)
8. The stimulations of increasing intensities were applied on neuron 1. However, the amplitude and the frequency of AP were recorded at the level of neuron 2. How does neuron 1 inform neuron 2 that the intensity of stimulation is increasing? (1)
9. If we stimulate neuron 2, will we record an AP in neuron 1? Justify your answer. (1)

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Exercise 1 (3 points)

1. True. (1)
2. False (0.25). Positively (0.75).
3. False (0.25). The negativity (0.75).

Exercise 2 (3.25 points)

1. Nerve (0.75).
2. From 1 a.u. to 3 a.u., the amplitude was 0 indicating no response of the nerve. No nerve fiber is transmitting any message since the intensity of stimulation is subthreshold. Starting from 3 a.u. and up until 7 a.u., the amplitude of the action potential increases from 0 to 800 mV. Each time the intensity of stimulation increases, more nerve fibers start transmitting an AP and they sum up to produce a global potential with a higher amplitude each time. From 7 a.u. till 9 a.u., the amplitude of the global potential remains constant at 800 mV since all the nerve fibers of the nerve are already transmitting an AP. Therefore, the amplitude of their sum remains constant and maximum even if the intensity of stimulation increases (2.5).

Exercise 3 (7.25 points)

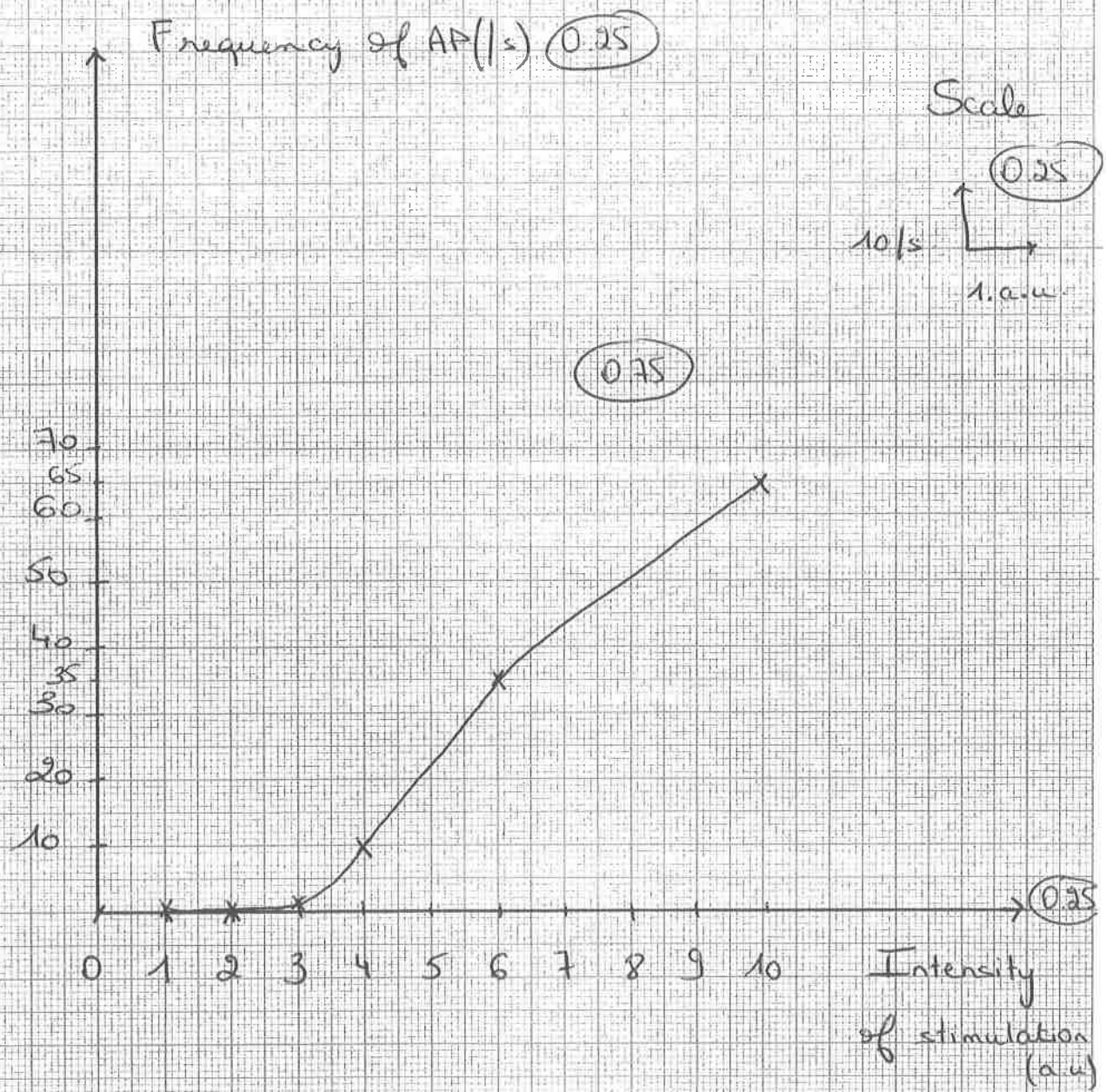
1. A. Vesicle. B. Neurotransmitters. C. Presynaptic neuron. D. Synaptic cleft. E. Receptors (each 0.25)
2. A. Arrival of an AP to the axon terminal of the presynaptic neuron.
   B. Opening of the calcium channels and entry of calcium to the presynaptic neuron.
   C. Vesicles containing neurotransmitters approach the membrane of the presynaptic neuron and fuse with it.
   D. Release of the neurotransmitters in the synaptic cleft (exocytosis).
   E. Binding of the neurotransmitters to the postsynaptic receptors.
   F. Contraction of the muscle.
   G. Elimination of the neurotransmitters either by enzymatic degradation of reuptake through the pumps of the presynaptic neuron.
   (each mistake -0.5, total of 2 points).
3. a. After the injection of eserine with acetylcholine, the amplitude of muscle contraction is 20 a.u, which is greater than that in the absence of eserine which is 12 a.u. (1.5)
   b. Eserine amplifies the action of acetylcholine (1).
4. Curare has a similar shape to acetylcholine. It can bind to its postsynaptic receptors at the level of the muscle preventing acetylcholine itself from binding. No binding of acetylcholine to the receptors on the surface of the muscle leads to the absence of contraction. (1.5)

Exercise 4 (10.5 points)

1. Axo-dendritic since it is a junction between the axon terminal of the presynaptic neuron and the dendrites of the postsynaptic neuron. (1)
2. It is excitatory since an AP was recorded at the level of the postsynaptic neuron as shown in documents 2 and 3. It allowed the transmission of the message. (1)

3. The threshold intensity is 3 a.u. since it is the minimal intensity at which we observe 1 AP. (1)
4. When the intensity of stimulation increases from 1 to 2 a.u., the amplitude of the AP remains constant at 0 mV. This amplitude increases to 100 mV when the intensity of stimulation increases till 3 a.u. and then remains constant at 100 mV as the intensity of stimulation increases till 10 a.u. This indicates that the nerve fiber obeys to the law of all or none (1.5)
5. On the graph paper (2).
6. When the intensity of stimulation increases from 1 to 2 a.u., the frequency of AP remains constant at 0/s. However, when the intensity of stimulation increases till 3 a.u., the frequency increases to 1/s and as the intensity of stimulation increases till 10 a.u., the frequency of AP increases till 65/s. (1)
7. The nervous message at the level of a nerve fiber is coded by the frequency of APs and not by the amplitude. (1)
8. Whenever the intensity of stimulation increases on neuron 1, neuron 1 releases more neurotransmitters in the synaptic cleft to inform neuron 2 of this increase (1).
9. No since at the level of a synapse, the message is unidirectional. It is only transmitted from the presynaptic to the postsynaptic neuron. (1)

5.



Title: A graph showing the variation of the frequency of AP as a function of the intensity of stimulation. 0.5