

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

يتكوّن هذا الامتحان من خمسة تمارين، موزعة على أربع صفحات. يجب اختيار ثلاثة تمارين فقط.

اقرأ الأسئلة بشكل عامّ وشامل، ومن ثمّ حدّد اختياراتك.

ملاحظة: في حال الإجابة عن أكثر من ثلاثة تمارين، عليك شطب الإجابات المتعلقة بالتمارين التي لم تعد من ضمن اختيارك، لأنّ التصحيح يقتصر على إجابات التمارين، الثلاث الأولى غير المشطوبة، بحسب ترتيبها على ورقة الإجابة. تعطى نصف علامة على وضوح الخط والترتيب.

Answer three exercises out of five exercises:

Exercise 1 (6.5 points)

Vitamins

Vitamins are organic compounds indispensable for our health. They play an essential role in many biological processes, such as regulating metabolism, supporting the immune system, and promoting bone and skin health. They are found in a variety of foods such as fruits, vegetables, dairy products, meats and grains. A vitamin deficiency can lead to a variety of health problems, from fatigue and digestive problems to more serious illnesses.

Document 1

- 1- Pick out from document 1:
 - 1.1- One of the roles of vitamins.
 - 1.2- The food sources of vitamins.
 - 1.3- The consequences of deficiency in vitamins.
- 2- Name a liposoluble vitamin and a hydrosoluble one.

To show the importance of the vitamins of whole milk among which the vitamins A, B₂, B₁₂, and D, we realize the following experiment on two lots of young rats, A and B, of the same age, sex and mass.

The rats of lot A are fed by whole fresh natural milk while the rats of lot B receive fresh milk deprived of its vitamins.

The growth of the two lots of rats is monitored during 3 weeks. The results are revealed in document 2.

- 3- Draw the curve of the evolution of the mass of lot A as a function of time.
- 4- Analyze the obtained results.
- 5- Draw out the role of milk vitamins.

Time (days)	0	6	12	18
Mass of rats of lot A (g)	40	55	65	70
Mass of rats of lot B (g)	40	44	47	50

Document 2

Exercise 2 (6.5 points)**BMI, Waist Circumference and Obesity**

Obesity has become a major health problem because it predisposes individuals to many diseases and reduces life expectancy. It can be evaluated by measuring the waist circumference and/or by the body mass index (BMI).

The waist circumference or abdominal circumference corresponds to the measurement in centimeters of the narrowest part of the abdomen. The abdominal obesity is associated with a waist circumference greater than 90 cm in women and 110 cm in men.

The body mass index is calculated using the following formula: $BMI = \text{mass}/\text{height}^2$, with “mass” in kg and “height” in m^2 .

According to their BMI, people can be classified into three categories:

- Normal if $18.5 \leq BMI < 25$
- Overweight if $25 \leq BMI < 30$
- Obese if $BMI \geq 30$

Document 1

- 1- Draw out from document 1 the value of BMI and that of the waist circumference based on which we consider that there is an excessive accumulation of body fat in men, which can be harmful to health.
- 2- State two health risks of obesity.

Document 2 shows the height and the mass of 3 adults A, B, and C.

	A	B	C
Height (in m)	1.7	1.8	1.8
Mass (in kg)	80	70	110

Document 2

- 3- Calculate the BMI of each of these 3 adults.
- 4- Determine the category to which each of these adults belong.

Exercise 3 (6.5 points)**The Effects of Nicotine**

Nicotine, present in tobacco, acts rapidly on the brain by stimulating the liberation of dopamine, provoking a feeling of pleasure and reward. This effect reinforces tobacco consumption behavior and leads to physical and psychological dependence. Physiologically, nicotine increases heart rate, blood pressure and can restrict blood flow to the heart. Smokers developing tolerance require higher doses for the same effects.

Document 1

- 1- Pick out from document 1:
 - 1.1- The neurotransmitter liberated following the consumption of nicotine.
 - 1.2- The consequences of nicotine consumption.
- 2- Justify, referring to the acquired knowledge, that nicotine is a drug.

Document 2 represents the results of a study on the mortality rate from lung cancer as a function of the number of the consumed cigarettes per day.

Number of cigarettes consumed per day	10 – 20	21- 40	41 - 60
Lung cancer mortality rate (per 100,000 deaths)	6	10	24

Document 2

- 3- Draw a histogram representing the obtained results.
 - 4.1- Analyze the obtained results.
 - 4.2- What can you conclude?
- 5- Suggest two measures that the government can take to prevent smoking.

Exercise 4 (6.5 points)**Parkinson Disease**

Parkinson disease is a progressive neurodegenerative disorder that primarily affects the central nervous system. It is characterized by the progressive decrease in the production of dopamine, a neurotransmitter essential for the control and the coordination of movements. This chronic disease is manifested by symptoms such as muscle stiffness, slowness of movements, tremors and sometimes non-motor disorders such as depression and cognitive problems. Managing Parkinson disease often aims to attenuate the symptoms and improve the patients' quality of life, through drug treatments and special therapies.

Document 1

- 1- Pick out from document 1:
 - 1.1- Two symptoms of Parkinson disease.
 - 1.2- The origin of this disease.
- 2- Name another neurodegenerative disease.

Selegiline is a medicine used for the treatment of Parkinson. To understand the effect of this molecule, the variation in the quantity of dopamine in the synaptic cleft in a man affected by Parkinson disease in presence and absence of selegiline is measured. The results are presented in document 2.

Time (ms)	0	1	2	3	4	5
Quantity of dopamine in the absence of selegiline (μmol)	100	75	60	50	20	0
Quantity of dopamine in presence of selegiline (μmol)	100	90	80	75	70	55

Document 2

- 3- Draw the curve of the variation of the quantity of dopamine in the absence of selegiline.
 - 4.1- Analyze the obtained results (document 2).
 - 4.2- What can you conclude?

Exercise 5 (6.5 points)

The Neuro-Neuronic synapse

The neuro-neuronic synapse is a complex structure of the nervous system, essential for the transmission of the nerve messages between the neurons. It consists of three main elements: the terminals of the axon of the presynaptic neuron, the synaptic cleft and the dendrites or cell bodies of the postsynaptic neuron.

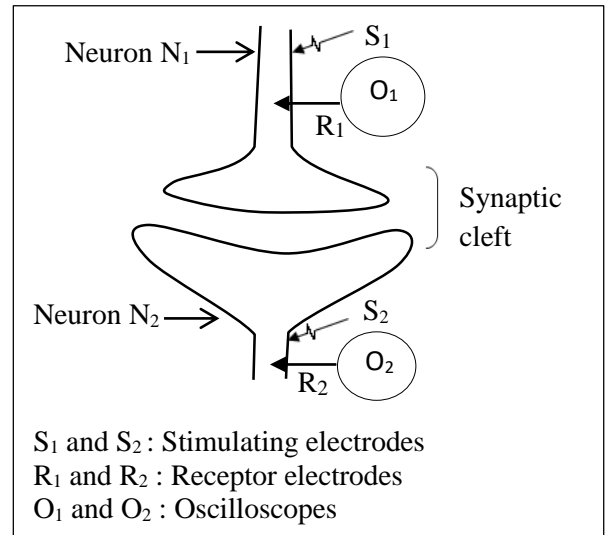
Document 1

1- Pick out from document 1 :

- 1.1- The definition of a neuro-neuronic synapse.
- 1.2- The structural components of a synapse.

In order to study the mechanism of the transmission of the nerve message at the level of a synapse, we carry out, using the setup of document 2, a series of experiments on two squid neurons N1 and N2.

Document 3 represents the experimental conditions and the results of each experiment.



Document 2

Experiments	Experimental conditions	Results	
		O1	O2
1	S1 Stimulation	AP	AP
2	Stimulation S2	—	AP
3	Injection of acetylcholine in the synaptic cleft	—	AP

Document 3

AP : Action potential

- 2- Specify the nature of the studied synapse.
- 3- Show that acetylcholine is the neurotransmitter of this synapse.
- 4- Draw out the direction of the propagation of the nerve message in the synapse.
- 5- List the steps of the transmission of the nerve message at the level of the synapse.