

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

Answer the following exercises

Exercise 1 (5 pts.)

"Scurvy is one of the old known diseases. It was the main cause of death among sailors. This disease starts with fatigue then it is manifested by edema in arms and legs, followed by bleeding of the nose and gum. The teeth become unstable and fall down. Persons having this disease are incapable of standing, and die from exhaustion or from complications of respiratory infections.

In 1593, the sailors of an English ship that was sailing to India did not get the disease because their captain made them drink daily a few drops of fresh citrus juice: orange and lemon.

In May 20<sup>th</sup>, 1747, James Lind, an English physician, prescribed six different treatments to 12 sailors, having the disease, divided into groups of two. After six days, only the sailors who ate fresh oranges and lemons were healed. Analysis showed that citrus fruits are rich in ascorbic acid."

Doctor C.BINET, Vitamines et vitaminotherapie

1. Pick out from the text the symptoms of scurvy.
2. Refer to the text to draw out the cause of this disease.
3. Name the vitamin which corresponds to ascorbic acid, and specify two roles of this vitamin in the body.
4. Draw out from the text two characteristics which show that ascorbic acid is a vitamin.

Exercise 2 (5 pts.)

The inhabitants of certain regions in the world cook with butter (region A), others use mostly the duck fat (region B), while some others use olive oil (region C).

Regions	A	B	C
Number of persons dying from coronary diseases	114	90	78

Document 1

Document 1 reveals the number of persons dying from coronary diseases in populations of 100,000 inhabitants whose ages range between 35 to 64 years in the three regions A, B, and C.

Fatty Acids	Butter	Duck fat	Olive oil
Saturated	52%	27%	17%
Unsaturated	25%	67%	78%

Document 2

Document 2 shows the percentage of saturated and unsaturated fatty acids present in the lipids used for cooking.

1. Indicate, in reference to documents 1 and 2, the characteristic of lipids that helps in preventing coronary diseases. Justify the answer.

There are two categories of lipoproteins: HDL and LDL. The privileged consumption of lipids that are rich in unsaturated fatty acids increases the proportion of HDL in the blood.

Document 3 presents the two categories of lipoproteins: HDL and LDL.

Document 3

2. Indicate the role of each of these two lipoproteins in the body.
3. Explain, by referring to the acquired knowledge and document 3, why the consumption of lipids rich in unsaturated fatty acids helps in preventing coronary diseases.

**Exercise 3 (5 Pts.)**

**Amphetamines are substances used to fight fatigue. Their consumption leads to cognitive and psychic troubles, decrease in body weight, liver and kidneys disorders, cardiac and vascular troubles, and degradation of nerve cells.**

**Like cocaine, amphetamines increase the concentration of dopamine in the synaptic cleft. In fact, amphetamines enter into the presynaptic buds by Dopamine carriers. Once they are in the presynaptic buds, amphetamines induce the expulsion of dopamine molecules stored in the vesicles into the synaptic cleft.**

**Moreover, Amphetamines decrease dopamine recapture; and when they are in high concentration, they inhibit an enzyme, Mono-amine Oxidase A, which degrades dopamine. As a result, the concentration of dopamine increases in the synaptic cleft .**

**Amphetamines lead to a strong psychological dependence, mild physical dependence, and very strong tolerance. Amphetamines' withdrawal leads to insomnia and depression.**

1. Pick out from the text:

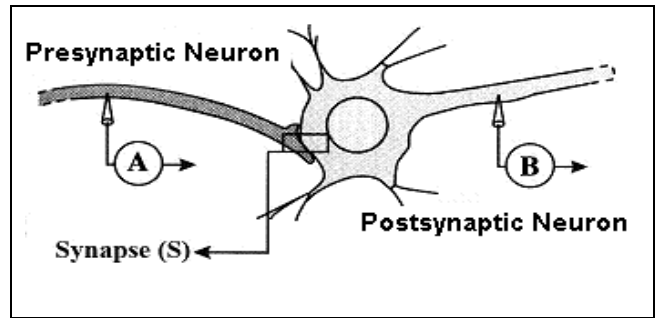
- 1-1- The consequences of amphetamines' consumption.
- 1-2- The effects of withdrawal of amphetamines.
- 1-3- The action of high concentration of amphetamines at the level of a synapse.

2. Referring to the acquired knowledge and to the text:

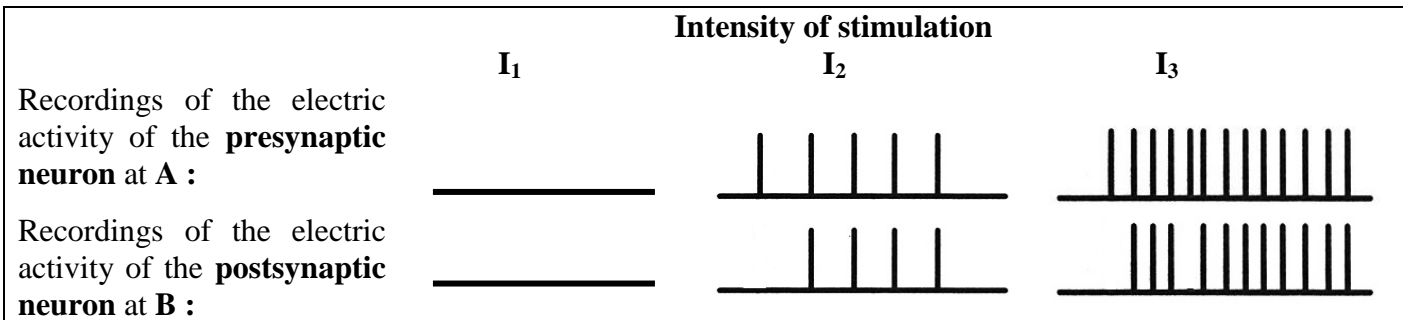
- 2-1- Justify that amphetamines act as a drug.
- 2-2- Explain how amphetamines' consumption prolong pleasure sensation.

**Exercise 4 (5 pts.)**

We perform a series of electric stimulations of increasing intensity on a presynaptic neuron and we record the electric activity of the presynaptic and post synaptic neurons. Document 1 shows the experimental set-up, and document 2 represents the recordings obtained during a certain time (t).



*Document 1*



*Document 2*

*N.B. each vertical tracing corresponds to an action potential (AP)*

1. Represent, in one table, the variations of the frequency of AP (number of AP/t) of the two neurons at A and B as a function of the intensity of stimulation.
2. Justify, in reference to document 2, that the nerve message is coded by the modulation of frequency of action potentials and not by the amplitude.
3. Is synapse (S) represented in document 1 inhibitory, or excitatory? Justify the answer.

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أسس التصحيح**Exercise 1 (5 pts.)**

1. This disease starts with fatigue, it is then manifested by edema in arms and legs, then in bleeding of the nose and gum. The teeth become unstable and fall down . Persons having this disease are incapable of standing, and die from exhaustion or from complications of respiratory infections. (1 pt.)

2. In 1593, the sailors did not get the disease because they drank daily a few drops of fresh citrus juice: orange and lemon. (1/2 pt.) Since citrus fruits are rich in ascorbic acid (1/2 pt.), therefore, scurvy is due to the absence of ascorbic acid found in fresh citrus fruits. (1/2 pt)

OR

In 1747, among 12 sailors who had scurvy and subjected to different treatments, only sailors who ate oranges and lemons were healed. (1/2 pt.). Since citrus fruits are rich in ascorbic acid (1/2 pt.), therefore, scurvy is due to the absence of ascorbic acid found in fresh citrus fruits. (1/2 pt)

3. Vitamin C (1/2 pt)

Roles: Favors the absorption of iron or/and fights anemia.(1/2 pt)

Stimulates body defense (anti-infectious) (1/2 pt)

4. Vitamins are needed in small amounts: a few drops (1/2 pt.)

Vitamins are fragile to heat: fresh (1/2 pt.)

**Exercise 2 (5 pts.)**

1. Lipids that help in preventing coronary diseases are lipids that are rich in unsaturated fatty acids. (1 pt.), because document 1 shows that the number of persons dying from coronary diseases in region (C) is the lowest 78, where olive oil is used in cooking. Therefore, olive oil is the most favorable for preventing coronary diseases. (1 pt.) Document 2 shows that olive oil is the richest in unsaturated fatty acids 78% in comparison to 17 % saturated fatty acids. (1 pt)

2. HDL carries cholesterol from the tissues to the liver. (1/2 pt.)

LDL transports cholesterol to body cells when needed. (1/2 pt)

3. Document 3 shows that the privileged consumption of lipids rich in unsaturated fatty acids increases the proportion of HDL in the blood, (1/2 pt.) or, the increase in HDL plays a protective role against coronary diseases by inhibiting the accumulation of lipids along the walls of arteries.(1/2 pt.)

**Exercise 3 (5 pts.)**

**1-1-** The consumption of amphetamines leads to cognitive and psychic troubles, decrease in body weight, liver and kidneys disorders, cardiac and vascular troubles, and degradation of nerve cells.(1pt.).

**1-2-** Amphetamines' withdrawal leads to insomnia and depression. (1/2 pt.)

**1-3-** Amphetamines in high concentration inhibit the enzyme, Mono-amine Oxidase A, which degrades dopamine. (1pt.)

**2-1-** Amphetamines lead to a strong psychological dependence, mild physical dependence, and very strong tolerance, which are characteristics of drugs consumption. This shows that amphetamines act as a drug. (1pt.).

**2-2-** Dopamine is a neurotransmitter responsible for pleasure sensation and amphetamines increase the amount of dopamine in the synaptic cleft by increasing their release, decreasing their recapture, and inhibiting their degradation. Therefore, dopamine remains trapped into the synaptic cleft, which increases and prolongs pleasure sensation. (1 1/2 pt.)

**Exercise 4 (5 pts.) .**

**1.**

<b>Intensity of stimulation</b>	<b>I<sub>1</sub></b>	<b>I<sub>2</sub></b>	<b>I<sub>3</sub></b>
Frequency of AP at A (in AP/t)	0	5	13
Frequency of AP at B (in AP/t)	0	4	11

*Variation of AP frequency at A and at B as a function of the intensity of stimulation (2 pts.)*

**2.** Coded by the modulation of frequency, because we observe an increase in the frequency from 5 to 13

AP as a function of the increased intensity,  $I_2 < I_3$  at A.

**OR**

Because we observe an increase in the frequency from 4 to 11 AP as a function of the increased intensity,  $I_2 < I_3$  at B. (3/4 pt.)

Not by the amplitude, because whatever the intensity of stimulation was, the amplitude is always constant (in the two recordings corresponding to  $I_2$  and  $I_3$  in both neurons). (3/4 pt)

**3.** Excitatory synapse (1/2 pt), because we observe a nerve message at B upon stimulating the presynaptic neuron by intensities  $I_2$  and  $I_3$ .

This means that synapse S permits the transmission of the nervous message from presynaptic neuron to the postsynaptic neuron. (1 pt)