

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

Answer the following questions.

Question I (4 pts)

Correct the following sentences :

- a- A reflex is an automatic and voluntary response to an effective stimulus.
- b- To cut a DNA, we use ligase enzymes.
- c- A clone of hybridomas produces polyclonal antibodies
- d- A hormone acts on all the cells of the body.

Question II (6 ½ pts)

In the framework of studying a nervous message, we record the response of a single nerve fiber to increasing temperatures applied at the level of the sensory receptors of the skin, document 1. In these recordings, each vertical line corresponds to an action potential.

- a- What is the nature of the action potential?
- b- The response is recorded at a certain distance from the point of stimulation. What property of the nervous message is shown?
- c- Represent in a table the variations of the frequency of action potentials (number of action potentials per second) as a function of the stimulating temperature.
- d- Analyze the recordings of document1. What can you deduce concerning the coding of the nervous message ?

Document 1. Response of a nerve fiber to stimulations of increasing intensities.

Question III (5 pts)

"Exposure to tobacco leads to the appearance of respiratory diseases, cardiovascular diseases, and cancer. These diseases are due to the presence of nicotine and polycyclic aromatic hydrocarbons (PAH) in the tobacco fumes.

Nicotine is a widespread addictive substance. Smokers become attached to tobacco and become addicts due to the effect of nicotine. Tobacco contains also carcinogenic substances that include mainly PAH. Smoking is responsible for the appearance of 30% of cancer cases.

Dependence to nicotine is characterized by a convulsive behavior for searching for this substance and consuming it despite the awareness of its dangerous effects on health. The longer the smoking period is, the more difficult quitting smoking becomes.

Tolerance to nicotine is reached when there is a need to increase the quantity of absorbed nicotine.

One cigarette ensures for a smoker an average of 0.5 mg of nicotine per one gram of tobacco, while the nargileh ensures 0.1mg per gram. But, if the nargileh filters a certain amount of the nicotine it does not filter any of the PAH. Moreover a nargileh smoker absorbs 1.3 times more PAH than a cigarette smoker. The problem becomes more serious when the cigarette smoker shifts to nargileh, he increases the nargileh smoking to satisfy his need for nicotine. This leads to increased consumption of PAH. "

- a- Pick up from the text the statements that show:
 - 1- The dangers of smoking.
 - 2- Dependence to nicotine.
 - 3- How is nargileh more dangerous than cigarettes.
- b- Mention 4 measures that should be taken in a certain country to fight smoking.

Question IV (5 ½ pts)

In the framework of studying certain aspects of behavioral reactions of a certain animal species raised in industrial farms, we perform the following experiments.

1st experiment: we isolate an animal that is conditioned to obtain its food by pressing on a mobile plate using its mouth. When this animal is subjected to an aggression test by suppressing the food supply, it presents many behavioral reactions (scraping the soil, pushing strongly the edge of the food container, biting its tail).

2nd experiment: when two animals obtained from different farms are subjected to the same conditioning and the same test, they fight each other.

- a- What is the state that explains the behavioral reactions of the animals in the first and the second experiment.

3rd experiment: when two animals obtained from the same farm subjected equally to the same conditioning and the same test, they do not present the behavioral reactions mentioned in the preceding experiments.

- b- What practical recommendation can you suggest to avoid the behavioral reactions concerning the raising of these animals?

We measure the plasma concentration of glucocorticoids before and after these experiments of aggression. We obtain the results presented in the adjacent document.

- c- Name the gland that secretes glucocorticoids.
- d- Analyze the obtained results. What can you deduce?

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Question I (3 pts)

- e- A innate reflex is an automatic and involuntary response to an effective stimulus.(1pt)
- f- To cut a DNA we use restriction enzyme.(1pt)
- g- Monoclonal antibodies are produced by hybridomas.(1pt)

Question II (6 ½ pts)

- a- The action potential corresponds to an electrochemical phenomenon. (½ pt)
- b- The action potential is a phenomenon that can propagate. (½ pt)
- c- The frequency of action potential is null between 0°C and 40°C. At 40°C, only one potential is recorded then, this frequency increases with the increase of temperature to reach 9 potentials at 55°C.(1 ½ pt)

This indicates that the frequency of action potential depends on the temperature thus the variation of the temperature is coded by the nerve cells by modulation of the frequency of AP.(1 pt)

- d- (3pts)

Temperature (in °C)	0	10	20	30	40	45	50	55
Frequency of ^o action potentials (number/sec)	0	0	0	0	1	3	5	9

Variation of the frequency of AP as a function of temperature.

Question III (5pts)

- a- 1- Respiratory and cardiovascular disease and cancers. (½ pt)
2- Dependence to nicotine is characterized by a convulsive behavior for searching for this substance and consuming it despite the awareness of its dangerous effects on health. The longer the smoking period is, the more difficult quitting smoking becomes, (½ pt)
- b- The nargileh provides more PAH, 1.3 times more than the cigarette. More over, although it filters a quantity of nicotine 0.1 mg/g <0.5 mg/g, there is a risk to smoke more nargileh than cigarettes to satisfy the need for the high amount of nicotine that increases the consumption of carcinogenic PAH. (1 ½ pt)
- c- · Protect the population in public places.
· Forbid selling to under aged.
· Fight the smugglers.
· Treat tobacco dependency.
· Write on cigarette packages statements that indicate the dangers of tobacco.(2pts)

Question IV (5 ½ pts)

- a- Conditional reflex; hit of nuzzle on the edge of a mobile plate.(½ pt)

- b- State of stress. (½ pt)
- c- Choose animals of the same farm to reduce the stress in these animals. (½ pt)
- d- The suprarenal cortex.(½ pt)
- e- The comparison of the amounts of glucocorticoids shows that they increase after the frustration session in the isolated animal from 2.8µg/100mL to 4.5 µg/100mL and in the two animals raised in two different farms from 1.8 µg/100mL to 3 µg/100mL. On the contrary, the amount of these hormones decreases in the two animals of the same farm from 2 µg/100mL to 1.2 µg/100mL. (1 ½ pt)
This indicates that the frustration session has lead to a state of stress, which is much stronger in the isolated animal than in the two animals of the different farms but has no stressful effect on the animals of the same farm. Therefore the state of stress is conditioned by the nature of the raising of the animals.(1 pt)
- f- (1pt)

Aggression
(frustration)

→ Hypothalamus



Pituitary
Gland



Suprarenal cortex



Response to
aggression