

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

Answer the following questions.

Question I (3 ½ pts.)

“In an attempt to know the reason that makes smokers continue smoking, doctors put rats in a cage having two holes. When the rats put their heads into one hole, nothing happens. When they put their heads into the second hole, they receive a nicotine dose.

At the beginning of the experiment, rats move toward the two holes in the same way, then gradually, they start going toward the hole where they receive nicotine.

Cerebral tissue analysis of the rats at the end of the experiment shows that certain modifications appear: The links between the neurons are weakened, a number of neurons are degenerated, and a number of neurons are not renewed.”

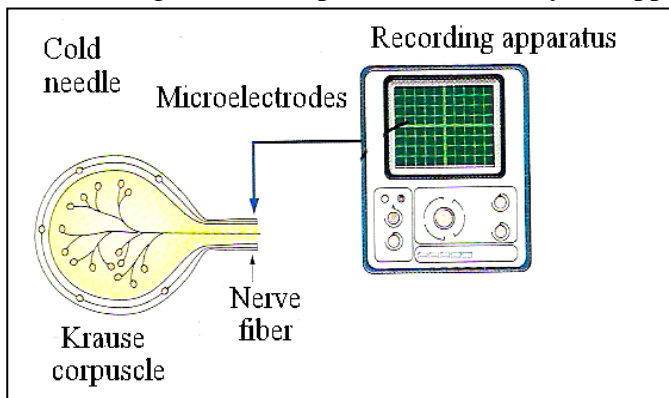
- a- Pick up from the text: 1- The statement that shows the existence of dependence.
2- The cerebral modifications that appeared after the consumption of nicotine.
- b- Can we say that nicotine found in tobacco is a drug? In reference to the acquired knowledge, justify the answer.

Question II (4 ½ pts.)

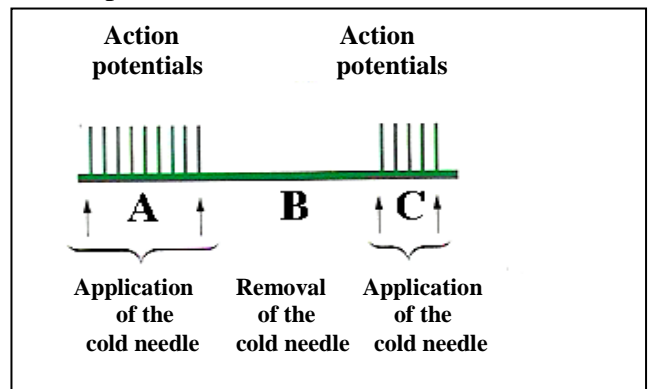
In the skin, there are nerve fibers linked to corpuscles called Krause corpuscles that are sensitive only to a certain temperature variation.

We isolate one of these Krause corpuscles, and we place on its nerve fiber microelectrodes connected to a recording apparatus that allows us to see, on a screen, the responses obtained when the temperature is changed, document 1.

We apply a cold needle to the corpuscle, then we remove the cold needle, and finally we apply the cold needle again. The responses recorded by the apparatus are presented in document 2.



Document 1. Experimental set up



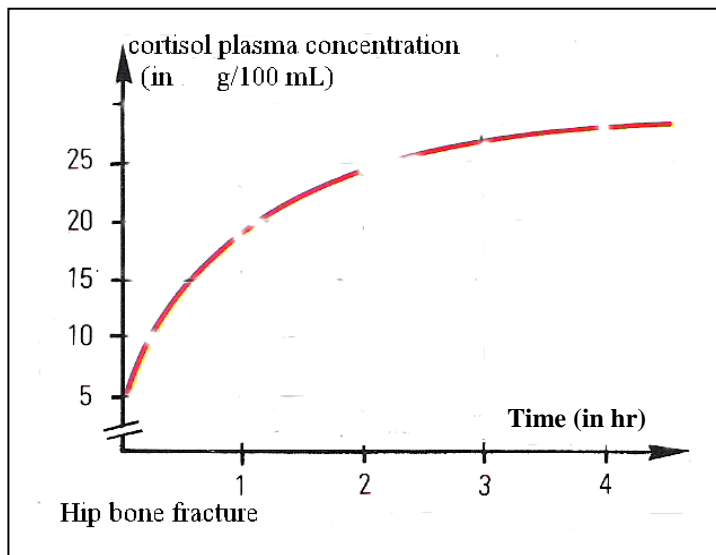
Document 2. Obtained recordings

- a- Pick up from the text the name of the receptor that is sensitive to variation in temperature.
- b- The nerve fiber is a part of a specialized cell. Name this cell.
- c- Interpret the obtained recordings.
- d- How will the recording A vary if we increase the intensity of the stimulus by making the needle colder?

Question III (5 pts.)

We measure the concentration of plasma cortisol of a person having a bone fracture in the hip. The results are presented in the adjacent document.

- a- Interpret the obtained results.
- b- In which state is this person passing?
- c- Mention three physiological modifications that might result if somebody is exposed to a similar situation.
- d- Name another hormone that is liberated in the same state.



Question IV (7 pts.)

Pregnancy test uses antibodies that permit to detect in the urine a hormone called HCG (Human chorionic gonadotropin), which appears on the first few days of pregnancy.

Early in the seventies, pregnancy tests used polyclonal antibodies that are capable to detect HCG concentration between 1000 and 2500 IU/L.

Today, by using monoclonal antibodies, we can detect an HCG concentration between 50 and 250 IU/L. The document below represents the variation of the concentration of HCG in the urine of a pregnant woman in function of the duration of pregnancy.

Duration of pregnancy (in days)	7	10	12	15	25
Concentration of HCG (IU/ L)	100	250	500	1000	2500

Concentration of HCG during pregnancy

- a- Name the cells that produce antibodies.
- b- Construct a curve that represents the variation of the concentration of the secreted HCG as a function of the duration of pregnancy.
- c- What is the practical advantage that a pregnant woman can benefit from this technological progress. Justify the answer by referring to the given data.
- d- Mention another important application for monoclonal antibodies.

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Question I (3 1/2 pts.)

- a- 1- At the beginning of the experiment, rats move toward the two holes in the same way, then gradually, they start going toward the hole where they receive nicotine. (1 pt.)
2- The links between the neurons are weakened, a number of neurons are degenerated, and a number of neurons are not renewed. (1 pt.)
- b- Yes (1/2 pt) because nicotine affects the functioning of the neurons and modifies the behavior of an individual by inducing a state of dependence, habitual usage, and tolerance. (1 pt)

Question II (4 1/2 pts.)

- a- Krause corpuscle (1/2 pt)
- b- The neuron or the nerve cell. (1 pt.)
- c- The application of the cold needle on the corpuscle provokes a nervous message that is expressed by a series of action potentials, of the same amplitude, recorded at the level of the nerve fiber at A and C. However, upon removing the needle, no recordings are obtained at B. This implies that the Krause corpuscle is sensitive to cold temperature. (1 1/2 pt.)
- d- The frequency of action potential increases while the amplitude remains constant. (1 1/2 pts.)

Question III (5 pts.)

- a- **The hip bone fracture.** After the fracture, the plasma concentration of cortisol increases from 5 µg/ 100 mL to become 28 µg/ 100 mL, 4 hours later.
This implies that the hip bone fracture favors the secretion of cortisol (2 pt.)
- b- The individual is passing in a state of stress. (1/2 pt.)
- c- Acceleration of cardiac rhythm, paleness, modifications in respiratory rhythm, an increase of blood glucose concentration, blood flow in the muscles, a decrease in the release of water by the kidneys... (1 1/2 pt.)
- d- Adrenaline (1 pt.)

Question IV (7pts.)

a- B lymphocytes or plasmocytes

(1 pt)

b- **(3 pts)**

Variation of HCG concentration in function of the duration of pregnancy

c- The woman knows that she is pregnant since the first week; **(1 pt.)**
because the test that is based on monoclonal antibodies is sensitive to a concentration of HCG between 50 to 100 IU/ L. On the seventh day after fertilization, the concentration becomes 100 IU/ L. On the contrary, with the tests based on polyclonal antibodies, pregnancy can not be detected except starting from day 25.

(1 pt.)
(1 pt.)

d- Detecting cancer cells.