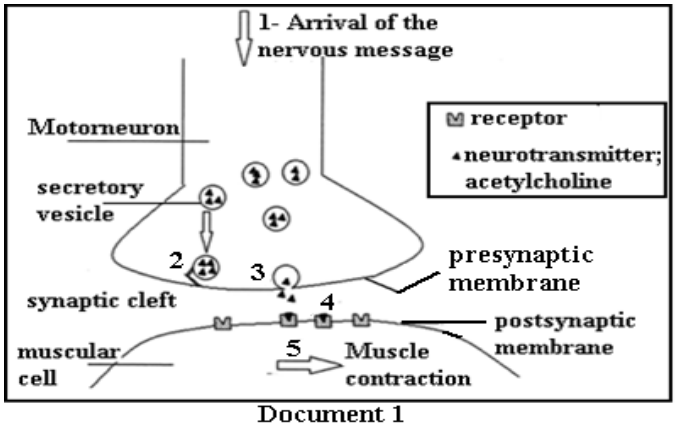
المادة: علوم الحياة – لغة إنكليزية الشهادة: الثانوية العامة الفرع: الآداب والانسانيات نموذج رقم 2019/1 المدّة : ساعة واحدة	الهيئة الأكاديميّة المشتركة قسم : العلوم	المركز التربوي للبحوث والإنماء

Answer the following three exercises.

Exercise 1 (6.5 points) Muscular Paralysis in Worms

Caenorhabditis elegans is a small worm used as a model animal to study the function of the neuromuscular synapse. Document 1 shows a number of the steps of synaptic transmission in a normal worm.



Document 1

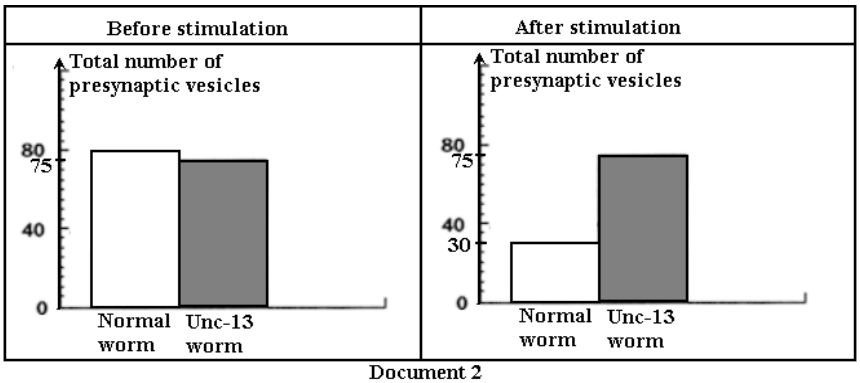
1. List, by referring to document 1, the steps of the synaptic transmission that leads to muscle contraction.
2. Specify if the synapse presented in document 1 is inhibitory or excitatory.

Unc-13worm is a one type of Caenorhabditis elegans, which shows complete muscle paralysis related to abnormality in the synaptic transmission. To find out the cause of this abnormality, the following studies are performed.

Study 1: Radioactive acetylcholine is injected into the synaptic cleft of the neuromuscular synapse of both worms, normal one and Unc-13 worm. Radioactivity is detected at the level of the postsynaptic membrane and muscle contraction is observed, in each of the worms.

3. Show that the paralysis of Unc-13 worm is not due to a defect in the postsynaptic receptors.

Study 2: Document 2 presents the total number of presynaptic secretory vesicles containing acetylcholine in both worms, before and after an effective electric stimulation of a motor neuron innervating the muscle.



Document 2

4.1 Analyze the obtained results.

4.2 Draw out the cause of paralysis in Unc-13 worm.

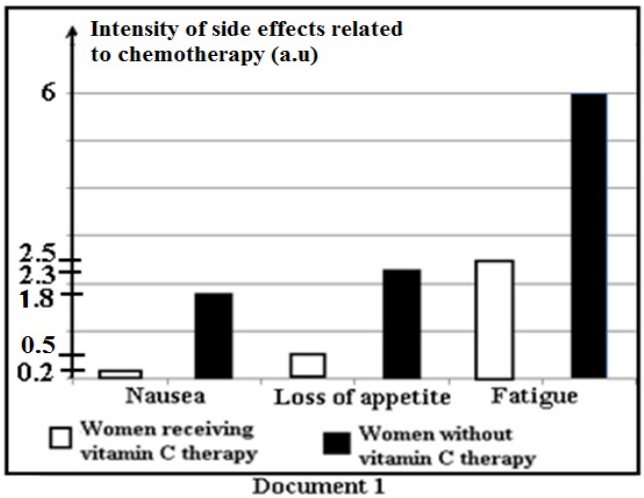
Exercise 2 (7 points) Vitamin C therapy and Cancer

Ascorbic acid or vitamin C is a vital nutrient for health. It occurs naturally in some foods, especially, the fruits and vegetables. It is an antioxidant that slows down the oxidation process and prevents or slows down cellular damage.

1. Pick out, from the text, the role of an antioxidant.

In the framework of studying the importance of supplying cancer patients with vitamin C, the following studies are performed.

Study 1: To show the effect of vitamin C administration on the intensity of side effects related to chemotherapy, a research is performed in Germany on 125 patients with breast cancer for 4 weeks. The results are presented in document 1.



Document 1

2. Interpret obtained results (document 1).

Study 2: Another research is performed in order to show the effect of vitamin C therapy on the survival of nine cancer cell lines and four normal cell types. The tested cells are placed for 1 hour in a culture medium to which vitamin C is added. The obtained results are presented in document 2.

3. Construct the graph that shows the variation of the percentage of cell survival of both, the normal cells and the cancer cells, as a function of time (document2).

4. Interpret the results presented in document 2.

Time (minutes)		0	10	20	30	40	50	60
Percentage of cell survival (%)	**Normal cells**	100	100	100	100	100	100	100
	Cancer cells	100	90	80	70	60	50	40

Document 2

5. Determine the effects of vitamin C on the health of the patients affected with cancer.

Exercise 3 : (6.5 points)Coronary Heart Disease

Coronary heart disease is characterized by the narrowing of the coronary arteries that supply the heart with oxygen gas and nutrients. This narrowing is due to the formation of atheroma plaque (atherosclerosis).

There are two major forms of cholesterols in blood: Low-density lipoprotein or LDL and high-density lipoprotein or HDL. One of these forms is qualified as "bad cholesterol" since it facilitates the formation of atheroma plaque.

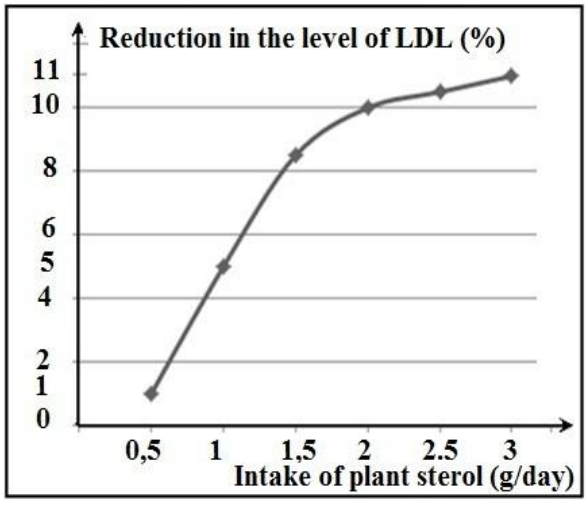
1. Indicate:

1.1 The cause of the coronary heart disease.

1.2 The forms of cholesterol transported via blood and the role of each.

2. Justify the following statement: "The excessive intake of food rich in lipids that favors the production of LDL, such as milk, egg, and meat, increases the risk of occurrence of heart attack".

In order to reduce the risk of coronary heart disease, dietitians recommend a healthy diet in addition to plants sterols. Plant sterols are substances that occur naturally in small quantities in a number of plant products such as fruits, legumes, nuts, and seeds. The adjacent document shows the effect of the intake of plant sterols on the level of LDL



3. Interpret the results presented in the adjacent document.

4. Explain, by referring to all what precedes, why dietitians recommend to consume plant sterols.

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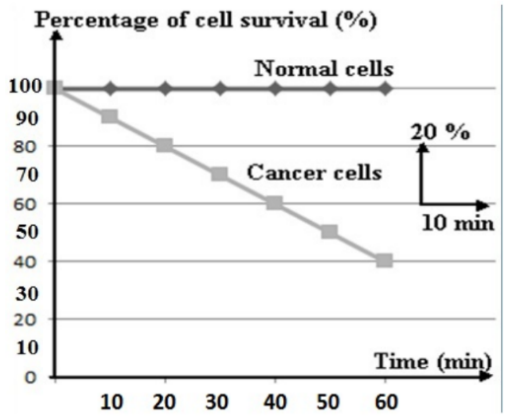
أسس التصحيح:

Part of the exercise	Exercise 1 (6.5 points) Muscular paralysis in worms	Mark
1	The steps of the synaptic transmission that lead to muscle contraction: **1.** Arrival of the nervous message to the terminal buds of the motor neuron **2.** Fusion of the secretory vesicles containing the neurotransmitter, acetylcholine, with the presynaptic membrane. **3.** Exocytosis of the neurotransmitter, acetylcholine, into the synaptic cleft. **4.** Binding of acetylcholine to the postsynaptic receptors found on the postsynaptic membrane of muscular cells. **5.** This binding induces muscle contraction.	**2**
2	The synapse is excitatory since the binding of the neurotransmitter; acetylcholine, to its specific postsynaptic receptors launches a response at the level of the muscle (contraction).	**1**
3	The injection of radioactive acetylcholine in the synaptic cleft leads to muscle contraction in both worms, the normal one and the Unc-13, and radioactivity is detected at the level of postsynaptic membranes. This means that the postsynaptic receptors in Unc-13 worms are sensitive to acetylcholine and consequently they are normal. Thus, the worm paralysis is not due to a defect in the postsynaptic receptors.	**1.5**
4.1	Before the electric stimulation, the total number of presynaptic vesicles which contain acetylcholine is approximately the same in both, the normal worm, 80 vesicles, and the Unc-13 worm.75 vesicles. However, after applying an effective electric stimulation on the motor neuron innervating the muscles in both worms, the number of the presynaptic vesicles in the normal worm decreases to 30 vesicles, while that in Unc-13 worm remains the same, 75 vesicles.	**1.5**
4.2	The paralysis of Unc-13 worm is due to the absence of exocytosis of neurotransmitters (acetylcholine) in the synaptic cleft.	**0.5**

Part of the exercise	Exercise 2 (7 points) Vitamin C Therapy and Cancer	Mark
1	An Antioxidant is a substance that slows down the oxidation process and prevents or slows down cellular damage.	**1**
2	The intensities of side effects related to chemotherapy: nausea, loss of appetite and fatigue are 1.8a.u, 2.3 a.u and 6 a.u respectively in women who did not receive a treatment with vitamin C. However, these intensities decrease to 0.2 a.u, 0.5 a.u and 2.5 a.u respectively, in women who receive supplements of vitamin C. Thus, the treatment with vitamin C reduces the side effects of chemotherapy in cancer patients.	**1.5**

3		Title: Graph showing the percentage of cell survival following vitamin C therapy as function of time. 	**2**
4		The results in document 2 show that vitamin C decreases the percentage of cancer cells survival from 100 % to 40 % while it has no effect on the survival of normal cells (100%). Therefore, this vitamin facilitates the destruction of cancer cells without harming normal cells.	**1**
5		Vitamin C acts as an antioxidant that slows down the oxidation process and prevents cell damage. In addition, it reduces the intensity of the side effects of chemotherapy and facilitates the destruction of cancer cells without harming normal cells. Thus, vitamin C has a positive effect on cancer patients by improving their quality of life, slowing the progression of cancer and preserving their cells.	**1.5**
Part of the exercise		**Exercise 3 (6.5 points)** **Coronary heart disease**	**Mark**
1	**1.1**	Coronary heart disease is caused by the formation of atheroma plaques that block the coronary arteries.	**0.5**
	1.2	Cholesterol is transported by blood in two forms: Low-density lipoprotein or LDL and high-density lipoprotein or HDL. HDL transports the excess of cholesterol from the tissues to the liver to prevent its accumulation in the blood. LDL deposes cholesterol on the internal walls of arteries, where it accumulates, causing the formation of the atheroma plaques.	**2**
2		The consumption of food rich in lipids such as milk, egg, and meat leads to an increase in the level of LDL in the blood. The excessive level of LDL deposes cholesterols on the internal walls of arteries, where it accumulates, causing the formation of the atheroma plaques which leads to the narrowing of the coronary arteries. This narrowing decreases the supply of oxygen gas and nutrients to body cells and eventually increases the risk of heart attack occurrence.	**2**
3		The reduction in the level of LDL increases progressively from 1 % to 11 % as the intake of plant sterols increases from0.5g/day to 3g/day. Thus, plant sterols favor the reduction of LDL level in the blood.	**1**
4		The high level of LDL favors the formation of atheroma plaques, which block the coronary arteries, thus, increasing the risk of heart attack. However, a diet rich in plant sterols reduces the level of LDL in the blood which in turn reduces the risk of the formation of atheroma plaque and consequently decreases the risk of heart attack. Thus, plant sterols prevent coronary heart disease, and that's why they are recommended by dieticians.	**1**