

اسم :
رقم :
مسابقة في الثقافة العلمية
مادة "علوم الحياة"
المدة: ساعة واحدة

Answer the following exercises.

Exercise 1 (5pts)

The document below shows the causes of certain nervous system diseases and their consequences on health.

Diseases	Causes and Consequences
Lateral amyotrophic sclerosis (LAS)	Attack of certain cerebral neurons, which provokes difficulties in movements leading to gradual paralysis of all the body muscles.
Parkinson disease	Attack of certain cerebral neurons, which release a neurotransmitter, dopamine. Patients show tremors, muscles rigidity and difficulty in movements.
Huntington chorea	Attack of certain cerebral neurons, which provokes uncontrolled movements and mental capacities progressive deterioration.

1- Pick up from the document the similarities between all these diseases.

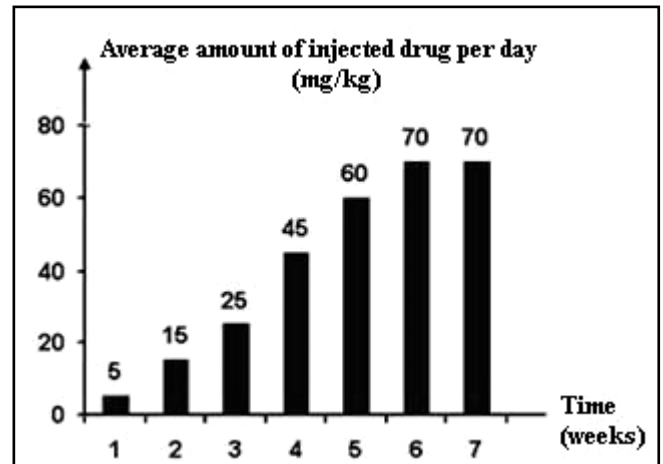
L-dopa is a molecule converted into dopamine within the cerebrum. Chlorpromazine is a molecule that has a similar spatial structure to that of dopamine, and prevents the action of this latter at the level of the synapse.

- 2- "L-dopa reduces the disorders observed in patients affected with Parkinson disease". Justify this statement.
- 3- Explain how chlorpromazine prevents the action of dopamine at the level of a synapse.
- 4- Indicate the consequences of injecting chlorpromazine into the cerebrum of a normal individual and into the cerebrum of an individual affected with Parkinson disease.

Exercise 2 (5pts)

A fasting monkey is placed in a cage supplied with a lever. When the monkey hangs to the lever, it receives a drug injection. In the course of a few hours, the monkey steps on the lever repeatedly.

The average quantity of drug injected into the monkey is measured for 7 weeks. The results are shown in the next document.



- 1- Draw a table showing the variations of the average amount of the injected drug as a function of time.
- 2- Analyze this document.
- 3- What does "tolerance" mean with respect to drugs?

By referring to the document, show that the monkey is in a state of tolerance.

Exercise 3 (5pts)

The document below summarizes the action of thyroid hormones on the organism.

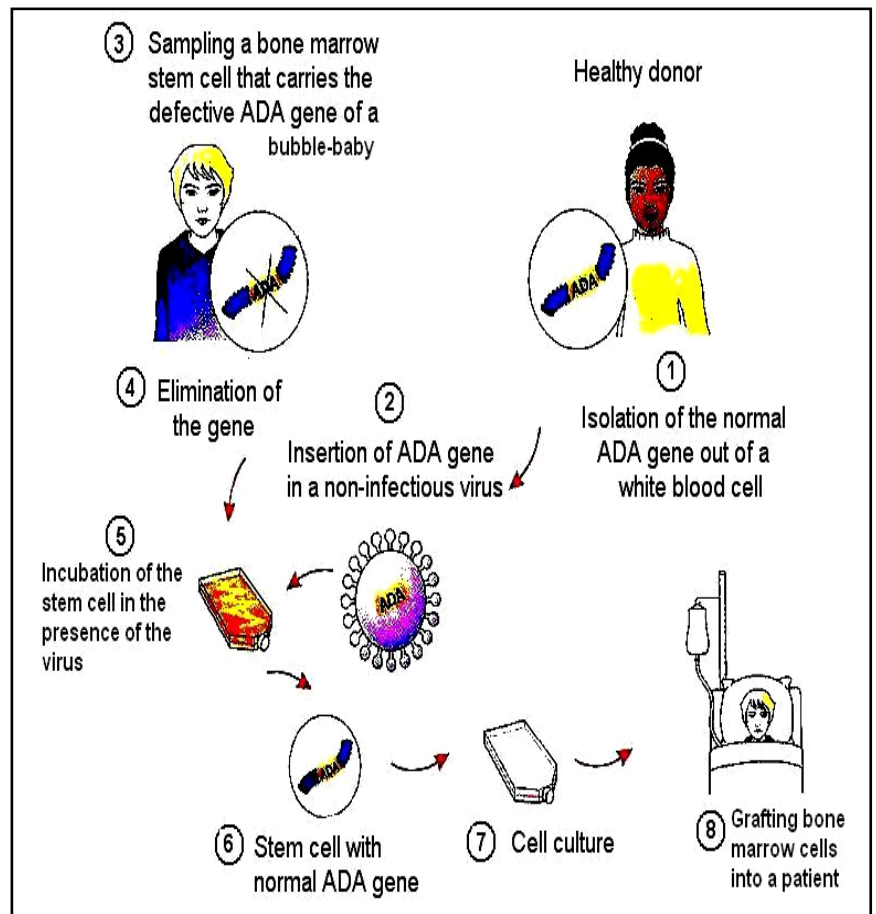
The function of the thyroid begins as early as fetal age. It plays an important role in growth. At puberty, the thyroid hormones, together with growth hormones and sex hormones, favor a change in the adolescent's body. Throughout our life, the thyroid produces the hormones, T3 and T4, both essential for the functioning of our body. An excess of these hormones or hyperthyroidism provokes body temperature increase, cardiac rhythm acceleration, diarrhea, weight loss, excitement, and aggressiveness. On the other hand, a lack in these hormones or hypothyroidism leads to a drop in body temperature, slowing down of cardiac rhythm, weight gain, constipation, weak memory, and signs of depression.

- 1- Pick up from the text the two thyroid hormones and the period during which they act on the body.
- 2- By referring to the text, draw up a comparative table showing the differences between hyperthyroidism and hypothyroidism.
- 3- Indicate the essential constituents needed for the production of the thyroid hormones.
- 4- "The thyroid is an endocrine gland". Justify this statement.
- 5- Explain the mode of action of the thyroid hormones on their target cells.

Exercise 4 (5pts)

Gene therapy is a method used to correct the defective cells of the organism. The next document reveals a gene treatment for babies affected with a rare disease: the absence of adenosine deaminase enzyme (ADA), leading to a deficiency of the immune system. These babies, called "bubble-babies", spend generally their brief life in a sterile bubble chamber in order to prevent infection.

- 1- Write a short text describing the gene treatment performed.
- 2- Name the biotechnology method used in this therapy. Justify the answer.
- 3- Specify the advantages acquired by the "bubble-baby" following this therapy.
- 4- Name two applications of this method in the domains of health and food technology.



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Exercise 1 (5pts)

- 1- Similarities:
 - Attack of certain cerebral neurons **(0.75pt)**
 - Motor disorders: difficult and uncontrolled movements **(0.75pt)**
- 2- L-dopa is converted into dopamine within the cerebrum. Since Parkinson disease is due to an attack of the dopamine neurons, then L-dopa will substitute the lacking dopamine at the level of the cerebrum and reduce the troubles in the affected person. **(1.5pts)**
- 3- Chlorpromazine molecule has a similar spatial structure to that of dopamine and will fix to dopamine receptors located at the level of the postsynaptic membrane, preventing the fixation of dopamine thus, inhibiting its action. **(1pt)**
- 4- Motor disorders appear in a normal individual and will be similar to those provoked by Parkinson disease. The disease will aggravate in individuals already affected with Parkinson disease. **(1pt)**

Exercise 2 (5pts)

1- (2pts)

Time (weeks)	1	2	3	4	5	6	7
Average amount of drug injected per day (mg/kg)	5	15	25	45	60	70	70

Variations of the average quantity of injected drug versus time

- 2- On the first week, the quantity of the drug injected by the monkey is 5mg/kg; it increased in the course of the coming weeks to reach 70mg/kg at the 6th week and remains constant until week 7. **(1pt)**
- 3- Tolerance is the increase in the dose of the drug consumed in order to obtain the same pleasure sensations felt with the lower previous doses. **(1pt)**
The histogram reveals that the monkey is gradually increasing the doses with time in order to obtain the same previous effects; this means the monkey is in state of tolerance. **(1pt)**

Exercise 3 (5pts)

1- Thyroid hormones: T3 and T4. They act for lifetime. **(1pt)**

2- **(1.5pts)**

Hyperthyroidism	Hypothyroidism
Excessive hormonal secretion	Lack of hormonal secretion
Increase in body temperature	Decrease in body temperature
Cardiac rhythm acceleration	Slowing down of cardiac rhythm
Diarrhea	Constipation
Weight loss	Weight gain
Excitement and aggressiveness	Weak memory, signs of depression

3- The essential constituents: iodine and amino acids **(0.5pt)**

4- The thyroid is an endocrine gland because it secretes hormones released in the blood and acting on other organs of the body. **(1pt)**

5- Specific thyroid hormones are located on target cells. The hormone fixes to the receptors, and the complex hormone – receptor provokes a series of cellular reactions that modify the activity of the cell. **(1pt)**

Exercise 4 (5pts)

1- The normal ADA gene is isolated from the white blood cell of a healthy donor, and then introduced in a non-infectious virus. A bone marrow stem cell that carries the defective ADA gene is extracted from the bubble-baby. This defective gene is eliminated and this stem cell is incubated in the presence of a virus. A stem cell carrying the normal ADA gene is obtained, and put in culture. It results in stem cells that are grafted to the patient. **(2pts)**

2- Transgenesis. This is because a foreign normal ADA gene was inserted in a cell having a defective ADA gene, and led to the production of a stem cell having a normal ADA. **(1pt)**

3- His immune system will not be defective anymore and it will be possible for him to live normally and not inside a bubble chamber in order to prevent infections. **(1pt)**

4- Health domain: Production of insulin, growth hormone.
Food technology: The production of plants resistant to diseases. **(1pt)**