الامتحان الوطني الموحد للبكالوريا
المسالك الدولية
الدورة الاستدراكية 2020
- الموضوع –

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المملكة المغربية
وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي
المركز الوطني للتقويم والامتحانات

المادة	علوم الحياة والأرض	مدة الإنجاز	3
الشعبة أو المسلك	شعبة العلوم التجريبية مسلك علوم الحياة والأرض (خيار أنجليزية)	المعامل	7

Candidates may use non-programmable calculators

Section I: Knowledge Retrieval (5 pts)

I. Answer the following questions on your answer sheet:

1. **Define**: a - pedigree b- karyotype. **(1 pt)**
2. **Give** two ways of Prenatal diagnosis of chromosomal abnormalities **(0.5 pt)**
3. **Give** two examples of difficulties related to the study of human genetic. **(0.5 pt)**

II. For each of the propositions numbered from 1 to 4, there is only one correct suggestion in each set.
C**opy down** these pairs (1; ..), (2; ..), (3; ..), (4; ..), and **match** each number with its corresponding letter. **(2 pts)**

1. The meiosis is constituted of: **a.** succession of two divisions and one interphase; **b.** reductional division preceded by equational division; **c.** reductional division followed by equational division; **d.** succession of two divisions each one is preceded by interphase.	**2. In the case of hereditary disease controlled by dominant allele carried by chromosome X:** **a.** the father with the disease is heterozygote; **b.** the healthy woman give birth to a sick boy; **c.** the father with by the disease gives birth to a healthy girl ; **d.** the father with by the disease gives birth to a sick girl.
3. The intrachoromosomal recombination result in: **a.** exchange of fragments between non homologous chromosomes during prophase I; **b.** exchange of fragments between homologous chromosomes during prophase I; **c.** random separation of homologous chromosomes during anaphase I; **d.** random separation of homologous chromosomes during anaphase I.	**4. The mitosis is a division which allows:** **a.** intrachromosomal recombination following the phenomenon of chromosomal crossover; **b.** maintaining the number of chromosomes in daughter cells in comparison with mother cell; **c.** passage from diploid mother cell to two haploid daughter cells; **d.** separation of the homologous chromosomes during anaphase.

III. **Copy down** on your answer sheet the letter of each of the following propositions, and **write** whether the statements are « true » or « false »: **(1pt)**

a. Down syndrome is caused by loss of a chromosome 21.

b. The DNA replication is semiconservative.

c. The chromosome formula of human female gamete is n= 22AA+X.

d. Replication bubbles are observed during phase S of the interphase.

Section II: Scientific reasoning and communication in graphic and written modes (15 pts)

Exercise 1 (5 pts)

The muscle contraction requires a constant renewal of ATP molecules. Some people suffer from a disease called **glycogenosis type 0 (GSD-0)**. Among these symptoms is the intolerance to muscular effort from early childhood. In order to explain the metabolic origin of this intolerance, it is proposed to exploit the following data:

- **Data 1:** the figure 1 of document 1 presents simplified diagrams of the cross-section at the level of two samples of skeletal muscle in child suffering from **GSD-0** and a healthy child of the same age. The figure 2 represents steps of the synthesis of glycogen, reserve form of glucose, in muscle cell to meet its energy needs.

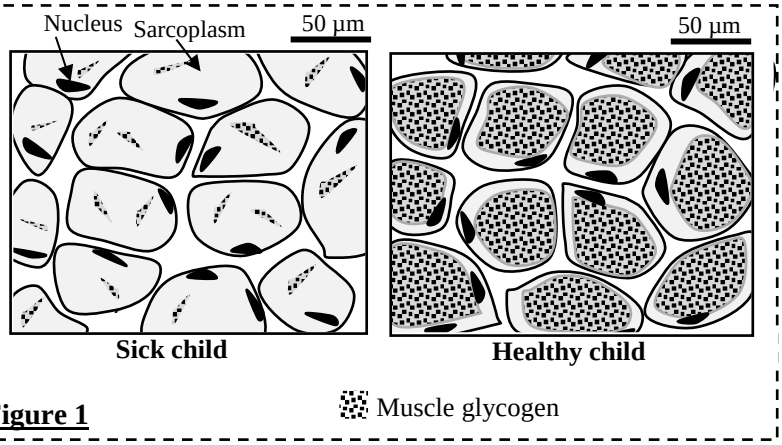
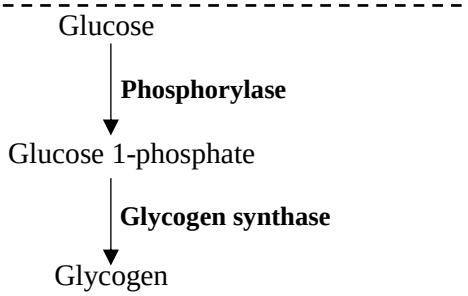


Figure 1



The phosphorylase and the glycogen synthase are the enzymes present in muscle cells.

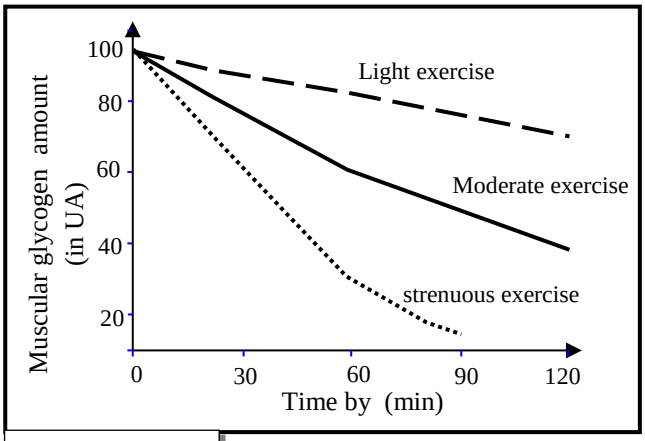
Figure 2

Remarque: the sick child presents a dysfunction in the enzyme glycogen synthase

Document 1

1. Based on document 1, **extract** the observed difference between the muscle of the healthy child and the muscle of sick child then **explain** this difference. **(1pt)**

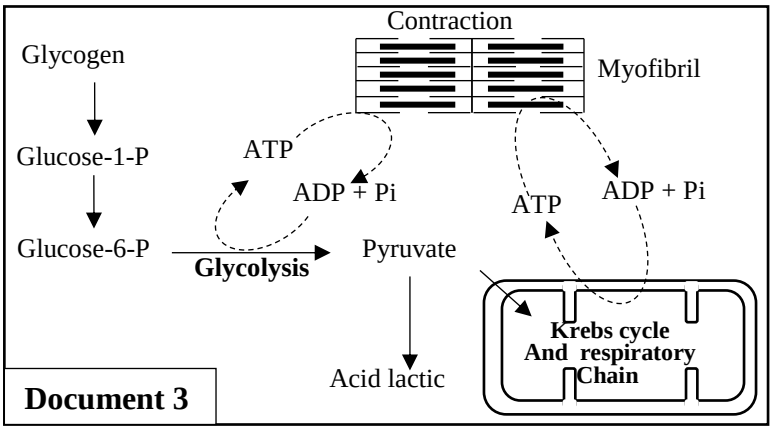
- **Data 2:** the document 2 presents results of the measurement of the glycogen amount of the thigh muscle, according to the intensity of muscular effort.



Document 2

2. Based on data from document 2, **describe** the evolution of the amount muscle glycogen according to intensity of muscular effort, then **deduce** the relationship between intensity of muscular effort and glycogen consumption. **(1.25 pt)**

- **Data 3:** the document 3 represent metabolic pathway of synthesis and utilization of ATP in muscle cell.



Document 3

3. By using documents 2 and 3, explain the relationship between glycogen consumption and muscular effort. **(1.25 pts)**

4. Based on precedent data, explain the metabolic origin of the **GSD-0 disease**. **(1.5 pts)**

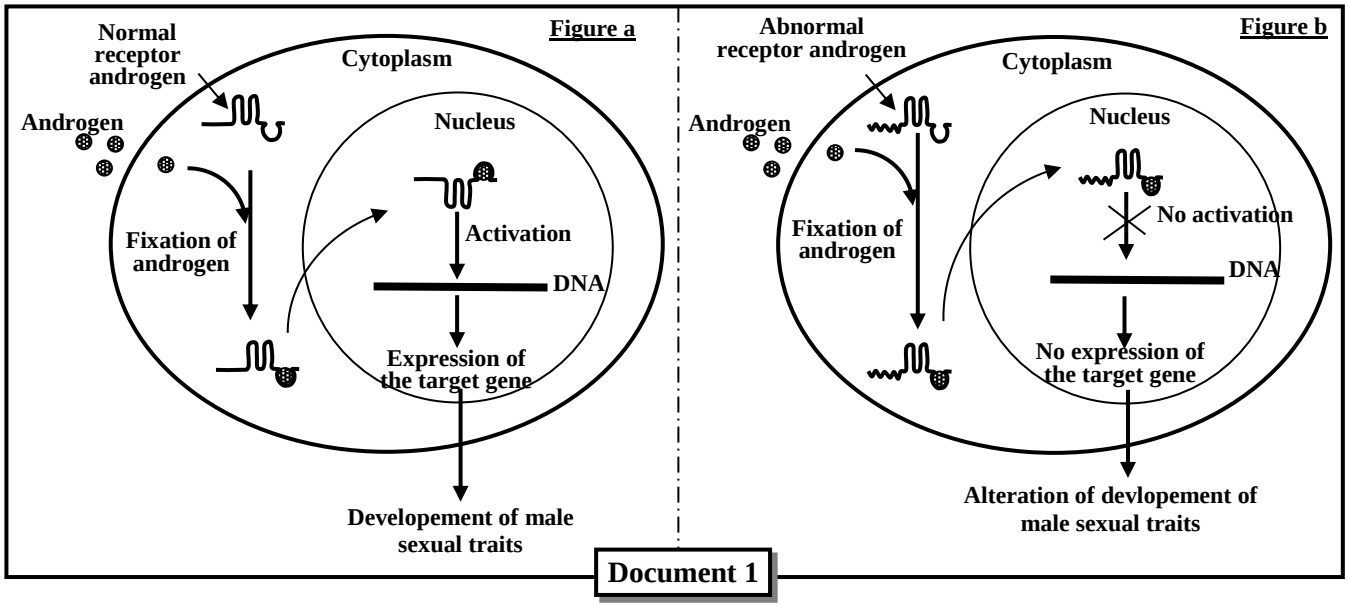
Exercise 2 (6.5 pts)

Kennedy disease is a hereditary disease that affects male people. The affected persons present a set of symptoms among which alteration of development the male sexual traits.

In order to determine the genetic origin of Kennedy disease, we present the following data:

- **Data 1:** Research has shown that this disease is associated with a protein-like cytoplasmic receptor that binds to sex hormones (androgens) leading to the development of male sexual characteristics.

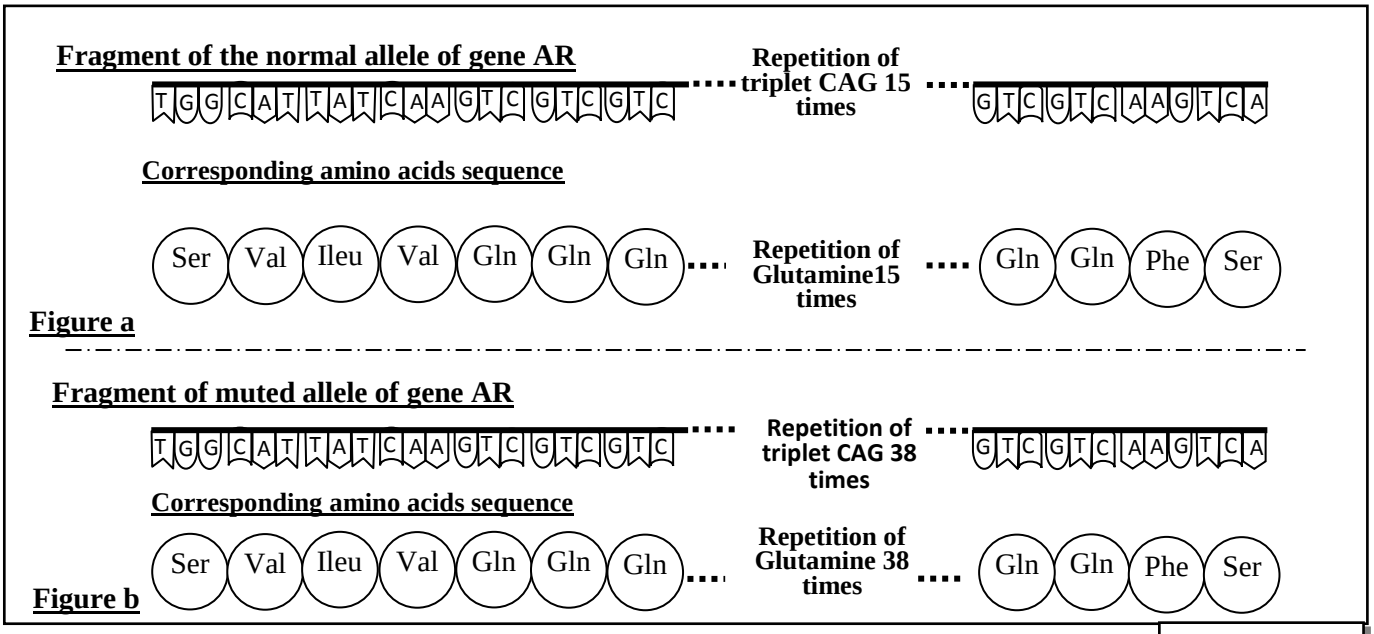
The figure 1 of document 1 shows the relationship between androgen receptor and development of male sexual traits in a healthy person (figure a) and in a person affected by Kennedy disease (figure b).



Document 1

1. Based on document 1, **show** the relationship protein-trait. **(1pt)**

The synthesis of androgen receptor is controlled by a gene called AR situated on the chromosome X. The document 2 represents a fragment of gene AR and corresponding amino acids sequence in a healthy individual (figure a) and in an affected individual by Kennedy disease (figure b).



Document 2

2. Based on document 2, **compare** nucleotides sequences of gene AR and amino acids sequences between the healthy individual and the sick individual. **(1 pt)**

3. Based on precedent documents, **explain** genetic origin of Kennedy disease. **(0.75 pt)**

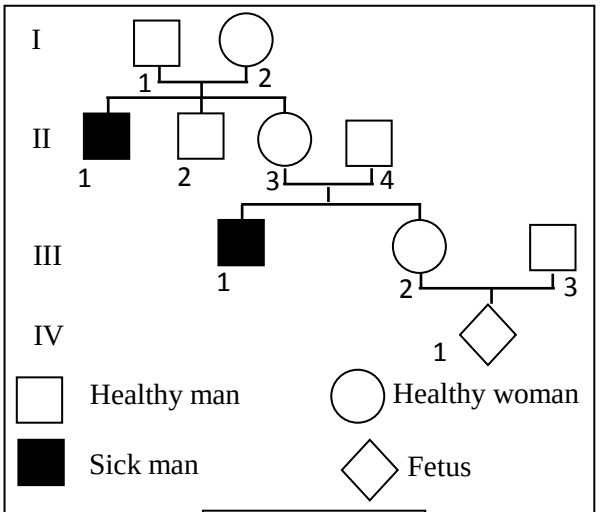
● **Data 2:** the document 3 presents a pedigree of a family whose set of members are affected by Kennedy disease.

4. Based on document 3:

a. show that the allele responsible is recessive and determine genotypes of individuals I_2, II_1, III_2. **(1pt)**

b. assuming that woman III_2 is heterozygous, **calculate** the probability that couple $III_2 \times III_3$ give birth to a sick child by using the Punnet square. **(0.75 pt)**

(Use the symbols N and n for the two alleles of the studied gene)



Document 3

- **Data 3:** The Kennedy disease is a rare hereditary disease. In a given population it affects one man in 150 000. Let's suppose that this population abides by the Hardy-Weinberg equilibrium:

5. Calculate the frequency of the allele responsible for the disease and that of the normal allele. **(1pt)**

6. Calculate the frequency of women carrying and healthy women not carrying of the allele responsible for the disease. **(1pt)**

N.B: Give six digits after the decimal point in numerical applications.

Exercise 3 (3.5 pts)

To study the transmission of certain hereditary traits in tomato it is suggested to exploit the results of the following crosses:

- **1st cross:** realized between a line of wild tomato (normal sized plant with smooth fruit) and mutant line (dwarf-sized plant with velvety fruit).Plants of first generation F_1 are all of wild phenotype.

1. What do you **deduce** from the results of this cross? **(0.75pt)**

- **2nd cross**: realized between plants of tomatoes of the mutant line and plants of generation F_1. The following table presents the obtained results of generation F'_2:

Phenotypes of plants	normal sized plant with smooth fruit	dwarf-sized plant with velvety fruit	normal sized plant with velvety fruit	dwarf-sized plant with smooth fruit
Repartition the phenotype in generation F'_2	476	480	21	23

2. a. Show that studied genes are linked et **deduce** the relative distance between two genes. **(0.75pt)**

b. **Use** Punnet square to **give** the chromosomal interpretation of results of second cross. **(1pt)**

Use the following symbols: -N and n for alleles responsible for the size of plant;
-L and ℓ for alleles responsible for the fruit appearance.

● To determine the relative position of a third gene responsible for the color of the leaf (green color; mottled color) in relation to two other genes, we propose the results of 3rd and 4th cross

Cross	**3rd cross**	**4thcross**
Phenotypes of parents	Between plants with normal size and green leaves heterozygous for both traits and double recessive plants with dwarf-size and mottled leaves.	Between plants with smooth fruit and green leaves heterozygous for both traits and double recessive plants with velvety fruit and mottled leaves.
Results	- 878 plants with parental phenotypes - 122 plants with recombined phenotypes	- 834 plants with parental phenotypes - 166 plants with recombined phenotypes

3. Based on results of 3rd and 4th crosses:

a. determine the relative distance between : **(0.5 pt)**

- gene responsible for the plant size and the one responsible for the color of the leaf,
- gene responsible for the fruit appearance and the one responsible for the color of leaf.

b. establish gene maps of the three genes studied. **(0.5 pt)**

Use the symbols V and v for the two alleles of the gene responsible of color of the leaf.

-END-