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	2
الشعبة أو المسلك	شعبة العلوم الرياضية (أ) (خيارإنجليزية)	المعامل	3

Candidates may use non-programmable calculators

Section I : Knowledge Retrieval (5 pts)

I. **Answer** the following questions on your writing sheet:

1. Define the following notions: **- Diploid cell - Crossing-over**. **(1pt)**

2. Cite two characteristics of a diplophasic chromosomal cycle. **(1pt)**

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

1. From one generation to the next, the alternation of meiosis and fertilization ensures: **a-** the reduction of the amount of DNA; **b-** the variation of the chromosomal formula; **c-** reducing the number of genes; **d-** the diversity of individual traits.	**2- During meiosis:** a- the pairing of chromosomes with two chromatids takes place during prophase I; b- the homologous chromosomes form an equatorial plate during metaphase I; c- the chiasmas result in an interchromosomal mixing; d- random separation of homologous chromosomes results in intrachromosomal mixing.
3- **A cell with 2n chromosomes containing an amount of DNA of 2Q during the G2 phase:** **a-** will have n chromosomes having a chromatide in prophase II ; **b-** its amount of DNA will be Q in prophase I; **c-** will have n chromosomes having two chromatids in telophase I; **d-** the amount of DNA of its daughter cells will be Q in telophase II.	**4- In a haplophasic development cycle:** **a-** the gametophyte is diploid and gives gametes with n chromosomes; **b-** the gametophyte is haploid and gives gametes with n chromosomes; **c-** the sporophyte is diploid and gives gametes with n chromosomes; **d-** the sporophyte is haploid and gives gametes with n chromosomes.

III. Match the name of each chromosomal abnormalities (Group 1) with its corresponding characteristic (Group 2). **Copy down** these pairs (1; ..), (2; ..), (3; ..), (4; ..), and **match** each number to its corresponding letter. **(1 pt)**

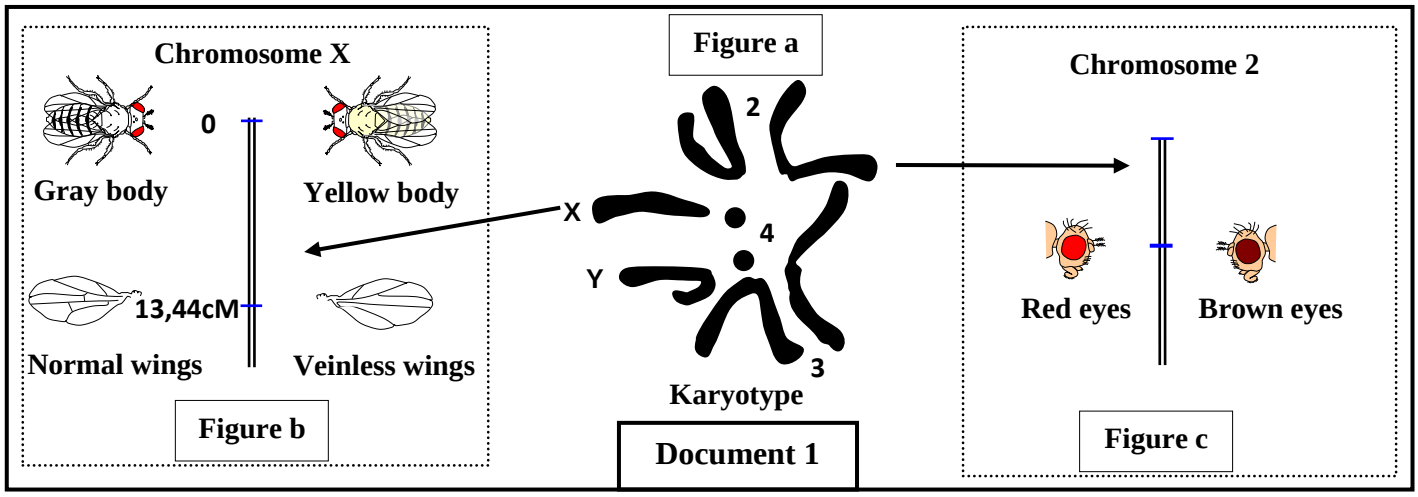
Group 1(chromosomal abnormalities)	**Group 2 (**characteristic)
1. Down syndrome	**a.** deletion of part of chromosome 5.
2. Klinefelter syndrome	**b.** presence of an additional chromosome 21.
3. Turner syndrome	**c.** presence of 44 autosomes and a single X sex chromosome.
4. Lejeune syndrome (Cat-cry)	**d.** présence de 44 autosomes et trois chromosomes sexuels 2X et Y.

Section II: Scientific Reasoning and Communication in graphic and written modes (15 pts)

Exercise 1 : (5pts)

In Drosophila we follow the transmission of three genes:
- A gene responsible for eye color has two alleles: a dominant allele "bw^+" responsible for red color and a recessive allele "bw" responsible for brown color.
- A gene responsible for body color has two alleles: a dominant allele "j^+" responsible for the gray color and a recessive allele "j" responsible for the yellow color.
- A gene responsible for wing shape has two alleles: a dominant allele "cv^+" responsible for normal wings and a recessive allele "cv" responsible for veinless wings.

• Document 1 presents the karyotype of a male drosophila (Figure a) and the location of these three genes on the chromosomes (Figure b and c).



1- Determine the chromosomal formula of the karyotype presented in document 1 and the chromosomal formula of the gametes produced by this individual. **(0 .75pt)**

2- Based on the arrangement of these three genes on the chromosomes **give**, by justifying your answer, the type of chromosomal mixing possible during gamete formation in a heterozygous female between the genes responsible: **(1pt)**

a- the body color and eye color.

b- the body color and the wing shape.

3- Based on a Punnett Square, **determine** for the characters, eye color and body color, the percentages of phenotypes expected during a test-cross between a double heterozygous female and a double recessive male. **(1.75pt)**

• In order to verify the mode of transmission of the two characters: body color and wing shape, a cross was made between a heterozygous female with a grey body and normal wings and a male with a grey body and normal wings. Generation F_2 from this cross and the experimental results are presented in document 2:

Phenotypes	Grey body and normal wings **[j^+, cv^+]**	Grey body and veinless wings **[j^+, cv]**	Yellow body and veinless wings **[j, cv]**	Yellow body and normal wings **[j, cv^+]**
Male	1621	254	1625	250
Female	3747	0	0	0

Document 2

4- Based on the experimental results of document 2:

a- Show that the two genes are linked and carried by the X sex chromosome. **(1pt)**

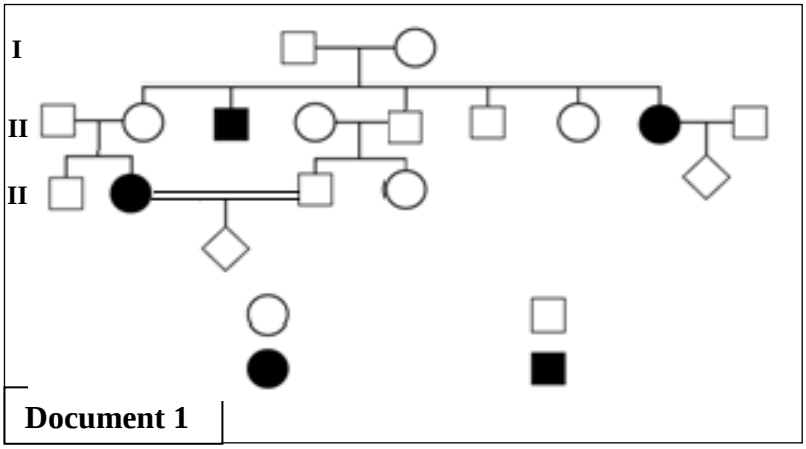
b- Verify that the distance between the two genes corresponds to the data in figure b of document**. (0,5pt)**

Exercise 2 : (4 points)

Sickle cell disease is an inherited disease that affects humans. One of the mutations in the gene that governs the synthesis of hemoglobin causes deformation of red blood cells and subsequently a depletion of oxygen in the body's cells, hence the onset of the disease. This gene is found in the form of two alleles (H / h). One of these alleles is responsible for the synthesis of normal hemoglobin and the other is responsible for the synthesis of abnormal hemoglobin.

In order to study the mode of transmission of this disease in a family, the following data is proposed:

● Document 1 presents a pedigree of the family studied, some members of which are affected by sickle cell disease.



Document 1

1- Based on document 1 :

a- Determine the mode of transmission of the disease. **Justify** your answer. **(1pt)**

b- Give the genotypes of II_2, II_5, III_2 and III_3. **(1pt)**

***Use** the symbol **H** for the dominant allele, and the symbol **h** for the recessive allele.*

2- D**etermine** the probability that couple III_2 and III_3 would give birth to a sick child**. Justify** your answer by **using** Punnett Square to. **(1.25pt)**

● To determine the genotypes of some individuals of this family, the electrophoresis technique is used to separate the two types of alleles, H and h, in an electric field, as shown in figure (a) of Document 2. The results of this electrophoresis, carried out on individuals II_2, II_5, III_2 and the fœtus, are shown in figure (b) of the same document.

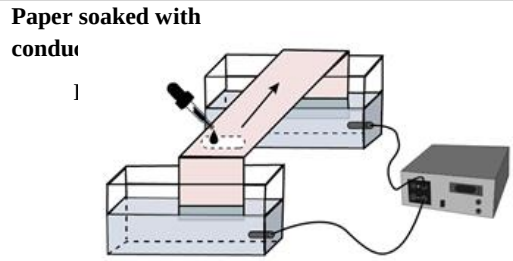


Figure a

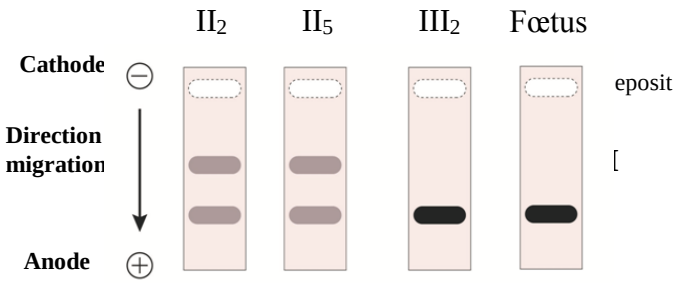


Figure b

Document 2

3- Based on document 2, determine the genotype and phenotype of the fetus and **specify** the consequences on the progeny of individual III_3. **Justify** your answer. **(0.75pt)**

Exercise 3 : (6 pts)

In order to study the variation in the diameter character of the eye in catfish (*Ameirus melas*), the following data are proposed:

Data 1: A fish farmer measured the eye diameter in a sample of 20 catfish of the same age (Population E1). The results obtained are represented by document 1.

Eye diameter in mm	1,6	7,6	4,2	3,4	5,4	2,4	5,8	4,4	3,6	4,5
	4	6,4	6,2	3	5,6	4,3	4,8	2	4,6	3,8
Document 1										

1- Based on document 1 and using 1mm interval classes (from [1-2 [to [7-8 [), make on your exam sheet the frequency histogram and of the distribution of the number of fish according to the diameter of the eye in mm. **(2pts)**

Use 1cm for each class and 1cm for 1 fish.

2- Calculate the arithmetic mean and the standard deviation of this distribution, **based** on an application table for the calculation of the statistical parameters. **(2pts)**

Use the following formula: $\sigma = \sqrt{\frac{\sum_1^i f_i (x_i - \overline{x})^2}{n}}$ **and** $\overline{x} = \frac{\sum_1^i (f_i x_i)}{n}$

Data 2: Comparison of the eye diameter of two purebred catfish populations, one population of blind fish (P1) and one of sighted fish (P2) with normal vision, shows that the eye diameter of sighted fish is six times larger than that of blind fish. Document 2 presents the statistical parameters calculated for the two populations.

Document 2	Catfish	Arithmetic mean	Standard deviation
Population P1		1,22 mm	0,2 mm
Population P2		7,48 mm	0,22 mm

Data 3: In order to obtain sighted fish, the fish farmer made the cross between the individuals of sample E1 having eyes of diameter greater than 6mm. The progeny obtained (E2) is homogeneous with an arithmetic mean of 7.46 mm and a standard deviation of 0.21 mm.

3- Based on data 2 and 3 and your previous answers:

a- Show that this fish farmer artificial selection is effective. **(1pt)**

b- Show that artificial selection at the level of E2 progeny would be ineffective. **(1pt)**

----------The end----------

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