★★★

الامتحان الوطني الموحد للبكالوريا
المسالك الدولية ـ خيار أنجليزية
الدورة العادية 2017
- الموضوع -

NS 36E

المملكة المغربية
وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي

المركز الوطني للتقويم والامتحانات والتوجيه

المادة	علوم الحياة والارض	مدة الإنجاز	2
الشعبة أو المسلك	مسلك العلوم الرياضية (أ) – خيار أنجليزية	المعامل	3

Candidates may use non-programmable calculators

Section I : Knowledge Retrieval (5 pts)

I. **Define** the following notions: - **Mode (M)** - **Arithmetic mean** ($\bar{X}$). **(1pt)**

II. Copy down the letter corresponding to each proposition and **Write** whether the statement is **"true"** or "**false"**. **(2pts)**

a. pure lineage is a group of individuals homozygous for the genes studied.
b. a heterogeneous population is a population that, after artificial selection, gives more than one pure lineage;
c. biometry is a quantitative study of the varying characteristics of organisms;
d. multimodal frequency curve shows that the population is heterogeneous for the trait studied.

III. 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. **(2 pts)**

1 – position parameters are:

a – mode, arithmetic mean and variance.
b – mode and variance.
c – arithmetic mean and mode.
d – arithmetic mean and variance.

2 – standard deviation is**:**

a –the value of the most frequent variable.
b – used with the mode to calculate confidence interval.
c – one of the dispersion parameters.
d – one of the position parameters.

3 – Artificial selection :

a – is effective when the populations are homogeneous.
b – is the result of environmental impact on a given hereditary trait.
c – makes it possible to obtain lineages with desirable traits.
d – is effective when there are populations characterised by a low genetic variability.

4 – In continuous variation :

a - there is a complete range of measurements from one extreme to the other.
b – the variables take the values of natural numbers in the variation interval.
c – we can determine the mode of transmission of genetic traits.
d - we can measure the variation of qualitative genetic traits.

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

Exercise 1 : (7,5 pts)

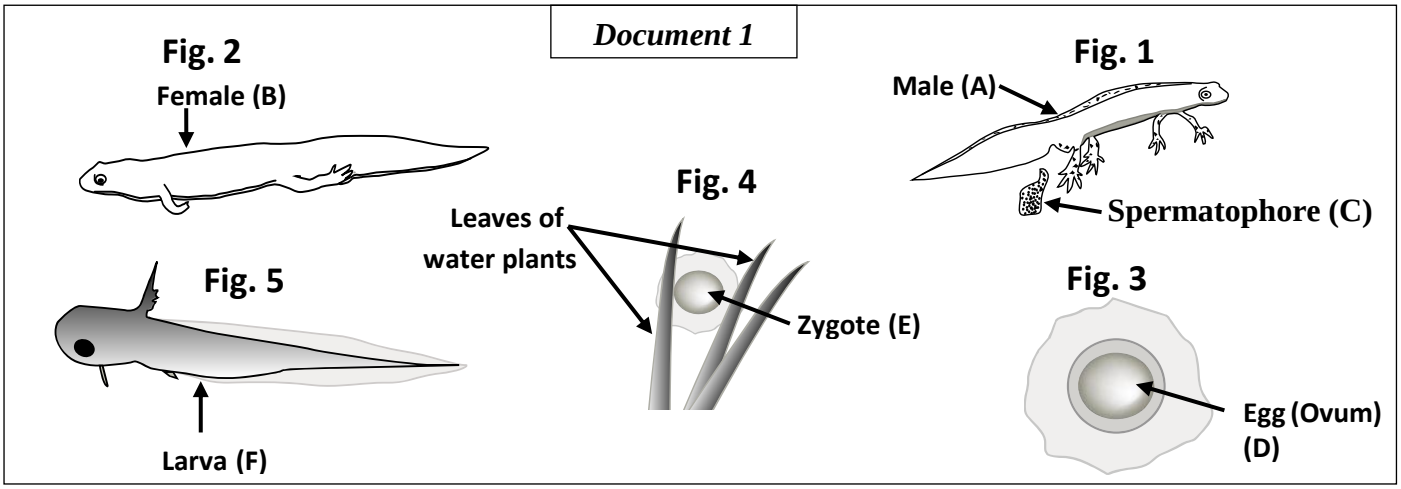
To highlight the role of alternation of meiosis and fertilisation in the karyotype stability, and in the diversity of phenotypes through the succession of generations, the following data are proposed:

I – **Newt** (*Tritinus vulgaris)* is an amphibian that breeds in fresh-water by the end of winter. Continuous observations of this animal in its natural environment have allowed to determinate some stages of its life cycle. These stages are represented in figures of document 1.

During the reproduction period, the male (A) takes a position in front of the female (B), and puts a spermatophore (C) (packet of sperm) on the leaves of plants. The female follows the male and collect the spermatophore by its cloaca, which allows to fertilise the ova (eggs) (D). It is an internal fertilisation without copulation.

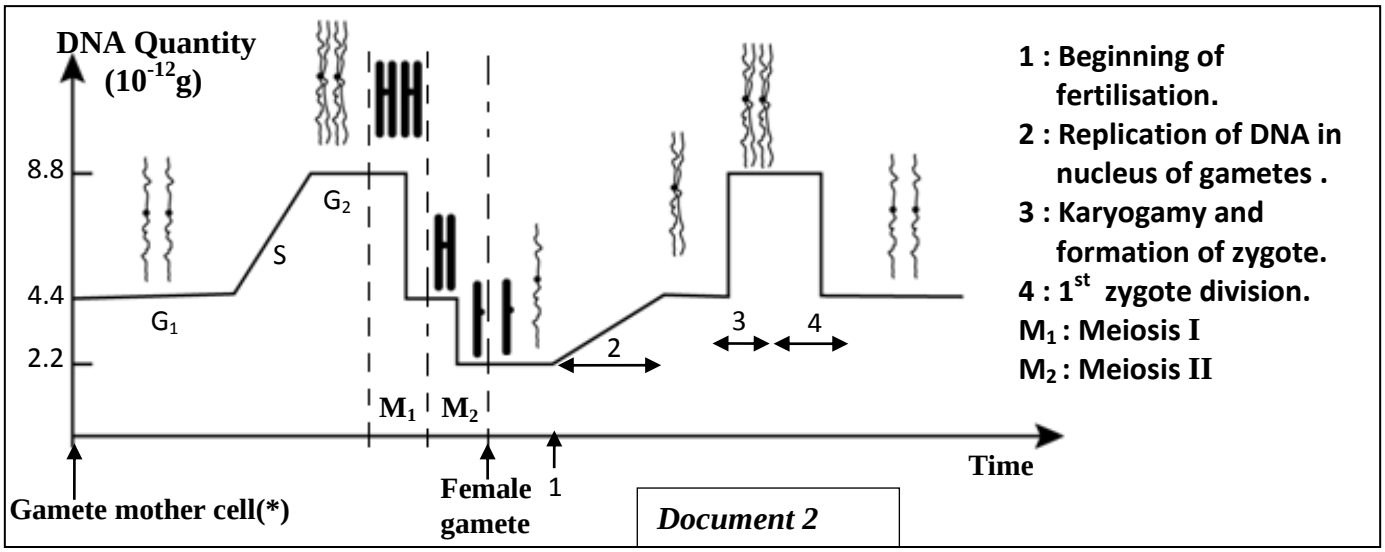
The female gives 200 at 300 zygotes (E) on the leaves of water plants or rocks. After 15 at 20 days, the zygotes give larvae each measuring about 1cm. Then they are developed and become mature Newts after 3 years.

Document 1



1. **Use** only the letters (A,B,C,D,E and F) as indicated in document 1 to **draw** the life cycle of this animal. (*you don't need to draw the schemes*). **(0,25 pt)**

The life cycle of newt is characterised by alternation of meiosis and fertilisation. Document 2 shows the evolution of DNA quantity and the chromosomes aspect for each nucleus from the female gamete formation (oogenesis) starting from the mother cell to a two-cell embryo.



Document 2

***(*):** DNA quantity and chromosomal aspect variations are the same during the formation of both male and female gametes*

2. Describe the DNA quantity evolution and the chromosomal aspect in the nucleus before, during and after fertilisation, and then **deduce** the type of chromosomal cycle of this animal (Newt). **Justify** your answer. **(1,75 pts)**

3. Draw a chromosomal cycle diagram of the Newt. **(0,5 pt)**

II - To study the mode of transmission of the colour of body and the colour of the eyes in Drosophila, the following crosses are suggested:

First cross between two pure lineages: a male with red eyes and a female with framboesia eyes. This cross gives a first generation (F_1) composed of males with framboesia eyes and females with red eyes.

Second cross between two pure lineages: a male with black body and framboesia eyes and a female with grey body and red eyes. This cross gives a first generation (F_1) composed of individuals with grey body and red eyes.

Third cross: between individuals of the generation F_1 (resulting from the second cross). This cross gives a second generation (F_2) composed of:

- 564 individuals of Drosophila with grey body and red eyes;
- 189 individuals of Drosophila with black body and red eyes;
- 185 individuals of Drosophila with grey body and framboesia eyes;
- 62 individuals of Drosophila with black body and framboesia eyes.

4. What can you deduce from the results obtained in the first, the second and the third crosses? **Justify** your answer. **(2.75 pts)**

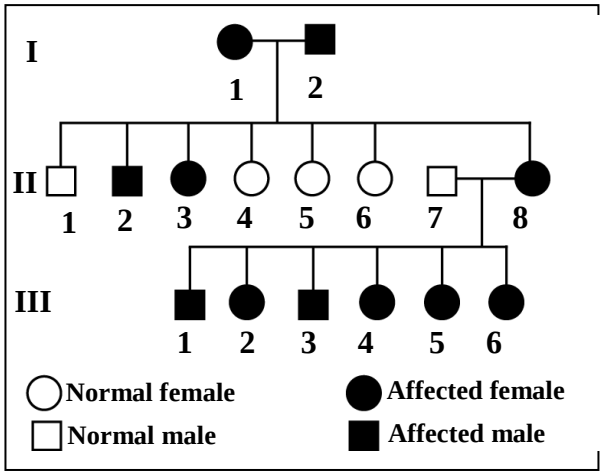
5. Interpret and **use** Punnett square to explain the results obtained in the second and the third crosses. **(2,25 pts)**

Use the following symbols:

- ***(G and g)*** *to represent the colour of the body;*
- ***(R and r)*** *to represent the colour of the eyes.*

Exercise 2 : (2.5 points)

In order to study the transmission mode of a hereditary disease called *Epithelioma adenoides* and which is characterised by appearance of small nodules on the face and tumors of different sizes on the rest of body, we suggest this pedigree (see the diagram on the right hand side) of a family who some of its members are affected by this disease.



1. Based on the pedigree chart, **determine** the mode of transmission of this disease. **Justify your answer**. **(1 pt)**

2. a. Determine the genotype of the two parents II_7 and II_8.

b. Based on Punnett square, **calculate** the probability of this couple (II_7 and II_8) who will have a normal child. **(1,5pts)**

Use the following symbols:

- ***(E)*** *to represent the dominant allele and* ***(e)*** *to represent the recessive allele*

Exercise 3 : (5 pts)

To highlight the influence of the evolutionary factors on the genetic structure of populations, we suggest the following data:

I. ***Geospisa fortis*** are finches (bird species) that live in Daphne Major Island, situated in the center of Galapagos Islands, where the climate is the most important factor impacting the availability of seeds on which these finches feed. These finches have beaks of medium size that they use to eat different seeds, but they prefer to eat easy-to-break seeds.

The year 1977 knew a scarcity of rainfall (no rain for 151 days). This led to a decrease of seeds for *G. fortis* bird. These finches would be content with the remaining seeds left on the Island after the season preceding the drought. After eating the easy-to-break seeds, there remained only the hard seeds to break.

In order to determine the impact of the drought of the genetic structure of these birds, we have studied the variations in the beak size during one year from 1977 to 1978. The results obtained are shown in the following chart (document 1):

document 1

		Number of finches	The most common beak size (per/mm)
1977	Before the drought	216	8.8
	After the drought	36	10.3
1978	One generation after the drought	142	9.8

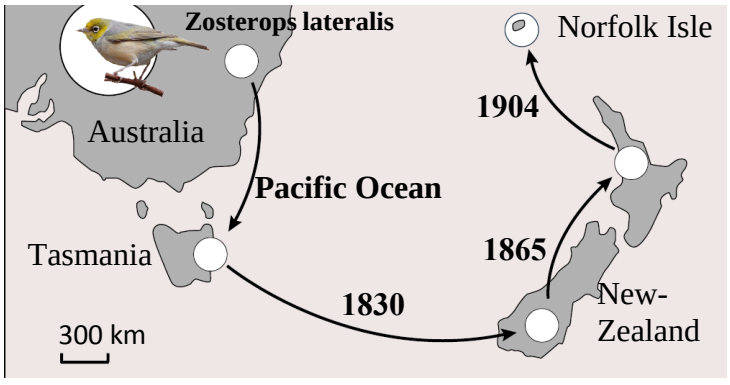
1. Based on the above chart, **extract** the variations that the *G. fortis* population has undergone before and after the drought. **(0,5 pt)**

2. Explain the variations you have extracted in question n° 1. **(0,5pt)**

3. Based on your knowledge and the previous data, **determine** the studied variation factors and show its impact on the genetic structure of the population of *G. fortis*. **(1.25 pts)**

II- ***Zosterops lateralis*** is a small bird with a grey back living in Australia. Individuals of this species have colonised the Tasmanie Isle at the beginning of 19th Century, and after that the South and North of New Zealand, and in the end the Norfolk Island (document 2). *Zosterops* have difficulty flying over long distances, which means that only a small number of the birds could colonise other islands to set up different populations. Studies have shown that individuals of these populations are interfertile**.**

4- Based on document 2**,** make the difference between the notion of population and the notion of species. **(0.75 pt)**



Document 2

A group of scientific researchers have carried out studies on six different genes in Zosterops. Document 3 presents the theoretical frequency distribution of two alleles a_1 and a_2 of a specific gene in the population of origin in Australia, and populations coming as a result of colonisation.

Document 3	**Zosterops population of Australia**	**Zosterops population of Tasmania Island**	**Zosterops population of Isles of New Zealand**	**Zosterops population of Norfolk Isle**
Frequency of allele a_1	$f(a_1) = 0,75$	$f(a_1) = 0,875$	$f(a_1) = 1$	$f(a_1) = 1$
Frequency of allele a_2	$f(a_2) = 0,25$	$f(a_2) = 0,125$	$f(a_2) = 0$	$f(a_2) = 0$

5- Based on the previous data and document 3:

a. Describe the frequency variations of the two alleles a_1 and a_2 in the four populations. **(0.5 pt)**

b. Explain the frequency variations of the two alleles a_1 and a_2 in the four populations. **(1.5 pts)**

°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°