الامتحان الوطني الموحد للبكالوريا
المسالك الدولية
الدورة الاستدراكية 2020
- عناصر الإجابة –

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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

Key and marking scale

Questions	Response elements	Scores
Section I : Knowledge Retrieval (5 pts)		
I	**1- definition** (accept any correct definitions) **a- Pedigree:** Schematic representation of the phenotypes of individuals belonging to the same family in order to follow their characters through the generations. ……..… **b- Karyotype:** Simple schematic representation of the individual chromosomes of a cell, based on their size, the arrangement of the centromere and the colored bands ……..……..…… **2- two ways to Prenatal diagnosis of chromosomal abnormalities :** - Ultrasonography ……..…….. - Chorionic villus sampling and realization of karyotype…… **3- difficulties related to human genetics (accept two of):** - Human is not subject to experimental crosses. - Human is not subject to inducing mutations by mutagens. - Low number of descendants which limits the application of the statistical laws of heredity. - High number of chromosomes - Long gestation period. - Long development cycle	**0.5** **0.5** **0.25x2** **0.25x2**
II	(1, c) ; (2, d) ; (3, b) ; (4, b) ……..……	**0.5x4**
III	a- false b- true c- false d- true ……..……..……	**0.25x4**
Section II : Scientific reasoning and communication in graphic and written modes (15 pts)		
Exercise 1 (5 pts)		
1	**Comparison :** The amount of glycogen in the muscle cells of the affected child is very low compared to that of a healthy child…….. **Explanation:** Affected children by disease present a dysfunction of enzyme glycogen synthesis → the glycogen is not formed in muscle cell →low quantity of glycogen stored in muscle cell……	**0.25** **0.75**
2	**Description:** In strenuous exercise: glycogen content decreases slowly from 100 UA to 70 UA after two hours of muscular effort ……..…… In moderate exercise: glycogen content decreases from 100 UA to 40 UA after	**0.25**

	two hours of muscular effort …… In light exercise: glycogen content decreases quickly from 100 UA to 10 UA after 90 mn of muscular effort ……..……... **Deduction :** The consumption of glycogen increases in muscle cells with increasing muscular effort. ……...	**0.25** **0.25** **0.5**
3	**Explanation**…… Increase in muscular effort → increase consumption of ATP during muscular effort→ activation of metabolic pathway of ATP synthesis in muscle cells (glycolysis, Krebs cycle, respiratory chain, lactic fermentation) → increase of the consumption of necessary glucose to ATP synthesis → increase of glycogen consumption.	**0.25x5**
4	**Explanation of the metabolic origin of disease ……..……** Increase of muscular effort →leads to a high consumption of stored glycogen and release more glucose → synthesis more ATP necessary to muscle contraction…… But children with GSD-0 present dysfunction in glycogen synthase → the content of stored glycogen in muscle cells is low → intolerance to muscular effort……	**0.25x3** **0.25x3**
Exercise 2 (6.5 pts)		
1	**Protein-trait relationship:** - With normal androgen receptors→ fixation androgen to receptors allows the formation of a complex that activates expression of target genes →development of male sexual traits →healthy person……... - With abnormal androgen receptors→ fixation androgen to receptors allows the formation of a complex that does not became active expression of target genes → alteration of sexual traits →sick person……..…… - So a modification in protein (androgen receptor) leads to a modification in trait (healthy or sick person)……	**0.25** **0.25** **0.5**
2	**Comparison of nucleotide sequences of gene AR between healthy individual and sick individual:** - Resemblance in nucleotide sequences before and after CAG triplet repeats. - The CAG triplet is repeated 15 times in nucleotide sequence of the normal person while it is repeated 38 times in the nucleotide sequence of the sick person. **Comparison of Amino acids sequences between healthy individual and sick individual:** - Resemblance in nucleotide sequences before and after amino acids glutamine repeats. - The amino acid (Gln) is repeated 15 times in amino acids sequence of the normal person while it is repeated 38 times in amino acids sequence the sick person……	**0.5** **0.5**
3	**Explanation of genetic origin of the disease:** Mutation by repatiton (addition) of 23 triplet at the level of transcribed strand (DNA) → incorporation the **23 additional amino acids Gln** in amino acid sequence → synthesis abnormal androgen receptor (protein)→alteration of development of male sexual traits (the Kennedy disease appear). ……	**0.75**

4

a. The responsible allele for disease is recessive (accept any logic response): **0.25**

-The parents I_1 and I_2 (or II_3 and II_4) are healthy phenotypes and give birth to a child II_1 (or III_1) of sick phenotype →parent are heterozygous → responsible allele for disease is recessive.

-The responsible allele for disease is not carried by chromosome X → the woman I_2 (orII_3) is healthy and give birth to a sick child, so she is carrying allele responsible for disease →responsible allele for disease is recessive……

- Genotype of individuals I_2,II_1, III_2: **0.25x3**

- I_2 : X_NX_n
- II_1 : X_NY
- III_2 : X_NX_N ou X_NX_n

b. The probability for that couple III_2 and III_3 to give birth to healthy child:

Parents :	III_2 ♀		**x**	III_3♂	
Phenotypes :	[N]			[N]	
Genotypes :	X_NX_n			X_NY	
Gametes :	X_N ½	X_n ½		X_N ½	Y ½

0.25

Punnet square: …… **0.25**

Gamètes ♂ / ♀	X_N 1/2	Y 1/2
X_N 1/2	X_NX_N [N] 1/4	X_NY [N] 1/4
X_n 1/2	X_NX_n [N] 1/4	X_nY [n] 1/4

The probability for that couple $III_2 \times III_3$ to give birth to healthy child is ¼ … **0.25**

5

The frequency of the normal allele and abnormal allele

the frequency of abnormal allele **:** $f([XnY])= q^2 = 1/150000$

So $f([n]) = q = \sqrt{1/150000} = 0.000006$…… **0.5x2**

- the frequency of normal allele : $f([N])= 1 - q= 1 - 0.0000066 = 0.999994$

6

The frequencies of women carrying and women not carrying allele responsible for disease:

$f(X_NX_N) = p^2 = 0.999988$ …….. **0.5**

$f(X_NX_n)= 2pq = 2 \times 0.99999 \times 0.000006 = 0.000011$ ……..…… **0.5**

Exercise 3 (3.5pts)

1

Deduction and justification:

-the parents are of pure lineage …….. **0.25**

-The responsible allele for normal size is dominant (N) and responsible allele for dwarf size is recessive (n)…… **0.25**

-The responsible allele for smooth fruit is dominant (l) and responsible allele for velvety fruit is recessive (ℓ)……..... **0.25**

2

a. The two genes are linked: **0.5**

The test cross gives two parental phenotypes with a percentage 95.6% upper to percentage of recombined phenotype 4.4% →The two studied genes are linked

Deduction : **0.25**

The percentage of recombined phenotype is 4.4%, so the distance between two studied genes is 4.4 cMg

b. chromosomal interpretation of result of second cross

Parents: Plants of generation F_1 **x** Plants of muted line

Phenotypes: [N; L] **x** [n ; ℓ]

Genotypes: $\frac{N\ L}{n\ \ell}$ **x** $\frac{n\ \ell}{n\ \ell}$ **0.25**

Gametes

$\frac{N\ L}{}$ 47.6%

$\frac{n\ \ell}{}$ 48%

$\frac{n\ L}{}$ 2.3%

$\frac{N\ \ell}{}$ 2.1%

$\frac{n\ \ell}{}$ 100%

0.25

Punnet square: ……

Gametes	$\frac{N\ L}{}$ 47.6%	$\frac{n\ \ell}{}$ 48%	$\frac{N\ \ell}{}$ 2.3%	$\frac{n\ L}{}$ 2.1%
$\frac{n\ \ell}{}$ 100%	[N,L] 47.6% $\frac{N\ L}{n\ \ell}$	[n, ℓ] 48% $\frac{N\ L}{n\ \ell}$	[n,L] 2.3% $\frac{N\ L}{n\ \ell}$	[N, ℓ] 2.1% $\frac{N\ L}{n\ \ell}$

0.5

3

a. The relative distance between the gene responsible for the plant size and the one responsible for leaf color is

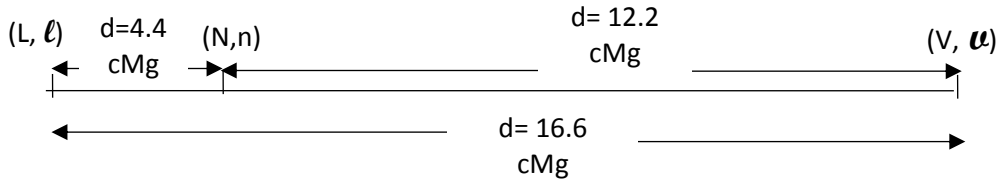
The percentage of the recombined phenotype is 12.2%, so the distance between two genes is 12.2cMg

The relative distance between the gene responsible for the plant size and the one responsible for leaf color is

The percentage of the recombined phenotype is 16.4%, so the distance between two genes is 16.4 cMg…….. **0.25x2**

b. The map gene of three studied genes:

scale (obligatory): 1cm → 2 cMg **(Accept any appropriate scale)**



0.5