الامتحان الوطني الموحد للبكالوريا
المسالك الدولية
الدورة الاستدراكية 2021
- عناصر الإجابة –

SSSSSSSSSSSSSSSSSS | RR 32E

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

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

Key and marking scale

Questions	Response elements	scores
	Section I : Knowledge retrieval (5 pts)	
I	**Definitions** (accept any correct definitions such as)**:** - **The meiosis:** succession of two cell divisions, meiosis I followed by meiosis II and that gives four haploid cells from diploid mother cell. - **Chromosomal abnormality:** modification of the number or the structure of chromosomes or both.	**0.5** **0.5**
II	(1, b) ; (2, d) ; (3, b) ; (4, d)	**0.5x4**
III	(a, false) (b, true) (c, true) (d, false)	**0.25x4**
IV	1 : aster 2 : achromatic spindle 3 : centromere 4 : tetrad	**0.25x4**
	Section II : Scientific reasoning and communication in graphic and written modes (15 pts)	
	Exercise 1 (5pts)	
1	**a. Comparison (accept values close to the those proposed)** **+About blood lactate concentration** :..... in **healthy person**, the lactate concentration increase from the beginning of the exercise to reach a maximum value (4.2 mol/l) at 2 min , then decreases to 2mmol/l at the end of the exercise while in **affected person**, the lactate concentration remains constant at 1.5 mmol/l along the exercice. **+About ADP concetration in muscle of the forearm:** ..... -At rest ADP concentration in affected person (40 µM) is higher than four time that measured in healthy person (10 µM). -After brief and intense physical exercise, the ADP concentration in two persons increases but this increase is more intense in affected person. (120µM >> 40µM) **b. Proposal of a hypothesis** (accept any correct hypothesis) ..... variation of ADP concentration in muscle after brief and intense physical exercise in affected person may be explain by low regeneration of ATP from ADP because of the non-functioning of lactic acid fermentation pathway.	**0.75** **0.75** **0.5**
2	**Relationship between the variation of blood lactate concentartion and that of muscular ATP in sprinter during race of 100 m :** -The muscular ATP concentration is almost constant while the blood lactate concentration incease progressively along the race..... -The stability of muscle ADP concentration, depsite the exercise, is due to its regeneration from reactions of lactic acid fermentation (anaerobic reactions) at the origin of the increase of blood lactate concentration.	**0.5** **0.75**

3	**Verification of hypothesis:** (proposed hypothesis is valid or not valid)……. **Explanation :** In affected person by Mc Ardle disease : deficit of the activity of Myophosphorylase → weak hydrolyse of muscle glycogen to glucose1-P→ formation of small amount of glucose6-P → dysfunction of the lactic acid fermentation pathway →weak regeneration of ATP at the beginning of the effort→ intolerance to brief and intense physical efforts from the first tens seconds of the exercise ……..	**0.25** **0.25x6**
	Exercise 2 (6.5 pts)	
1	**Protein-trait relationship:** - **In healthy person:** the quantity of active myophosphorylase is 34 UA→ normal hydrolyse of muscle glycogen → normal load of glycogen in muscle fiber with normal regeneration of ATP from the beginning of muscular effort → healthy person. - **In affected person** : weak quantity of active myophosphorylase (1UA) → weak muscle glycogen hydrolysis → overload of glycogen in muscle fiber with weak regeneration of ATP from beginning of muscular effort→ affected person …… ➢ The modification in the activity of the enzyme (protein nature) leads to modification of phenotype of the person so protein-trait relationship ……	**0.25** **0.25** **0.25**
2	**a. mRNA sequences and amino acids sequences corresponding to: ……..** **- the normal Allele:** mRNA : GAA- AAC- UUC- UUC- AUC- UUU-GGC Amino acid sequence: Ac.glu – Asn – Phe –Phe –Ile –Phe – Gly **- the abnormal Allele**: mRNA : GAA- AAC- UUC- AUC- UUU-GGC Amino acid sequence: Ac.glu – Asn – Phe –Ile –Phe – Gly **b. Explanation of the genetic origin of disease:** mutation by deletion of triplet in untranscribded stand (DNA)→ synthesis of modified mRNA in relation to normal mRNA→ synthesis of amino acids sequence different in relation to the normal → weak activity of to myophosphorylase →disease symptoms appear …….. **Accept a mutation by deletion of triplet such as:** - **TTC at the level of positions (2125, 2126, 2127) or (2128, 2129, 2130).** - **CTT at the level of positions (2124, 2125, 2126) or (2127, 2128, 2129).**	**0.25×4** **0.5**

a. Mode of transmission of the disease :

- Responsible allele for disease is recessive (m) and normal allele is dominant (M)… **0.25**

Justification: the couple I_1 and I_2 are healthy and gave birth to a sick boy II_2 (also accept: the couple II_5 and II_6 are healthy and gave birth to a sick girl III_2) ….. **0.25**

The studied gene is carried by an autosome

Justification :

-The disease is present in both sexes→ the studied allele is not carried by sexual chromosome Y…….. **0.25**

-The responsible allele is recessive→ the girl III_2 is sick and her father is healthy so the responsible allele for the disease is not carried by sexual chromosome X……. **0.25**

- The genotypes and justification: …… **0.75**

3

I_1: M//m healthy woman having a sick child.

II_2: m//m sick man.

II_3: M//m or M//M healthy girl from heterozygous parents.

b. The probability for that expected child will be healthy:

Parents	:	II_5	x	II_6
Phenotypes	:	[M]	x	[M]
Genotypes	:	M//m		M//m
Gametes	:	**½ M/; ½ m/**		**½ M/; ½ m/**…… **0.25**

Punnet square :

Gametes	**½ M/**		**½ m/**	
½ M/	**¼ M//M**	[M]	**¼ M//m**	[M]
½ m/	**¼ M//m**	[M]	**¼ m//m**	[m]

0.5

The probability for that expected child will be healthy is ¾. …….. **0.25**

a. The frequency of two allele M and m : …….. **1**

we have : f (m//m)=1/167000= q^2 this population abides by the Hardy- Weinberg equilibrium

so: -The frequency of allele m: f (m) = q= $\sqrt{1}/167000$= **0.002447.**

-The frequency of allele M: f (M) = p=1-q= **0.997553.**

N.B : also accepts the following numerical application :

f (m//m)=1/167000= q^2 = ***0.000005***

4

-The frequency of allele m: f (m) = q= $\sqrt{0.000005}$= ***0.002236***

-The frequency of allele M: f (M) = p=1-q= ***0.997764.***

b. The frequency of healthy carrier of disease : …….. **0.5**

the healthy carried are heterozygous (M//m) → the frequency of healthy carrier in studied population is f (M//m)=2pq= 2× 0.002447×0.99753≈**0.004882**

N.B : also accepts the following numerical application :

*f (M//m)=2pq= 2× 0.002236×0.997764≈****0.004462***

Exercice 3 (3.5 pts)

1

The generation of F_1 is composed of black and smooth seeds, so: **0.25×2**

- The responsible allele for black color of seeds is dominant **N** and responsible allele for yellow color of seeds is recessive **n**.
- The responsible allele for smooth shape of seeds is dominant **L** and responsible allele for rough shape of seeds is recessive **ℓ**.

2

- Linkage of genes: **0.5**

The second cross is a test cross and gave four different phenotypes not equiprobable:

- two majority parental phenotypes [N, ℓ] and [n, L] (80%)
- two minority recombined phenotypes [N, L] et [n, ℓ] (20%)

So the two genes are (partially) linked.

- Deduction : **0.25**

The distance between the two genes is 20cMg.....

3

-The genotypes : **0.25x3**

P_1 : $\frac{N\ \ell}{N\ \ell}$ P_2 : $\frac{n\ L}{n\ L}$ F_1 : $\frac{N\ \ell}{n\ L}$

The chromosomal interpretation of result of cross 2: **1**

Phenotypes of parent : [N ; L] x [n ; ℓ]

Genotypes : $\frac{N\ \ell}{n\ L}$ $\frac{n\ \ell}{n\ \ell}$

$\frac{N\ \ell}{}$	$\frac{n\ L}{}$	$\frac{N\ L}{}$	$\frac{n\ \ell}{}$	$\frac{n\ \ell}{}$
40.2%	39.8%	9,9%	10,1%	100%

Punnet square :

Gamètes	$\frac{N\ \ell}{}$ 40.2%	$\frac{n\ L}{}$ 39.8 %	$\frac{N\ L}{}$ 9.9%	$\frac{n\ \ell}{}$ 10,1 %
$\frac{n\ \ell}{}$ 100%	$\frac{N\ \ell}{n\ \ell}$ [N, ℓ] 40.2%	$\frac{n\ L}{n\ \ell}$ [n, L] 39.8%	$\frac{N\ L}{n\ \ell}$ [N, L] 09.9%	$\frac{n\ \ell}{n\ \ell}$ [n, ℓ] 10.1%

4

The cross that allows to obtain of the lineage P3 is (**accept any logical justification**) :..... **0.5**

To obtain plants of pure lineage P_3 black and smooth seeds (dominant phenotype), the parents must have a dominant phenotype for two traits. So we will cross the plants [N, L] with the genotype $\frac{N\ \ell}{n\ \ell}$ between them.