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

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

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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	**a- definition** (accept any correct definitions) **Genetic engineering:** set of techniques used to modify genetic cell or organism in order to express new traits …… **b- two example of application of genetic engineering:** -in agricultural field: producing plants resistant to pests …….. -in medical field: producing human insulin……	**0.5** **0.25** **0.25**
II	(1, b) ; (2, c) ; (3, b) ; (4, c) ……	**0.5x4**
III	1- true 2- false 3- false 4- false …..……	**0.25x4**
IV	(1, b) ; (2, a) ; (3, d) ; (4, c) ……..…….……	**0.25x4**
Section II : Scientific reasoning and communication in graphic and written modes (15 pts)		
Exercise 1 (5 pts)		
1	**Necessary conditions of muscle contraction:** Presence Ca^{++} ions…… ATP hydrolysis…… **Justification** (any correct justifications is accepted) By inhibiting ATP hydrolysis of ATP (medium 2), the myofibrils don't contract... By inhibiting the action of Ca^{++} ions (medium 3) the myofibrils don't contract….	 **0.25** **0.25** **0.5** **0.5**
2	Ca^{++} ions in sarcoplasmic reticulum→ relaxed fibers …….... Ca^{++} ions in sarcoplasm → contracted fibers ……	**0.25** **0.25**
3	**Explanation of the evolution of tension of muscle fiber** **During contraction phase (phase A)**…… - fixation Ca^{++} ions on the troponin and tropomyosin displacement → exposing the binding sites to the myosin heads in actin and forming the actin-myosin complex → release the ADP and Pi → the myosin heads swiveling and sliding of myofilaments (contraction of the muscle fiber) → the actin-myosin complex is dissociated by ATP → ATP hydrolysis and myosin heads returning to their original status and resume the cycle of contraction. **During relaxation phase (phase C):** …… In the absence of Ca^{++} ions, the actin-myosin complex is not formed → relaxation of muscle fiber even though the ATP is present.	**0.25x6** **0.25x2**

4	**Explanation of the Rigor Mortis ……..……** Exhaustion and non-renewal of the ATP after death → the actin-myosin complex is not dissociated (document 3) → stop of muscle contraction cycle in contraction phase (document 3) → maintaining strong muscle tension (Phase B of document 2) causing rigor mortis.	**0.25x4**
	Exercise 2 (6.5 pts)	
1	**Protein-trait relationship:** - With normal Endoglin, the complex "membrane receptor-growth factor" is functional so a normal angiogenesis → healthy person ……..…..… - With abnormal Endoglin, the complex "membrane receptor-growth factor" is dysfunctional so an abnormal angiogenesis→ person with ROW disease…… - So any modification in the protein Endoglin causes a modification in the trait (healthy or sick person)…….……	**0.25** **0.25** **0.25**
2	**mRNA sequences corresponding to:** - the normal allele fragment **: ……..** CCC-CAC- GUG- GAC-AGC-AUG-GAC-CGC - the abnormal allele fragment **: ……..** CCC-CAC- AUG- GAC-AGC-AUG-GAC-CGC **Amino acids sequences corresponding to :** - the normal allele fragment **: ……..** Pro-His-Val-Ac.asp-Ser-Met- Ac.asp -Arg - the abnormal allele fragment**: ……..……..** Pro-His-Met- Ac.asp -Ser-Met- Ac.asp -Arg Mutation by substitution of first nucleotide **G** for **A** at the level of third triplet of un transcribed strand (DNA) → incorporation the **Met** instead of **Val** in amino acid sequence → synthesis abnormal Endoglin protein →abnormal angiogenesis (the ROW disease appear). ……..…	**0.25** **0.25** **0.25** **0.25** **0.5 pt**
3	**a. The responsible allele for disease is dominant and the studied gene is carried by an autosome:** The daughter III_1 is healthy phenotype while her parents II_5 and II_6 are sick phenotype → parents are heterozygous→ responsible allele for disease is dominant. **(Accept also the answer: any person affected must descending from affected person)**…….. -The disease is present in both sexes → the responsible allele is not carried by chromosome Y. ……..…… -The daughter III_1 is healthy, her father II_5 is sick and responsible allele for disease is dominant → the girl III_1 will inherit of her father the responsible allele for diseases so the daughter should be affected → the responsible allele for disease is not carried by chromosome X **(accept any correct answers)**…… →the responsible allele for disease is not carried by chromosome X or chromosome Y so the responsible allele for disease is carried by autosome…..… **b. the probability for that couple II_8et II_9 to give birth to healthy child:** Parents : II_8 ♂ **x** II_9♀ Phenotypes : [r] [R] Genotypes : r//r R//r Gametes : r/ 1 R/ ½ r/ ½	**0.5** **0.25** **0.25** **0.25** **0.25x2**

	Punnet square: …… Gametes ♂ / ♀ : r 1 ; R 1/2 ; r 1/2 (R//r) [R] 1/2 ; (r//r) [r] 1/2 The probability for that couple II_8et II_9 to give birth to healthy child is ½ ……	**0.25** **0.25**
4	**a. The frequency of the normal allele and abnormal allele** **we have :** f ([R])= $p^2 + 2pq = 1/5000$ **we know** $p^2 + 2pq + q^2 = 1$ **So** $q^2 = 1 - 1/5000 = 0.9998$ …… - Normal allele frequency is: f (r) = q= **0.9998**…… - Abnormal allele frequency is: f(R) = p = 1- q = **0.0002**…… **b. The frequencies of different genotypes in studied population.** f (r//r) = $q^2 \approx 0.9998$…… f (R//r)= $2pq \approx 0.0003$…… f(R//R)= $p^2 \approx 0$……	**0.25** **0.5** **0.5** **0.25** **0.25** **0.25**
	Exercise 3 (5 pts)	
1	**Deduction and justification**: -We study transmission of a hereditary trait for each cross→ monohybrid cross… -The descending of two crosses are homogenous→ the parents are for pure lineage according to Mendel's first law …….. -The descendants of the first cross have erect ears→ responsible allele for erect ears form is dominant (D) and responsible allele for floppy ears is recessive (d)… -The descendants of the first cross have light muzzle→ responsible allele for light muzzle is dominant (S) and responsible allele for dark muzzle is recessive (s)…..	**0.25** **0.25** **0.25** **0.25**
2	The test cross gives two parental phenotypes with a percentage 83% upper to percentage of recombined phenotype 17% (Mendel's third law is not verified) →The two studied genes are linked…… **Deduction** : the parental genotype The genotype of sheep with dominant phenotype : $\frac{D\ S}{d\ s}$ The genotype of double recessives sheep : $\frac{d\ s}{d\ s}$	**0.5** **0.25** **0.25**

3

Chromosomal interpretation of the third cross with Punnet square:

Phenotypes : ♀ [D,S] x [d, ه] ♂

Genotypes : $\frac{D\ S}{d\ ه}$ $\frac{d\ ه}{d\ ه}$

Gametes : 45% $\frac{D\ S}{}$ 38% $\frac{d\ ه}{}$ 9% $\frac{D\ ه}{}$ 8% $\frac{d\ S}{}$; 100% $\frac{d\ ه}{}$ **0.25x2**

Punnet square : …… **0.5**

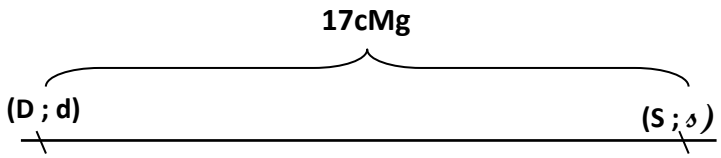
♂ \ ♀	$\frac{D\ S}{}$ 45%	$\frac{d\ ه}{}$ 38%	$\frac{D\ ه}{}$ 9%	$\frac{d\ S}{}$ 8%
$\frac{d\ ه}{}$ 100%	$\frac{D\ S}{d\ ه}$ 45% [D, S]	$\frac{d\ ه}{d\ ه}$ 38% [d, ه]	$\frac{D\ ه}{d\ ه}$ 9% [D, ه]	$\frac{d\ S}{d\ ه}$ 8% [d, S]

4

The map gene of two studied genes:

The percentage of the recombined phenotype is 17%, so the distance between two genes is 17cMg…… **0.25**

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



0.25

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