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 العلوم الفيزيائية (خيار إنجليزية)	المعامل	5

Key and Marking Scale

	Section I : Knowledge Retrieval (5 pts)	
	Questions	**Scores**
	Choice 1	
I	***Accept any appropriate answer.*** - **Renewable energy:** are energies that use natural, non-depleting sources such as the sun and the wind…… - **Household waste sorting:** Operation to separate mixed waste into different categories to facilitate its disposal in processes specific to each category……	0.5 pt 0.5 pt
II	(1,a) ; (2,b) ; (3,c) ; (4,c) ……..……(0.5pt×4)	2 pts
III	**Examples of measures to limit the impact of household waste on the underground water are:** …… (0.25pt ×2) - Implementation of controlled landfills that respect environmental protection conditions. - Treatment of leachate. - Waste water treatment	1 pt
IV	(1,b) ; (2,c) ; (3,d) ; (4,a) …… (0.25pt×4)	1 pt
	Choice 2	
I	***Accept any correct definition*** - **Obduction:** A geological phenomenon where a continental crust overlaps with an oceanic crust to form an ophiolitic complex..... - **Schistosity:** the structure of certain metamorphic rocks characterized by lamination under the effect of tectonic forces.	0.5 pt 0.5 pt
II	(1,b) ; (2,a) ; (3,b) ; (4,c) …… (0.5pt×4)	2 pt
III	(1,d) ; (2,c) ; (3,b) ; (4,a) ……..……(4×0.25)	1 pts

IV	**Accept any indices characterizing the subduction zones such as:** **Two petrographic indices:** …… - presence of magmatic rocks such as andesite and granodiorite. - presence of dynamic metamorphic rocks such as blueschists and eclogite. **Two geophysical indices:** …… - thermal anomalies. - distribution of seismic foci according to the Benioff zone.	1 pt
Section II : Scientific reasoning and communication in graphic and written modes (15pts)		
Questions	**Exercise 1 (7pts)**	**Scores**
1	**Manifestations of deterioration in the function and structure of the striated skeletal muscles that characterize COPD disease:** - Appearance of wounds within the sarcomere (ruptures and misalignments of the Z streaks) - Low muscle twitch tension - Small area of muscle section	0,75 pt
2	**Comparison of the distribution of muscle fibers in people with COPD and healthy people:** - The muscles of healthy people and people with COPD contain both types of fibers: type I and type II…… - The percentage of type II fiber is high in people with COPD, compared to healthy people…… -The percentage of type I fiber is low in people with COPD, compared to healthy people…… - **Deduction**: The dominant metabolic pathway in people with COPD is fermentation (anaerobic pathway)……..…….. - **Justification** : the skeletal muscles in people with COPD have a high percentage of type II fiber characterized by a low number of mitochondria, law activity of oxidative enzymes and a high activity of glycolytic enzymes and LDH enzyme intervening in the fermentation reactions (figure b) ……..	0.25 pt 0,25 pt 0,25 pt 0,25 pt 0,75 pt
3	**Explanation of the low muscle activity observed in the person with COPD:** - In addition to wounds at the level of the sarcommera, the skeletal muscles in people with COPD have a high percentage of type II muscle fibers characterized by a low resistance to fatigue which mainly uses the anaerobic pathway by producing a small quantity of energy. This explains the low muscle activity observed in and the person with COPD……	1pt
4	**- Explanation of the dominance of the metabolic pathway, determined in the answer to question 2, in people with COPD:** Compared to the healthy person, the muscles in the person with CODP have: - **A** low concentration of citrate synthase which catalyzes the respiratory oxidation reactions (Krebs cycle) → low regeneration of ATP by respiration…… - **A** low concentration of creatine kinase which intervenes in th production of the energy by phosphocreatine → low regeneration of ATP by degradation of	0, 5 pt

	phosphocreatine …… - **A** high concentration of LDH enzyme which intervenes in th production of the lactic acid →high regeneration of ATP by lactic fermentation…… - The presence of high concentration of LDH enzyme and a low concentration of citrate synthase and creatine kinase in the muscles in the person with CODP promote their adoption of lactic fermentation to regenerate ATP……	0, 5 pt 0, 5 pt 0, 5 pt
5	**- The exploitation of document 4:** **The relationship between training and improving skeletal muscle function in COPD patients:** The practice of training provokes in the person with CODP : - An increase in the muscle twitch tension→ improvement of the skeletal muscle performance …… - An increase in the creatine kinase activity→ improvement of the skeletal muscle capacity for regeneration of ATP by degradation of phosphocreatine …… - An increase in the citrate synthase activity and consumption of O_2→ improvement of the skeletal muscle capacity for regeneration of ATP by respiration..…… - A decrease in the lactic acid production → a decrease in the skeletal muscle capacity for regeneration of ATP by lactic fermentation……..…… The practice of training by the person with CODP promotes regeneration of ATP in the muscle by respiration and phosphoprylation of ADP from the degradation of phosphocreatine in favor of lactic fermentation → significant production of ATP → increasing of the muscle twitch tension and improvement of the skeletal muscle performance ……..	0,2 5 pt 0,2 5 pt 0,2 5 pt 0,2 5 pt 0.5 pt

Questions	**Exercise 2 (4 pts)**	**scores**
1	**Description of the mode of action of acetylcholinesterase :** - Acetylcholine binds to the active site of the acetylcholinesterase, a hydrolysis reaction releases the choline and acetate and regenerates the acetylcholinesterase with a free active site. …… **Description of the carbamate effect on acetylcholinesterase :** - After its binding, the carbamate occupies the active site of the acetylcholinesterase which becomes unable to degrade acetylcholine at the synapses which causes the appearance of a dysfunction of the nervous system of insects…….	0.5 pt 0.5 pt
2	**The relationship between the mortality of different mosquitoe strains S and R and the acetylcholinesterase activity.** - **In strain S** the activity of acetylcholinesterase decreases with increasing concentration of carbamate insecticide and stops completely once the concentration reaches 1mg/L, this is proportional to the rapid increase in insect mortality with increasing concentration of the insecticide used, which reaches 100% at a concentration below 1mg/L. ……..	0.25 pt

	- **In strain R**, acetylcholinesterase activity decreases slightly when the concentration of the insecticide used exceeds 1mg/L. This is proportional to the occurrence of insect mortality at a concentration of 10^2mg/L and only increases significantly to reach 100% at a concentration of 10^3mg/L of the insecticide used… **Hypothesis**: accept any logical hypothesis related to the proposed data. ……... The resistance of the R strain to carbamate is due to a mutation in the gene coding for the synthesis of acetylcholinesterase causing a change in the active site of this enzyme.	0.25 pt 0.5 pt
3	**The Ace-S allele of the S strain:** mRNA: AUC UUC GGG GGU GGC UUC UAC UCC GGG Amino acid sequence: Ile - Phe - Gly- Gly - Gly - Phe - Tyr – Ser - Gly **- The Ace-R allele of the R strain:** mRNA: AUC UUC GGG GGU AGC UUC UAC UCC GGG Amino acid sequence Ile - Phe - Gly - Gly - Ser - Phe -Tyr- Ser- Gly **Verification of the hypothesis** - In strain R, a mutation of substitution of nucleotide G by A at triplet 247 of the non-transcribed strand of the gene coding for the synthesis of acetylcholinesterase (substitution of C by T at the transcribed strand) → substitution of Gly by Ser at the amino acid sequence of the enzyme → synthesis of a modified acetylcholinesterase enzyme → non-fixing of the carbamate. (hypothesis verified)……	0.25 pt 0.25 pt 0.25 pt 0.25 pt 1 pt

Questions	Exercise 3 (4 pts)	scores
1	***First crossing :** - Dihybridism : study of transmission of two hereditary traits - F1 individuals have a wild parental phenotype → dominance of the two alleles responsible for striped grey body (G) and red eyes (R) over the recessive alleles responsible for black body (g) and cinnabar eyes (b)..... *** Second crossing :** Is a reciprocal crossing which gave an F2 generation composed of four phenotypes: 92% parental phenotypes and 8% recombinant phenotypes → the two genes studied are linked	0. 25 pt 0. 25 pt
2	***Third crossing:** - F1 individuals have a wild parental phenotype → dominance of the two alleles responsible for striped grey body (G) and red eyes (R) over the recessive alleles responsible for black body (g) and cardinal eyes (d) ..... *** Fourth crossing :** - Is a reciprocal crossing that gave an F2 generation composed of four phenotypes with equal percentages 25% → the two genes studied are independent ……..	0. 25 pt 0. 25 pt
3	The gene responsible for the cardinal eyes and the gene responsible for body colour are independent, i.e. located on two different chromosomes; The gene responsible for cinnabar eyes and the gene responsible for body colour are linked, i.e. located on the same chromosome; → so the eye color is controlled by two genes.	0.5 pt

4.a

Interpretation of the second cross using Punnet Square:

Parents : P × F_1

Phenotypes : [g, r] [G, R]

Genotypes : g r // g r G R // g r

Gametes : g r (100%) ; G R (46%) ; g r (46%) ; G r (4%) ; g R (4%) — 0. 25 pt

Punnet Square : — 0. 5 pt

σF1 / σ P	G R 46%	g r 46%	G r 4%	g R 4%
g r	G R // g r 46% [G, R]	g r // g r 46% [g, r]	G r // g r 4% [G, r]	g R // g r 4% [g, R]

Result obtained : 46% [G,R] ؛ 46% [g,r] ؛ 4% [G,r] ؛ 4% [g,R]

The theoretical results are in accordance with the experimental results.

4.b

Interpretation of the fourth cross using Punnet Square:

Parents : P × F_1

Phenotypes : [g, d] [G, D]

Genotypes : g//g d//d G//g D//d

Gametes : g/ d/ (100%) ; G/ D/ (25%) ; g/ d/ (25%) ; G/ d/ (25%) ; g/ D/ (25%) — 0. 25 pt

Punnet Square :…… — 0. 5 pt

σF1 / σ P	G/ D/ 25%	g/ d/ 25%	G/ d/ 25%	g/ D/ 25%
g/ d/ 100%	G//g D//d 25% [G, D]	g//g d//d 25% [g, d]	G//g d//d 25% [G, d]	g//g D//d 25%[g, D]

Result obtained : 25% [G,D] ؛ 25% [g,d] ؛ 25%[G,d] ؛ 25%[g,D]

The theoretical results are in accordance with the experimental results.

5

The descendant of the cross 4 is composed by the parental phenotypes and recombined phenotypes in equal percentages, this is explained by interchromosomal mixing …… — 0.25pt

Scheme showing the interchromosomal mixing using the symbols **G** and **g** for body color, **D** and **d** for eyes color…… — 0.75pt