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

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

3h	مدة الإنجاز	علوم الحياة والأرض	المادة
5	المعامل	شعبة العلوم التجريبية مسلك العلوم الفيزيائية (خيار إنجليزية)	الشعبة أو المسلك

Key and Marking Scale

Question	The elements of answer	Scores
	Section I : Knowledge Retrieval (6pts)	
I	**Accept any appropriate answers.** - **Eutrophication:** Eutrophication is an enrichment of water by nutrient salts that causes structural changes to the ecosystem such as: increased production of algae and aquatic plants and deterioration of water quality…… - **The ozone hole:** Is a thinning of the ozone layer resulting from air pollution …..	0.5 pt 0.5 pt
II	**Two techniques for household waste valorization by specifying their economic interest among the following proposition:** …… (2x0.5 pt) - Composting: obtaining a humus-like complex that can be used in agriculture as fertilizer for plants. - Biogas production: obtaining a significant amount of methane used in energy production. - Inceration: Energy production - Recycling: Is the process of converting waste materials (paper, plastic and glass) into new materials and objects.	1 pt
III	(1 ; b) ; (2 ; c) ; (3 ; b) ; (4 ; c) ……(4x0.5)	2 pts
IV	1 → true; 2→ false; 3→ true; 4→ true …… (4x0.25pt)	1 pt
V	**Advantages of using radioactive materials :** Two advantages such as - Low cost of production -Non release of greenhouse gases **Dangers of using radioactive materials :** Two advantages such as - Nuclear pollution resulting from explosion	0.5 pt 0.5 pt
	Section II : Scientific reasoning and communication in graphic and written modes (14 pts)	
	Exercise 1 (6 pts)	
1.a	In the presence and absence of cyanide, a perfect tetanus is obtained . …… In the presence of cyanide, the amplitude of tetanus is lower than that obtained in the absence of cyanide ……	0. 5 pt 0. 5 pt
1.b	**Accept any logical hypothesis in relation to the proposed data such as :** - Cyanide has an inhibitory action on the energy production pathways in muscle (respiration and lactic fermentation). - Binding of cyanide to myosin prevents the formation of the actomyosin complex.	0.75 pt
	Concerning the oxygen level : Before time T, the oxygen level decreases in the two media, going from 45% to 20%... From time T, the level of dioxygen remains stable at around 20% in medium 2	0.25 pt

2.a	(presence of cyanide) while this rate continues to decrease in medium 1 (absence of cyanide)……. **Concerning ATP :** Before time T, there is an increase in ATP concentration in both media to reach 100UA…… From time T, the concentration of ATP in medium 2 (presence of cyanide) stabilizes while it continues to increase in medium 1 (in the absence of cyanide)……	0.5 pt 0.25 pt 0. 5 pt
2.b	Cyanide blocks oxygen consumption and ATP production in the mitochondria……..	0.5 pt
3	The intensity of radioactivity is high at complex IV and low at the other complexes of the respiratory chain…….. Cyanide binds to complex IV and inhibits its activity which causes the flow of electrons and protons through the respiratory chain to be stopped and prevents the formation of the H+ gradient, thus blocking the reduction of oxygen and the production of ATP……	0.5 pt 0.75 pt
4	**Verification of the proposed hypothesis by justifying the answer :** The hypothesis is accepted (or rejected)…….. The cyanide binds to the IV complex and blocks the functioning of the respiratory chain which pushes muscle cells to produce ATP through lactic fermentation Pathway with low energy yield hence obtaining the contractions with low amplitude in presence of cyanide……	0.25 pt 0.75pt
	Exercise 2 (3.5 pts)	
1	**Comparison of copper paths in the two cells :** - In the hepatocyte of a healthy person, copper is bound to the ATP7B protein, which allows its elimination through the bile. …….. - In the hepatocyte of a person with Wilson's disease, copper does not bind to the ATP7B protein, which prevents its elimination through the bile, hence the accumulation of copper in liver cells…… **Deduction of the cause of the disease:** The disease is caused by the malfunction of the ATP7B protein which prevents the elimination of copper through the bile which leads to accumulation of copper in the hepatocytes. ……	0. 5 pt 0. 5 pt 0. 5 pt
2	**The mRNA and the corresponding amino acid sequence :** **- The normal ATP7B allele :**…….. m RNA: CUG GGC CGG UGG CUG amino acid sequence : Leu - Gly – Arg – Trp - Leu **- The ATP7B mutated allele :** …….. mRNA : CUG GGC CUG UGG CUG amino acid sequence : Leu - Gly – Leu - Trp - Leu	0. 5 pt 0. 5pt
3	**Explanation of the origin of Wilson's disease :**…… A mutation by substitution of nucleotide G by T at triplet 778 of the non-transcribed strand of the gene encoding ATP7B synthesis (or substitution of C by A at the transcribed strand) → substitution of Arg by Leu at the amino acid sequence of ATP7B protein → Non-functional ATP7B protein unable to bind copper →	1 pt

Accumulation of copper in tissues and excess of the circulating copper → appearance of Wilson disease.

Exercise 3 : (4.5 points)

1

*** First cross :**

- F1 is homogeneous, Mendel's first law is verified → non-sex related heredity ….. 0.25 pt
- The F1 individuals have a parental phenotype (returned thumb and rough fur), therefore :
- The allele responsible for the returned thumb is dominant **(P)** and the allele responsible for the normal thumb is recessive (p) ;..... 0.25 pt
- The allele responsible for the rough fur is dominant **(R)** and the allele responsible for the normal fur is recessive (r)..... 0.25 pt

*** Second cross :**

- This is a back-cross, F'$_2$ is composed of four phenotypes with different percentages: 63.83% of the parental phenotypes and 36.17% of the recombinant phenotypes → The two studied genes are linked..... 0.25 pt

2

Parents : double recessive individual × F_1

Phenotypes : [p , r] [P , R] 0.25 pt

Genotypes : $\frac{p\ r}{p\ r}$ $\frac{P\ R}{p\ r}$

↓ ↓

Gametes	p_r	$\frac{P\ R}{}$	P_r	p_R	p_r
	100%	31,38%	17,55%	18,62%	32,45%

0.5 pt

Chromosomal interpretation of the second cross:

Punnett square :

σF1 / σ P	$\frac{P\ R}{}$ 31,38%	P_r 17,55%	p_R 18,62%	p_r 32,45%
$\frac{p\ r}{}$ 100%	$\frac{P\ R}{p\ r}$ 31,38% [P, R]	$\frac{P\ r}{p\ r}$ 17,55% [P,r]	$\frac{p\ R}{p\ r}$ 18,62% [p, R]	$\frac{p\ r}{p\ r}$ 32,45% [p, r]

0.5 pt

Theoretical results are consistent with experimental results. 0.25 pt

3

- The presence in the F'2 generation of pigs with normal thumbs and the rough fur and pigs with returned thumb and normal fur is due to Intrachromosomal recombination (crossing-over) 0.5 pt
- Diagram of the Crossing over with the use of the symbols **P** and p for 'thumb shape' trait and the symbols **R** and r for 'fur shape ' trait. 0.75 pt

4

Establishing a correct gene map using a suitable scale and symbols. 0.75 pt