

الصفحة	<p style="text-align: center;">الامتحان الوطني الموحد للبكالوريا الممالك الحولية الدورة العادية 2021 - عناصر الإجابة -</p>		<p style="text-align: center;">  السلطة المغربية وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي المركز الوطني للتقويم والامتحانات </p>	
1				
4				
***	SSSSSSSSSSSSSSSSSSSS	NR 34E		
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)		
Accept any appropriate answers.		
I	- Pedunculated sphere: It is an inner mitochondrial membrane protein that catalyzes the production of ATP by phosphorylation of ADP.....	0.5 pt
	- Actomyosin complex: formed by binding actin filaments to myosin filaments and plays an important role in muscle contraction.	0.5 pt
II	$CH_3CO-COOH + NAD^+ + CoA \rightarrow CH_3CO-CoA + NADH, H^+ + CO_2$ (3x0.25pt)	0.75 pt
III	(1 ; b) ; (2 ; c) ; (3 ; d) ; (4 ; b) (4x0.5)	2 pts
IV	1 → Z disk ; 2 → Zone H ; 3 → Dark band (A); 4 → Light band (I) ; 5 →Sarcomere (5x0.25)	1.25 pt
V	(1 ; d) ; (2 ; c) ; (3 ; b) ; (4 ; a) (4x0.25)	1pt
Section II : Scientific reasoning and communication in graphic and written modes (14pts)		
Exercise 1 (4 pts)		
1	- The chicken is diploid: the chromosomes are distributed in pairs (2n = 78).....	0.25 pt
	- 38 pairs of autosomal chromosomes (each pair contains two homologous chromosomes);.....	0.25 pt
	- One pair of sex chromosomes:	
	* The hen has 2 different sex chromosomes ZW → heterogametic.....	0.25 pt
	* The rooster has 2 identical sex chromosomes ZZ → homogametic.....	0.25 pt
	- The chromosomal formula :	
	* For the hen : $2n = 38AA + ZW$	0.25 pt
	* For the rooster : $2n = 38AA + ZZ$	0.25 pt
2	- Cross 1 and cross 2 are reciprocal and do not give the same result in F1 and cross 1 between two pure lines of chickens gives a heterogeneous F1 descendants (50% ♀ with plain plumage and 50% ♂ with crossed-out plumage) → the 1st law of Mandel not verified → the gene studied is sex-linked (carried on the Z chromosome). Therefore, the hypothesis is rejected.....	0.25 pt
	- Individuals of the F1 generation of cross 2 have a parental phenotype (striped plumage) → dominance of the gene responsible for striped plumage (B) compared to the recessive gene responsible for plain plumage (n);	0.25 pt

*** Chromosomal interpretation of the cross 1 :**

Parents : P ♀ × P ♂
Phenotypes : [B] [n]
Genotypes : Z_B W Z_n Z_n
Gametes : 50% Z_B ; 50% W 100% Z_n

Punnett square :

	σ P ♀	50% Z _B	50% W
σ P ♂		Z _B Z _n [B] ♂ 50%	Z _n W [n] ♀ 50%
	100% Z _n		

0.5 pt

We obtain at F₁ : 50% [B] ♂ and 50% [n] ♀ .

The theoretical and experimental results are similar

The cross between individuals of F₁ hybrids of cross 2:

Parents : F₁ ♀ × F₁ ♂
Phenotypes : [n] [B]
Genotypes : Z_n W Z_B Z_n
Gametes : 50% Z_n ; 50% W 50% Z_B ; 50% Z_n

Punnett square :

	σ F ₁ ♀	50% Z _n	50% W
σ F ₁ ♂		Z _B Z _n [B] ♂ 25%	Z _B W [B] ♀ 25%
	50% Z _B		
	50% Z _n	Z _n Z _n [n] ♂ 25%	Z _n W [n] ♀ 25%

0.5 pt

We obtain at F₂ : 25% [B] ♂, 25% [n] ♂, 25% [n] ♀ and 25% [B] ♀ .

The theoretical and experimental results are similar.

*** Chromosomal interpretation of the cross 3 :**

Parents : P ♀ × P ♂
Phenotypes : [n] [B]
Genotypes : Z_n W Z_B Z_B
Gametes : 50% Z_n ; 50% W 100% Z_B

Punnett square :

	σ P ♀	50% Z _n	50% W
σ P ♂		Z _B Z _n [B] ♂ 50%	Z _B W [B] ♀ 50%
	100% Z _B		

0.5 pt

We obtain at F₁ : 50% [B] ♂ and 50% [B] ♀ (100%[B]) .

The theoretical and experimental results are similar .

The cross between individuals of F₁ hybrids of cross 4:

Parents : F₁ ♀ × F₁ ♂
Phenotypes : [B] [B]
Genotypes : Z_B W Z_B Z_n
Gametes : 50% Z_B ; 50% W 50% Z_B ; 50% Z_n

Punnett square :

	$\sigma P \text{♀}$	$50\% Z_B$	$50\% W$
$\sigma P \text{♂}$		$Z_B Z_B$ [B] ♂ 25%	$Z_B W$ [B] ♀ 25%
	$50\% Z_n$	$Z_B Z_n$ [B] ♂ 25%	$Z_n W$ [n] ♀ 25%

We obtain at F_2 : 75% [B] (50%♂ and 25%♀) and 25% [n] ♀.
 The theoretical and experimental results are similar .

0.5 pt

Exercise 2 : (4points)

1

The intestinal absorption of iron is ensured by the enterocytes through its transporter → passage of iron to the blood through ferroportins (transporters) → in the case of an increase in iron stock, the liver secretes hepcidin → degradation of ferroportins → inhibition of the passage of iron from intestinal cells to the blood and accumulation of iron in liver cells in ferritin.

Therefore, hepcidin decreases circulating (plasma) iron by blocking its intestinal absorption.

1 pt

The mRNA and the corresponding amino acid sequence :

- **The wild HFE allele :**

m RNA: CAG AGA UAU ACG UGC CAG GUG

amino acid sequence : Gln - Arg - Tyr - Thr - Cys - Gln - Val

0.25 pt
0.25 pt

2

- **The HFE mutated allele :**

mRNA : CAG AGA UAU ACG UAC CAG GUG

amino acid sequence : Gln - Arg - Tyr - Thr - Tyr - Gln - Val

0.25 pt
0.25 pt

3

In people with hemochromatosis, a substitution mutation of nucleotide G by A at the level of triplet 282 of the non-transcribed strand of the gene encoding the synthesis of the HFE protein (substitution of C by T at the level of the transcribed strand) → substitution of Cys by Tyr at the level of the amino acid sequence of the HFE protein → synthesis of a non-functional HFE protein → no synthesis of hepcidin in the hepatic cells → increase in the level of circulating iron and the appearance hemochromatosis...
 Consequently, a change in the nucleotide sequence of the gene induces a change in the character (appearance of a new phenotype).....

1.5 pt

0.5 pt

Exercise 3 : (6points)

1.a

- The mean value of the conductivity of the water in the different rivers studied exceeds the Moroccan standard for irrigation water, it varies between a minimum of 1200 $\mu S / cm$ for the waters of Taza river and a maximum of 5873 $\mu S / cm$ in the Waters of the Larbâa river (OA) next to the landfill.
- The BOD5 values are very high and far exceed the Moroccan standard.
- The waters of the Larbâa river and Taza river contain a high level of iron (70 and 22 mg / L) which exceeds the standard, while the iron rate in the waters of Jâouna river is lower than the standard.
- The bacterial load (quantity) in faecal coliforms in the waters of the different rivers studied is very high compared to the standards.

0.5 pt
0.25 pt

0.5 pt

0.25 pt

1.b

- OA (Larbâa river): class C4S3, water with very high salinity of medium quality with significant danger of alkalization ;

0.25 pt

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4			
		- OT (Taza river): class C3S1, high salinity water of excellent quality with low danger of alkalinization;	0.25 pt
		- OD (Dfali river) and OJ (Jaouna river): class C4S2, water with very high salinity and of good quality with an acceptable danger of alkalinization.	0.5 pt
1.c		The OA station is located near the public landfill installed on the edge of Larbâa river whose water is very polluted because this river collects the wastewater discharged at the level of Dfali river and Jaouna river → high organic and mineral loads generated by liquid discharges (wastewater) and leachate from the landfill of the Taza city → an average quality with significant danger of alkalinization of the water from the OA station which is polluted.	1 pt
2.a		Effects of the use of wastewater in agriculture: -Improving crop yields..... The yield of common wheat and alfalfa irrigated by wastewater is equivalent to or greater than that obtained during irrigation by water from the dam using fertilizers and exceeds their yield in the case of irrigation by rainwater	0.25 pt 0.5 pt
		- Bacteriological and chemical contamination (heavy metals) of crops..... We observe that the bacterial load (quantity) and the quantities of heavy metals are very high in plants irrigated by wastewater compared to that irrigated by water from the dam.....	0.25 pt 0.5 pt
2.b		The high risk of water-related diseases in the Taza region between 2001 and 2005 is linked to the consumption of the vegetable plants contaminated by bacteria.	0.5 pt
3		Proposition of two procedures for example: - Construction of a wastewater treatment plant before discharging it into the rivers of Taza city . - Construction of a controlled public landfill far from rivers and water sources.	0.5pt