	_					
<u>صفحة</u> 1 6		Ļ	تحان الوطني الموحد للبكالوري المسالك الدولية - خيار أنجليزية	الاه	+0.XHA.X+ I HEYOXO +0E0100+ I SOXEX 00ESO A SOES++X 0.XX800 A SOOHEA 010XH80 A SOXXX 0E0001	المملكة المغربية وزارق التربية الولمنية والتكوين الممني والتعليم العالم والبحث العلمي
**	$\star$		الدورة العادية 2017 - الموضوع -		قويه والامتدانات والتوجيه	المركز الوطني للتد
				NS 34E		
3	ماز	مدة الإنج	والارض	علوم الحياة	,	المادة
5	Ĺ	المعامر	ة – خيار أنجليزية	علوم الفيزيائي	مسلك ال	الشعبة أو المسلك
			Candidates may use non	i-program	mable calculators	
			Section I : Knowled	dge Retriev	al (5 pts)	
II. F Cop lette	For ea y do r.	ach of th wn these	e propositions numbered from 1 to e pairs $(1;)$ , $(2;)$ , $(3;)$ , $(4;)$	4, there is o ), and <b>matc</b>	only one correct suggestic ch each number with its o	on in each set. corresponding (2 pts)
<ul> <li>1. Complete tetanus is the result of the fusion of many muscle twitches due to a succession of excitations, so that the next excitation occurs:         <ul> <li>a- during the contraction phase of the previous muscle twitch.</li> <li>b- during the relaxation phase of the previous muscle twitch.</li> <li>c- after the previous muscle twitch.</li> <li>d- during the latent phase of the previous muscle twitch.</li> </ul> </li> <li>2. During muscle contraction the is a decrease in the length of the second and the H-band.</li> <li>b- clear band and the H-band.</li> <li>c- dark band and clear band, while H-band retains its length.</li> <li>d- during the latent phase of the previous muscle twitch.</li> </ul> <li>a- during the latent phase of the previous muscle twitch.</li>						Description there ne length of the: H-band. H-band. ar band, while the length. H bands.
<ul> <li>3. Lactic acid fermentation:</li> <li>a- releases 4 molecules of ATP from a glucose molecule.</li> <li>b- has a common stage with respiration called glycolysis.</li> <li>c- produces organic waste in the form of CO<sub>2</sub>.</li> <li>d- produces 2 molecules of ATP due to the appearance of the H<sup>+</sup> gradient on either side of the inner membrane of mitochondrion.</li> <li>d- dark, clear and the H bands.</li> <li>4. The reactions of the Krebs cy</li> <li>a- do not produce energy.</li> <li>b- release carbon dioxide (CO<sub>2</sub>).</li> <li>c- take place in the inner membrane of the mitochondrion.</li> <li>d- are common between respiration on the H<sup>+</sup> gradient on either side of the inner membrane of mitochondrion</li> </ul>						

**III**. Give the global reaction of glycolysis.

**IV**. The following document shows the respiratory chain.





1- Give the appropriate name for each of the above numbered structures 1, 2 and 3. (0.75 pt) 2- Name each of the above reactions A, B and C.





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Section II : Scientific reasoning and communication in graphic and written modes (15pts)

### Exercise 1 (5 pts)

**I.** There are two lineages of the Japanese quail (*Coturnix japonica*): a black-brown spotted plumage lineage and a red - yellow spotted plumage lineage. In order to identify the cause of the plumage colour difference in the Japanese quail, studies have been carried out on the **Mc1-R gene** that codes the synthesis of the *eumelanin* pigment responsible for the black- brown spotted plumage and the *pheomelanin* pigment responsible for the red - yellow spotted plumage.



Japanese quail (Coturnix japonica)

**Document 1** presents a part of the untranscribed strand of the allele responsible for the synthesis of *eumelanin* pigment in the Japanese quail.

Document 1

Number of Nucleotide triplets:225226227228229230231232233234235...Nucleotide sequence:CAGCCCACCATCTACCGCAGCAGCCTGA......

1. Give the mRNA strand and the amino acid sequence product from the part of the allele responsible for the synthesis of the *eumelanin* pigment from nucleotide triplet 225 to nucleotide triplet 234. Use document 1 and document 2 (genetic code). (1 pt)

			2 <sup>nd</sup> Base								
		I	U	C	l ,	A	l	G			
		UUU	Dha	UCU		UAU	True	UGU	Crea	U	
	TT	UUC	Phe	UCC		UAC	1 yr	UGC	Cys	С	
	U	UUA	Lon	UCA	Ser	UAA	aton	UGA	stop	Α	
		UUG	Leu	UCG		UAG	stop	UGG	Trp	G	
		CUU		CCU		CAU	Hic	CGU		U	
	С	CUC	Leu	CCC	Pro	CAC	<b>HIS</b>	CGC	Arg	С	
a		CUA		CCA		CAA	Cln	CGA		Α	es.
as		CUG		CCG		CAG	GIII	CGG		G	rd F
st B		AUU	Ile	ACU		AAU	Asn	AGU	Sor	U	Bas
1		AUC		ACC	The	AAC		AGC	Sei	С	e
	Α	AUA		ACA	Thr	AAA	<b>.</b>	AGA	A	Α	
		AUG	Met	ACG		AAG	Lys	AGG	Arg	G	
		GUU		GCU		GAU	Ac.	GGU		U	
	C	GUC	Val	GCC	Ala	GAC	asp	GGC	Gly	С	
	U	GUA	v al	GCA		GAA	Ac.	GGA		Α	
		GUG		GCG		GAG	Glu	GGG		G	

## **Document 2**

A mutation resulting from the deletion of many nucleotides at the level of the **Mc1-R** gene leads to the appearance of a mutant allele responsible for the synthesis of the *pheomelanin* pigment.

**Document 3** shows a part of the untranscribed strand of the mutant allele responsible for the synthesis of the *pheomelanin* pigment and the amino acid sequence produced.

	Number of nucleotide triplets:	225	226	227	228	229	230	231	232
Document 3	Nucleotide sequence:	CAG	CCC	ACC	GCA	CCA	GCA	GCC	TGA
	Amino acid sequence:	Gln -	Pro -	Thr -	Ala -	Pro -	Ala -	Ala	

2. Determine the location and the number of nucleotides lost by deletion that have led to the appearance of the mutant allele, and show the trait-gene relationship. (1.25 pts)



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**II-** In addition to the colour difference in eggs, Japanese quail can be affected by diabetes insipidus, which is an inherited disease characterised by excessive thirst and excretion of abnormal quantities of very diluted urine.

In order to study the mode of transmission of the two hereditary characteristics (traits), the colour of the eggs and the disease of diabetes insipidus in two lineages of the Japanese quail - one that gives blue eggs and is affected by diabetes insipidus and the other that gives green eggs and is not affected by diabetes insipidus, we suggest the exploitation of the results of the two following crosses:

- First cross between two lineages: a lineage that gives blue eggs and is affected by diabetes insipidus and a lineage that gives green eggs and is not affected by diabetes insipidus. The first generation obtained  $(F_1)$  is composed of individuals who give blue eggs and are not affected by diabetes insipidus.

## - Second cross between $F_1$ individuals:

The second generation obtained  $(F_2)$  is composed of:

- 10 individuals that give green eggs and are affected by diabetes insipidus.
- 33 individuals that give green eggs and are not affected by diabetes insipidus.
- 33 individuals that give blue eggs and are affected by diabetes insipidus.
- 82 individuals that give blue eggs and are not affected by diabetes insipidus.
- **3. Analyse** the results of the two crosses and **show** the mode of transmission of the two hereditary traits studied. (1.5pts)

4. Interpret and use Punnett square to explain the results obtained in the first and the second crosses.(1.25pts)

*Use the symbols* **B** *and* **b** *for the character " colour of the eggs " and the symbols* **D** *and* **d** *for the character " diabetes insipidus ".* 

Exercise 2 : (5 pts)

The M'nasra region near Kenitra city is characterised by an important agricultural activity which consists mainly of cattle breeding and farming using cattle manure (animal waste) which is rich in ammoniac ( $NH_4^+$ ) and which is often used in soil fertilisation. The groundwater of the M'nasra region is estimated to be about  $80 \times 10^6$  m<sup>3</sup> and it is the main resource for drinking water and agricultural use. The M'nasra phreatic nape (groundwater table) gets water supplies from rainwater but it is exposed to pollution.

In order to study the impact of the agricultural activity on the quality of groundwater in M'nasra region, chemical and biological analyses have been conducted on sample waters of four wells as indicated in document 1. The results of these analyses are shown in document 2.





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The wells Parameters	W1	W2	W3	W4	Drinking water standards
Ammoniac $NH_4^+$ (in mg/L)	0,00	0,00	0,28	0,00	$\leq$ 0,5mg/L
Nitrites $NO_2$ (in mg/L)	0,007	0,003	0,004	0,002	$\leq$ 0,1mg/L
Nitrates $NO_3$ (in mg/L)	26,16	107,76	114,47	198,46	$\leq$ 50mg/L
FC per 100mL Number of	380	57	120	0	$\leq 0/100 \text{ mL}$
Number of FS per 100mL	$1250 \times 10^{3}$	$8 \times 10^3$	$5,8 \times 10^{3}$	$2,5 \times 10^{3}$	$\leq 0/100 \text{ mL}$

FC: Faecal Coliforms - FS: Faecal Streptococci

- Faecal Coliforms and Faecal Streptococci are bacteria encountered in human and animal faeces (faecal material);

- In the soil, the ammoniac  $(NH_4^+)$  is transformed into nitrite  $(NO_2^-)$ , then into nitrate  $(NO_3^-)$ ;

- To identify the origin of coliforms and streptococci faecals detected in the water of the four wells

studied, we calculate the  $\frac{FC}{FS}$  ratio. The bacteria are of animal origin if the  $\frac{FC}{FS}$  ratio is  $\leq 0,7$ . **Document 2** 

**1. Based** on the data in document 2, **compare** the values of NO<sup>-3</sup>, FC and FS recorded in the water of the four wells with the drinking water standards, and **deduce** the water potability of these wells (whether the water of each will is drinkable or not). (1.25 pts)

**2. Calculate** the  $\frac{FC}{FS}$  ratio of the four wells and **deduce** the origin of coliforms and streptococci faecals detected in the water. (1 nts (1 pts)

**3.** Based on the data in documents 1 and 2 and on your knowledge, explain how the groundwater in the M'nasra region is polluted by  $NO_3^-$ . (1.25 pts)

In order to find solutions to the problem of groundwater pollution by NO<sub>3</sub>, the following data are suggested:

Fava bean culture contributes to the enrichment of the soil with mineral nitrogen used by plants. For example, winter fava bean culture leaves in soil round 67% of nitrogen needs for other cultures, like wheat.

**Document 3** shows the variation in nitrate content in groundwater according to agricultural practices in the southwest of France during the period 1963-1988.



**Document 3** 

4. Describe the variation in nitrate content in groundwater according to the agricultural practices illustrated in document 3, and suggest an appropriate solution to improve the quality of groundwater in the M'nasra region. (1.5pts)





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# Exercise 3 : (5 pts)

Karakorum is a mountain range located in the North-West of the Himalayas and extends from northern Pakistan to the South of Kashmir. In order to determine the stages of formation of this mountain chain, many studies were carried out on the tectonic and petrographic characteristics of rocks of Karakorum region.

Document 1 presents a simplified map of the studied area.



**Document** 1

Based on document 1, extract two indicators showing that the studied region has undergone compressive tectonic forces, and two other indicators showing that it has undergone a collision preceded by a subduction. (1 pt)

The Karakorum metamorphic complex is characterised by the presence of the gneiss rocks  $(R_2)$  which are the result of metamorphic transformation of paragneiss rocks  $(R_1)$ .

The table in **document 2** shows the mineralogical composition of the two rocks  $R_1$  and  $R_2$ .

**Document 3** shows the path of metamorphic evolution of these two rocks according to pressure and temperature variations.

	Minerals	Paragneiss (R <sub>1</sub> )	Gneiss (R <sub>2</sub> )
	Quartz	+++	+++
	Plagioclase	++	++
	Biotite	+++	++
	Muscovite	++	++
	Garnet	++	++
Document 2	Kyanite	++	-
	Sillimanite	_	++

(+): Low proportion of mineral
(++): Average proportion of mineral
(-): Absence of mineral





## Document 3

- Based on document 2, describe the mineralogical variations observed during metamorphic transformation from paragneiss to gneiss. (0.75 pts)
- **3. Based** on document 3, **determine** the conditions of the pressure and temperature allowing the formation of the two rocks R<sub>1</sub> and R<sub>2</sub>, and explain the mineralogical variations observed during metamorphic transformation from paragneiss to gneiss. (1.25pts)

**Document 4** shows the stages of formation of Karakorum mountain range according to the model proposed by Y. LEMENNICIER:



Document 4

4- Use the previous data and document 4 to reconstruct the geological history of Karakorum mountain and specify the relationship between the gneiss formation and the formation of this mountain range (orogeny).(2 pts)



لصفحة 1 4		Ļ	تحان الوطني الموحد للبكالوري المسالك الدولية - خيار أنجليزية	الام	+₀XNA\$+ I NEYO\$⊖ +₀E₀Li₀O+ I \$OXE\$ ₀l₀E\$O A \$OE\$++X ₀xx83N₀I A \$OONEA ₀lx8NN₀ A \$OXx85 ₀E₀O⊙I		المملكة المغربية وزارق التربية الولمنية والتكوين الممنى التعليم العالم والبحث ال		
**	*		الدورة العادية 2017 - عناصر الإجابة -	NR 34E	والامتحاذات والتوجية	ندي للتقويم و	المركز الوك		
3	إنجاز	علوم الحياة والارض			,		المادة		
5	امل	مسلك العلوم الفيزيائية – خيار أنجليزية		مسلك ال	إى	الشعبة أو المسا			
Key and Marking Scale									
	Section I : Knowledge Retrieval (5 pts)								
			Questions				Scores		
	т		A agant any annuant	iato anomon	a				

	Questions	Scores				
I	Accept any appropriate answers.					
	<ul> <li>Muscle twitch: muscle response after an effective stimulation; it is composed of a latent phase, a contraction phase and a relaxation phase 0.5 pt</li> <li>Mitochondrion: is the organelle powerhouse of the cell where organic molecules are broken down inside a double membrane to release energy and transfer it to ATP through the respiratory chain</li></ul>	1 pt				
II	$(1,a)$ ; $(2,b)$ ; $(3,b)$ ; $(4,b)$ $(4 \times 0.5)$	2 pts				
III	- Global reaction of glycolysis: $C_6H_{12}O_6 + 2 \text{ ADP} + 2\text{NAD}^+ + 2\text{Pi} \rightarrow 2\text{CH}_3\text{COOH} + 2 \text{ ATP} + 2 \text{ NADH},\text{H}^+$	0.5 pt				
IV	Names of structures: (1) inner mitochondrial membrane; (2) ATP synthase ;(3) Complex electron and proton transporter $(T_1)$	1.5 pts				
Section II : Scientific reasoning and communication in graphic and written modes (15pts)						
Questions	Exercise 1 (5 pts)	Scores				
1	<ul> <li>the mRNA strand corresponding to the part of allele responsible for the synthesis of the <i>eumelanin</i> pigment:</li> <li>CAG CCC ACC AUC UAC CGC ACC AGC AGC CUG0.5pt</li> <li>amino acid sequence product from the part of the allele responsible for the synthesis of the <i>eumelanin</i> pigment</li> <li>Gln - Pro - Thr - Ile - Tyr - Arg - Thr - Ser - Ser - Leu :0.5 pt</li> </ul>	1 pt				
2	<ul> <li>The location and the number of nucleotides lost by deletion: deletion of seven nucleotides: two nucleotide triplets numbered 228 and 229 and the first nucleotide of the triplet number 230 (TAG ATG G) of the DNA transcribed strand (or ATC TAC C of the DNA untranscribed strand). :</li></ul>	1.25 pts				
3	<b>Exploitation of the first cross results:</b> <b>- Dihybrid cross:</b> study of the transmission of two hereditary traits0.25 pt $F_1$ is homogenous, Mendel's law of dominance (Mendel's first law) has been verified $\rightarrow$ heredity not linked to sex0.25 pt					

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4		ية	ئية_ خيار أنجليز	ك العلوم الفيزيا	ة والأرض – مسا	- مادة: علوم الحيا			
	- All	F1 individuals oi	ve hlue eggs an	d are not affec	ted by diabetes	insipidus ·			
	the al	lele responsible	for bleu eggs is	dominant "B"	and the allele r	esponsible for			
	green	eggs is recessiv	e "b"			0. 25pt			
	The a	llele responsible	for the trait "no	ot affected by c	liabetes insipidu	is" is dominant			
	reces	sive "d"		trait affected	by diabetes ins	<b>0. 25pt</b>			
	The s follow	econd generation w:	n obtained (F <sub>2</sub> )	is composed of	f four phenotype	es distributed as	1 pt		
	[B; D] 51,8 % (about 9/16); [B; d] 20,88% (about 3/16)								
	[b; D] 20,88% (about 3/16) [b; d] 6,32% (about 1/16)								
	<b>Men</b> linke	<b>lel's</b> law of inde d (unlinked gene	pendent assortn	nent has been v	verified $\rightarrow$ the t	two genes are not <b>0.5 pt</b>			
	- Chi	omosomal inter	rpretation of th	ne first cross:					
	Paren	ts :	- P1	×	P2				
	Phen	otype :	[d,B]		[D,b]				
	Geno	type : etes :	a//a , B//B 100% d/ B	/	D//D, $b//b$	(0.25 pt)			
	Guin		10070 07, 2	,	1007027,07	( <b>0.20 pt</b> )			
			F	<b>1</b> : D//d, B//b	[D,B]	( <b>0.25</b> pt)			
	- Chi	100% - Chromosomal interpretation of the second cross:							
	Paren	Parents $F1 \times F1$							
	Phen	otype :	[D, B]		[D, B]		1.25		
	Geno	type :	D//d , B//b		D//d , B//b	. /	pts		
	Game	extes: $D/,B/$	$\frac{1}{4}$ ; D/,b/ $\frac{1}{4}$ : d/b/ 1/	$\frac{1}{4}$ D/,B/	$\frac{1}{4}$ ; D/,b/	$\frac{1}{4}$ (0.25 pt)			
4	Punn	ett square:	74 , u/,0/ 74	+ u/,D/	/4 , u/ ,0/	(0.5 pt)			
		-	1	<b>1</b>	n				
		<u>γ</u> δ	D/,B/ 1⁄4	D/,b/ <sup>1</sup> ⁄ <sub>4</sub>	d/,B/ <sup>1</sup> / <sub>4</sub>	d/,b/ <sup>1</sup> / <sub>4</sub>			
		γ°							
	D/.	$\frac{I+}{B/1/4}$	D//D . B//B	D//D. B//b	D//d . B//B	D//d . B//b			
		_, ,,	[D,B] 1/16	[D,B] 1/16	[D,B] 1/16	[D,B] 1/16			
	D/,	b/ <sup>1</sup> / <sub>4</sub>	D//D, B//b	D//D, b//b	D//d , B//b	D//d , b//b			
		<b>D</b> ( 1 (	[D,B] 1/16	[D,b] 1/16	[D,B] 1/16	[D,b] 1/16			
	a/,	<b>B</b> / <sup>1</sup> /4	D// <b>d</b> , B//B	D//d, B//b	<b>d</b> // <b>d</b> , <b>b</b> // <b>b</b>	<b>a</b> // <b>a</b> , <b>b</b> // <b>b</b>			
	d/.	b/ <sup>1</sup> / <sub>4</sub>	D//d . B//b	$D//d \cdot b//b$	d//d . B//b	d//d . b//b			
	,		[D,B] 1/16	[D,b] 1/16	[d,B] 1/16	[d,b] 1/16			
	The f	ollowing theoret	ical results are	obtained:					
	[D,B]	9/16 · [d,B] 3/	/16: [D,b] 3/16	' [d,b] 1/16					
	The theoretical and experimental results are similar.								
Question	wastions Evonoise 2 (5 ntc)						scores		
<b>L</b> acionality	Com	parison :							
	- The	nitrate in the wa	ater of well $W_1$ l	has a value less	s than that of dri	nking water			
1	stand	ards, whereas in	the other wells, this value is higher than the drinking water						
	stand	ards.				0.25 pt			

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4	INK34E	- مادة· عله م الحياة ه الأرض – مسلك العله م الفيز بائية – خيار أنْجليزية						
-								
	- In drink ( abso - In drink <b>Dedu</b>	the three wells $W_1$ , $W_2$ and $W_3$ , the number of faecal coliforms exceeds the sing water standards, whereas the water in $W_4$ it is in accordance with the norms ence of faecal coliforms)	1.25 pt					
2	$\begin{array}{c} \textbf{Calc} \\ W_1 \\ \textbf{Dedu} \\ FC an \end{array}$	Calculation of the FC/FS ratio: $W_1 \rightarrow 0,0003 - W_2 \rightarrow 0,006 - W_3 \rightarrow 0,02 - W_4 \rightarrow 0$ <b>Deduction :</b> the calculated ratio for the four wells is less than 0,7, so theFC and FS detected in the water is of animal origin.0.5 pt						
3	Exp inten trans groun M'na	<b>Explanation of groundwater pollution in the M'nasra region:</b> intensive use of cattle manure $\rightarrow$ enrichment of the soil by ammoniac $\rightarrow$ transformation of ammoniac in the soil into nitrate $\rightarrow$ infiltration of nitrate towards groundwater via rainwater $\rightarrow$ increase in nitrate concentration and pollution of the M'nasra groundwater.						
4	Desc agric - the rotati with  The f conte stand - Sto gradu recor -Sug M'na	ription of the variation in nitrate content in groundwater according to cultural practices : concentration of nitrate in groundwater in fallow lands and lands cultivated in in on with fava beans is less than 50mg/L (This groundwater is in conformity the standards) 	1.5 pt					
Question	ns	Exercise 3 (5 pts)	scores					
1	The comp -Kara - pres -pres Two prece - pres - pres - pres	two indicators showing that the region of Karakorum has undergone the pressive tectonic forces:(for example)(0.5 pt) akorum is located in a confrontation zone between two plates. sence of reversed faults; ence of thrusts. indicators showing that the region of Karakorum has undergone a collision eded by a subduction: (for example)(0.5 pt) sence of migmatites around metamorphic rocks; sence of suture zone; sence of granitoids	1 pt					
2	Desc trans Decr sillin	ription of the mineralogical variations observed during metamorphic sformation from paragneiss to gneiss: ease in the proportion of biotite, disappearance of kyanite and appearance of nanite.	0.75pt					

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4		- مادة: علوم الحياة والأرض – مسلك العلوم الفيزيائية – خيار أنجليزية	
3	• Co rocks -Rock 750°C -Rock 650°C Expl The e 1.1 G	nditions of pressure and temperature allowing the formation of the two $\mathbf{s} \cdot \mathbf{R}_1$ et $\mathbf{R}_2$ : $\mathbf{k} \mathbf{R}_1$ : high pressure (nearly 1.1 GPa) and a moderate temperature (nearly C)	1.25 pt
4	Reco gneis - befo contin the in - befo contin and k forma - befo ocean accor parag tempo - befo forma parag	It and the appearance of simmanite	2 pts