الامتحان الوطني الموحد للبكالوريا
المسالك الدولية – خيار أنجليزية
الدورة الاستدراكية 2018
-الموضوع-

RS32E

المملكة المغربية
وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي

المركز الوطني للتقويم والامتحانات والتوجيه

3	مدة الإنجاز	علوم الحياة والأرض	المادة
7	المعامل	شعبة العلوم التجريبية : مسلك علوم الحياة والأرض – خيار أنجليزية	الشعبة أو المسلك

Candidates may use non-programmable calculators

Section I : Knowledge Retrieval (5 pts)

I. For each of the propositions numbered from 1 to 4, there is only one correct suggestion in each set. **Copy down** these pairs (1; ..), (2; ..), (3; ..), (4; ..), and **match** each number with its corresponding letter. **(2 pts)**

1-the reverse fault is a structure : a. that results from extensional tectonic stresses. b. characterised by two blocks one distancing from the other. c. characterised by a vertical fault plane. d. characterised by the two blocks one getting closer to the other.	**2- the andesite is a magmatic rock that :** a. results from rapid cooling of magma in the depth. b. results from slow cooling of magma on the surface. c. has a microlite structure characterised by microlites and glass. d. has a coarse-grained structure characterised by large-size crystals.
3-subduction chains result from the burial of: e. a less-dense oceanic lithosphere under a denser continental lithosphere. f. a less-dense continental lithosphere under a denser continental lithosphere. g. a denser oceanic lithosphere under a less dense continental lithosphere. h. a less dense continental lithosphere under a less dense oceanic lithosphere.	**4- metamorphic aureole is a zone surrounding :** a. intrusive granite and resulting from contact metamorphism. b. anatectic granite and resulting from contact metamorphism. c. intrusive granite and resulting from regional metamorphism. d. anatectic granite and resulting from regional metamorphism.

II. Define the following notions:

1. anatexis **(0.5 pt)**
2. metamorphic facies. **(0.5 pt)**

III. Copy down the letter of each of following propositions, and **write** whether these statements are "**true**" or "**false**". **(1 pt)**

a	The andesitic magma results from the partial melting of the pre- existing rocks under the action of a metamorphism of high temperature and low pressure.
b	Metamorphism of the subduction zones is characterised by a dynamic metamorphism.
c	A metamorphic sequence corresponds to all the rocks that have been formed in the same conditions of pressure and temperature.
d	schistosity and foliation are two structures characterising metamorphic and magmatic rocks.

IV.Give:

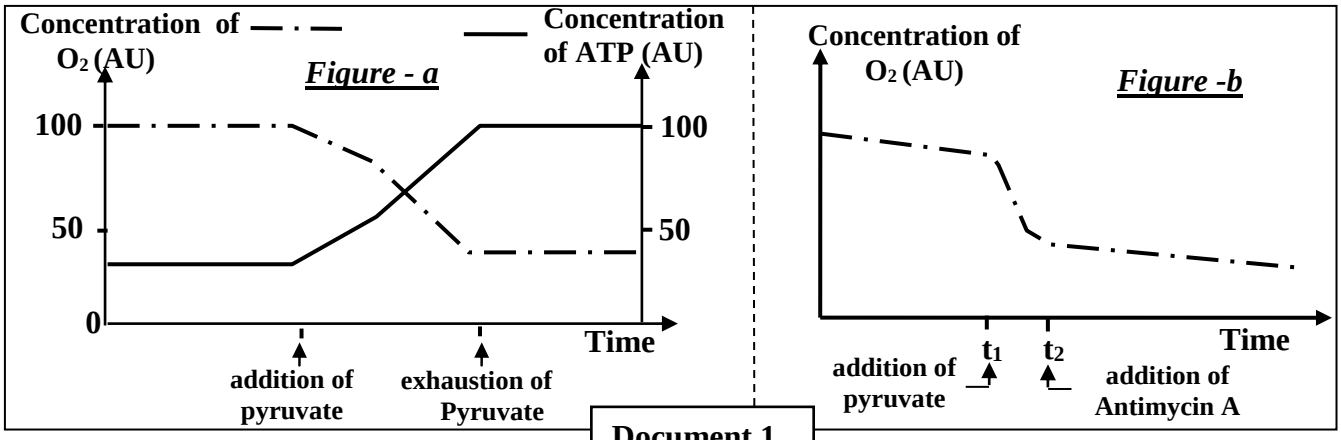
1- two characteristics of collisional mountain range. **(0.5 pt)**
2- two characteristics of obductional mountain range. **(0.5 pt)**

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

Exercise 1 (3 pts)

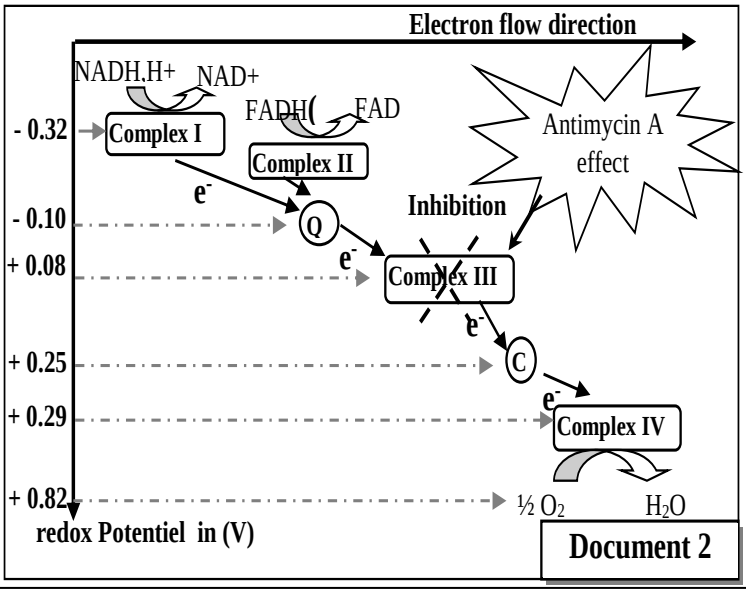
Cellular respiration is a set of reactions which take place partly in the mitochondria allowing cells to produce ATP. These reactions can be disrupted following the exposure to chemical substances like *Antimicyn A*. The latter is an antibiotic produced by some fungi (*streptomyces*). Exposure of individuals to this product has dangerous effects on the energetic metabolism of cells. In order to understand the mode of action of Antimicyn A, we present the following data:

- **Data1:** a mitochondria suspension is introduced in two mediums1 and 2 containing ADP and Pi and are saturated with oxygen and maintained at pH = 7,5.
  - **In medium 1:** we follow the evolution of dioxygen concentration and ATP before and after adding pyruvate. Figure (a) in document **1** presents the obtained results.
  - **In medium 2:** we follow the evolution of dioxygen concentration after introducing pyruvate at time (t_1) and Antimycin A at time (t_2). Figure (b) in document**1** presents the obtained results.



Document 1

1- Describe the obtained results in each figure (a) and (b) in document 1, and **make** a hypothesis that explains the relationship between Antimycin A and ATP production. **(1.5 pts).**

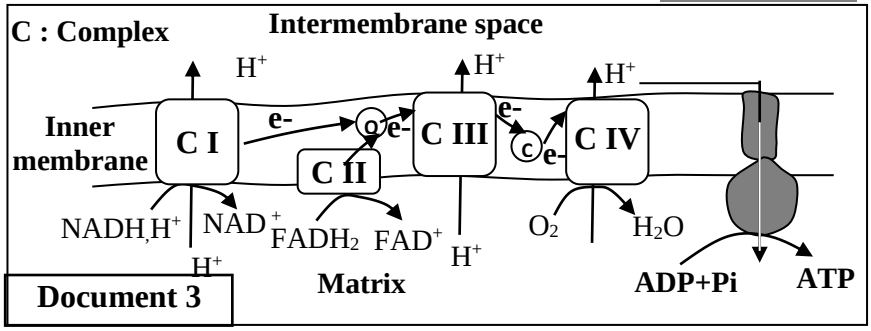


Document 2

- **Data 2:** the inner mitochondrial membrane contains protein complexes forming the respiratory chain. Document 2 shows the redox reaction sequence that takes place during the electron transfer along the respiratory chain, and the action site of Antimycin A. Document 3 presents the mechanism of ATP production at the level of inner mitochondrial membrane.

2- By exploiting document 2:

a- **Show** the relation between electron transfer direction and the redox potential of different complexes of the respiratory chain. **(0.25 pt)**



Document 3

b- **Explain** the effect of *Antimycin A* addition on the dioxygen concentration presented in figure (b) in document 1. **(0.5 pt)**

3- Using documents 2 and 3, **explain** the effect of *Antimycin A* on the production of ATP by the cells. **(0.75 pt)**

Exercise 2 (5 pts)

To study the transmission of genetic information and mechanisms of its expression, we suggest the following data:

• **Data1:** mitosis assures the multiplication and regeneration of living tissues. It also constitutes the cell cycle along with interphase. Document 1 presents two phases of this cycle in animal cells. [Figure a: interphase; Figure b: prophase].

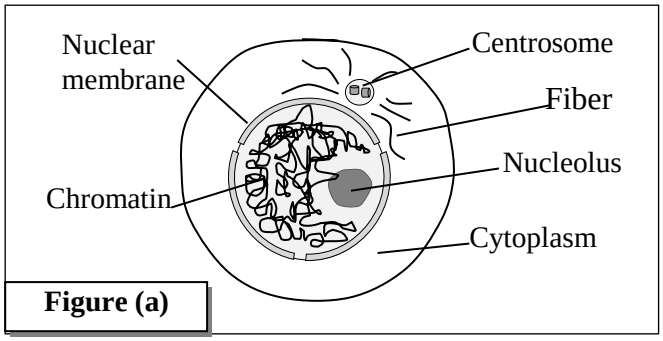


Figure (a)

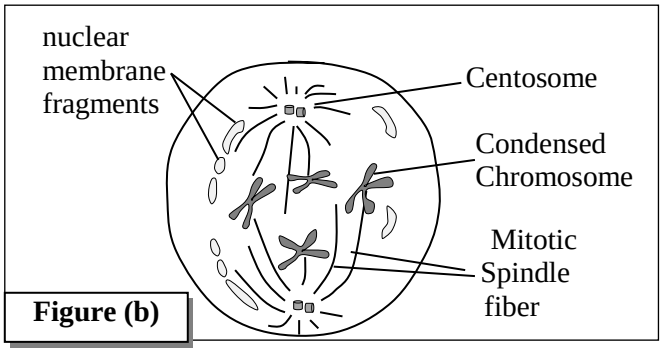


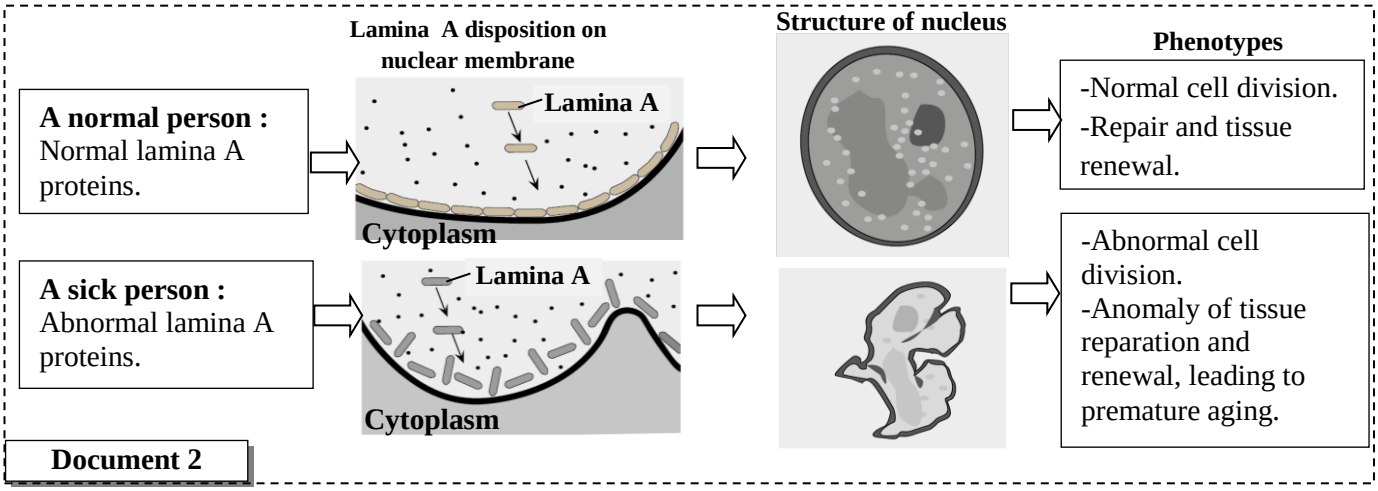
Figure (b)

Document (1)

1. Find the modifications occurring in nucleus and cytoplasm during the transition from interphase to prophase. **(1 pt)**

• **Data 2**: The nucleus includes many types of fibrous proteins called lamina responsible for the structure of the nucleus. Alteration of one type of lamina A can be at the origin of a syndrome called "*Progeria*". Symptoms of this syndrome include: short stature, metabolic complications and premature aging associated with a predisposition to cancer.

Document 2 presents data about the role of "lamina A" observed in a normal case and a "progeria" case.



Document 2

2. Use document 2 to **compare** data concerning the normal person and the sick person, and **show** the protein-trait relation. **(1.5 pts)**

- Genetic analyses allowed to associate this disease with LMNA gene. Tow alleles of this gene were identified: $LMNA^{+}$ which governs the normal protein synthesis, and $LMNA^{(-)}$ which governs the abnormal protein synthesis. Figure (a) in document 3 presents a transcribed strand fragment of allele $LMNA^{(+)}$in a healthy person, and a transcribed strand fragment of allele $LMNA^{(-)}$ in a sick person of one type of "progeria". Figure (b) in document 3 presents an extract of the genetic code table.

Number of triplets	169	170……									177
Fragment of LMNA allele in a normal person	CAC	-CGG	-TTC-GAA	-CTC	-CGT-CGG	-GAT-	CCA..				
Fragment of LMNA allele in a sick person	CCC	-GGT-	TCG-	AAC-	TCC-GTC-	GGG-	ATC-	CA…			

Reading direction ⟶

Figure (a)

Codons	UUG CUA CUU	UAG UGA	CCC CCA	GAG GAA	AAA AAG	AGA AGG	AGU AGC	GUU GUG	GCC GCA	GGA GGG GGU	CAA CAG
amino acids	Leu	stop	Pro	Ac.Glu	Lys	Arg	Ser	Val	Ala	Gly	Gln

Figure (b)

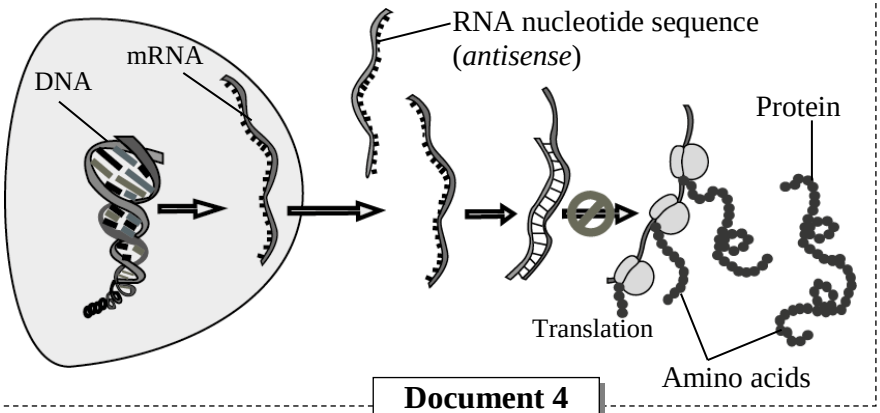
Document 3

3. Based on document 3, **give** mRNA and the amino acids sequence corresponding to a normal person and a sick person, then **show** the gene-protein relationship. **(1.5 pt)**

Data3:

In the hope of finding a cure for the « *progeria* » sydrome, recent research based on genetic engineering has been done on mice manifesting the same « *progeria* » symptoms.

These studies use a genetic treatment that consists of introducing an RNA nucleotide sequence (*antisense*) in mice cells. This antisense RNA is capable of binding in a complementary way to mRNA, which encodes abnormal protein. Document 4 presents the main treatment principle used.



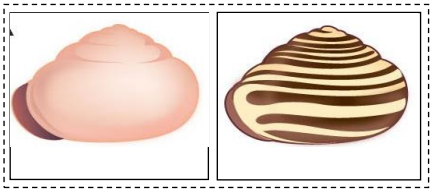
Document 4

4. a- **Show** how antisense RNA prevents the production of abnormal protein responsible for this syndrome (document 4). **(0.5 pt)**

b- **Suggest** a technique that allows the genetic modification of sick cells and make them capable of producing antisense RNA in a permanent way. **(0.5 pt)**

Exercise 3 (4 pts)

To study the transmission of hereditary traits in diploid organisms and the effect of some genetic variation factors on the structure of a population, we suggest the following data concerning the grove snail «*Cepaea nemoralis* »:



- **Data1:** the grove snail shell shows an important variation between individuals in terms of colours and the presence or absence of stripes. The focus is on the study of the transmission of two pairs of alleles:
  - A pair of alleles governing the shell colour: one responsible for the pink colour, and the other for the yellow color.
  - Another pair of alleles governing the presence or absence of stripes on the shell: one responsible for the presence of stripes and the other for their absence.

- **First cross between two pure lineages of snails** - P_1 and P_2 (parents): lineage P_1 has pink shells with stripes and lineage P_2 has yellow shells without stripes. This cross yielded individuals (F_1 generation) all having pink shells without stripes.
- **Second cross between individuals from generation F_1 and individuals from yellow-phenotypes with black stripes:**

- 234 individuals with black-striped pink shells	- 246 individuals with yellow shells without stripes
- 54 individuals with pink shells without stripes	- 66 individuals with black-striped yellow shells

1- Based on the results of the two crosses, **determine** and **justify** your answer concerning:
a- dominant alleles and recessive alleles. **(0.5 pt)**
b- are the two genes linked or independent? **(0.5 pt)**

2- Using Punnett square, **interpret** the two crosses. **(1.5 pts)**

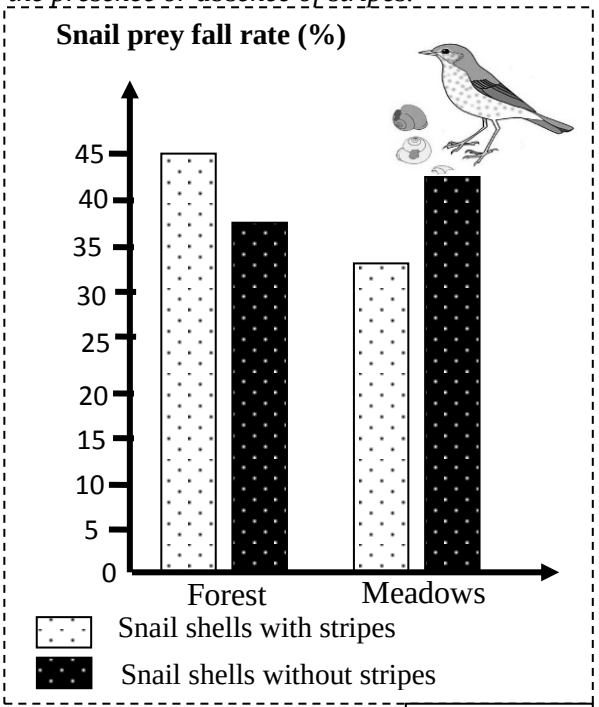
Use the following symbols: ***-R** and **r** for alleles responsible for shell color.*
***-B** and **b** for alleles responsible for the presence or absence of stripes.*

- **Data 2:** The habitat of Grove snail «*Cepaea nemoralis* » is very varied. The forest environment, in which the grove snail is encountered, is uniform and dark and composed particularly of grass and dead leaves. Whereas, in the meadows, the grass is more or less tall and constitutes a heterogeneous habitat for snails.

The song thrush *(Turdus philomelos*), a predatory bird of the grove snails, has the habit of breaking the snails' shells on rocks. The study of shell fragments allows to determine the phenotype most prey in forests and meadows.

Document **1** shows the results of debris shells in the forest and in meadows.

3- Compare the results obtained in the two habitats. **(0.5 pt)**
4- Determine the variation factor responsible for the observed difference between the two mediums, and then **explain** its action mode on the snail population in each habitat. **(1 pt)**

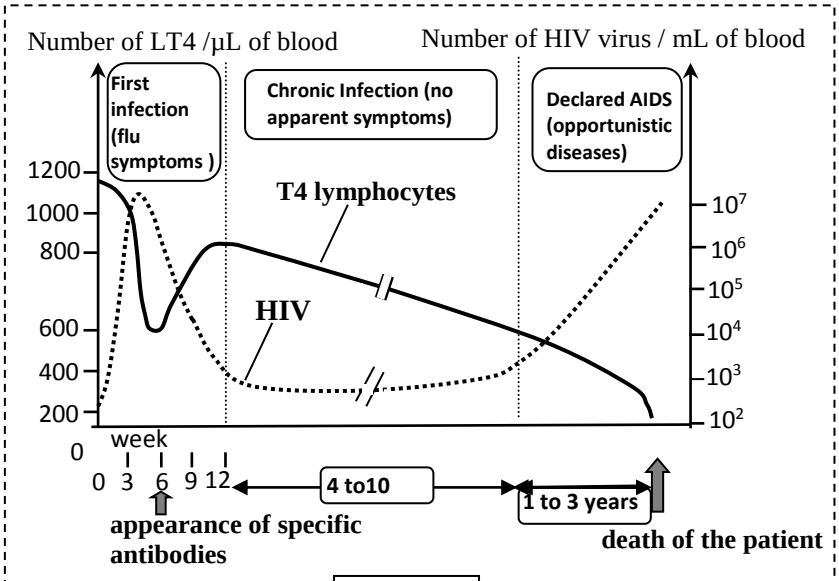


Document 1

Exercise 4 (3 pts)

Lymphocytes play a fundamental role in the specific immune response (adaptive). In a study of the role of these cells, we suggest the following data:

Data 1: In some cases, like in AIDS, the dysfunctioning of lymphocytes leads to severe consequences on the immune response. Document 1 presents the evolution of the number of T4 lymphocytes and the HIV virus in the blood of an individual infected with HIV.



Document 1

1. Based on data in document 1, **describe** the evolution of the number of HIV viruses and T4 lymphocytes starting from the 6th week to the 12th week on the one hand, and during the declared AIDS phase on the other hand. Then, **explain** the number evolution of HIV viruses during the two phases. **(1 pt)**

Data 2: To show the role of T4 lymphocytes in the specific immune response, we have carried out an experiment on 6 batches of mice:

- The batch of mice **1** has not received any treatment;
- Batches from 2 to 6 have received treatment which has allowed to eradicate some types of lymphocytes;
- The six mice batches have been infected with the flu virus.

After that, we have measured the effectiveness of the immune response according to the time needed to eliminate the virus and the survival rate for each batch. Document 2 presents the conditions for the experimentation and the results obtained.

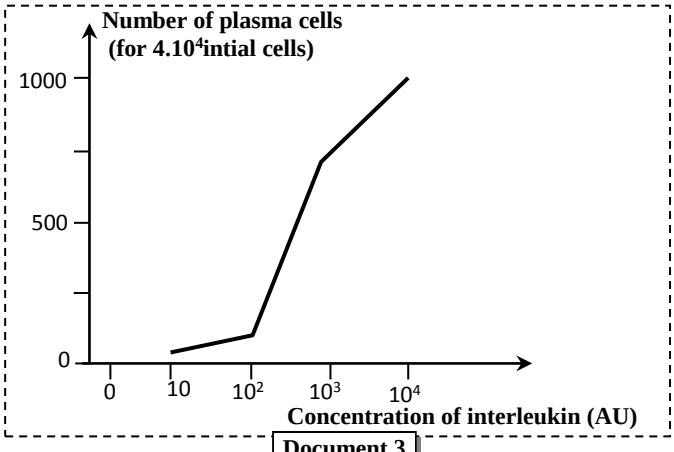
2. By exploiting data in document 2, **determine** the necessary conditions for the flow of an effective immune response. **Justify** your answer. **(0.5 pt)**

	Conditions of experimentation			Results	
	T8 Lymphocytes	T4 Lymphocytes	B cells	Time needed to eliminate the virus in days	Rate of survival (. . .%)
Batch 1	+	+	+	7 to 10	100
Batch 2	-	+	+	10 to 14	100
Batch 3	-	+	-	> 20	0
Batch 4	-	-	+	> 20	0
Batch 5	+	+	-	10 to 14	50
Batch 6	-	-	-	> 20	0

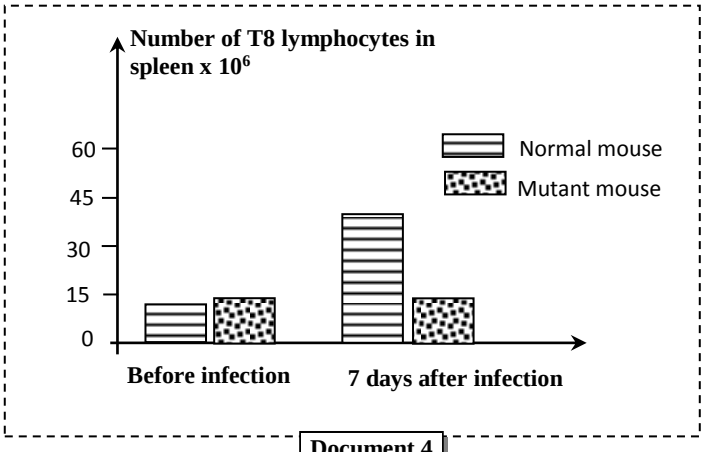
+ : Presence - : Absence

Document 2

- Culture of T4 Lymphocytes, in the presence of stimulating products playing the role of antigen, are activated, which allow them to secrete a substance called interleukin. Document 3 shows the effect of concentration of interleukin 2 on the number of plasma cells producing antibodies. Document 4 presents the number of T8 lymphocytes in the spleen of normal mice and mutant mice (deficiency of interleukin 2), **before** and then seven days **after** the infection with the virus (*choriomeningitis* virus)



Document 3



Document 4

3- Describe the results provided by documents 3 and 4, then **deduce** the role of interleukin 2. **(0.75 pt)**

4- Draw an explanatory diagram showing the role of T4 lymphocytes in the progress of immune response.**(0.75 pt)**

★★★

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الشعبة أو المسلك	شعبة العلوم التجريبية : مسلك علوم الحياة والأرض – خيار أنجليزية	المعامل	7

Question	Key and marking scale	scores
	Première partie (5 pts)	
I	(1, d) ; (2, c) ; (3, c) ; (4, a)	**0.5 pt x4**
II	**Definitions** (accept any correct definition) : **1.** anatexis: the partial or incomplete melting of metamorphic rocks . **2.**metamorphic facies: a set of metamorphic mineral assemblages formed under similar pressure and temperature conditions.	**0.5 pt x2**
III	a-false ; b-true ; c-false ; d-false	**0.25 pt x4**
IV	**1. Characteristics of collisional mountain range** (accept any correct definition) **:** Crustal thickening; thermal and dynamic metamorphism; tectonic deformations. …… **2. Characteristics of obductional mountain range** (accept any correct definition) **:** The nappes; the ophiolites; the reverse faults; the tip-line folds;the folds. ……	**0.5 pt x2**
	Second section (15 pts)	
	exercise 1 (3 pts)	
1	**Description :** **Figure a :** -before addition of pyruvate, there is a stability of the O_2concentration at a value of 100% and ATP concentration at a value of 30 AU - After addition of pyruvate, the O_2 concentration decreases to a lower value of 50%, and ATP concentration increases to 100AU. - After exhaustion of pyruvate, the concentrations remained fixed at O_2 50% for O_2 and in 100AU for ATP..……..……..... **Figure b :** - before t_1, the O_2 concentration remained fixed at100% ; - After addition of pyruvate, at t_1 the O_2 concentration decreases to proximately value of 50 UA. - After addition of Antimycin A at $t_2$the O_2 concentration is stabilisedat40 UA… **Hypothesis :**(accept any hypotheses capable of explaining the relationship between Antimycin A and ATP production). Example: Antimycin A inhibiting oxidative phosphorylation in mitochondrion.	**0.5 pt** **0.5 pt** **0.5 pt**

	Antimycin A inhibits oxidation reactions respiratoires mitochondriales permettant la production d'ATP. ……	
2	**a.**the electrons are transferred through resperatory chain complex in the direction of increasing redox potentiels. …….. **b.**Antimycin A inhibit the complex III of respiratory chain and prevent electron transfer to final acceptor et empêcheO_2 that is not reduced to H_2O (not consume O_2)……..	**0.25 pt** **0.5 pt**
3	**Explain :** with Antimycin A → inhibiting electrons flow at the level of respiratory chain → stop transfer of protons H^+ from matrix to intermembrane space → proton flow back to matrix through ATP synthase →ATP are not synthetize……	**0.75 pt**
	Exercise 2 (5 pts)	
1	**Modifications during transition from interphase to prophase :** - at cytoplasmic level: centrosome move towards opposite poles of cell, emergence of spindle fibers…. … - at nuclear level : envelope nuclear break down, disappearance of nucleolus, chromosome condensed from of chromatin…	**1 pt**
2	**Comparison :** - Normal lamina A protein → normal lamina A disposition on nuclear membrane → normal nuclear form → normal cell division with repair and tissue renewal → normal phenotype ; - Abnormal lamina A protein → irregular lamina A disposition on nuclear membrane→ deformed nucleus→ abnormal cell division with Alteration of tissue reparation and renewal → Progeria. **Relationship protein-trait :** The alteration of lamina A protein leads to abnormal cell division with stopped repair and renewal tissue what causing disease ; So all modification of protein leading to modification of traits from where relations.	**1.5 pts**
3	**mRNA nucleotide Sequences and amino acid corresponding to each LMNA allele fragments :** - in healthy person mRNA : GUG GCC AAG CUU GAG GCA GCC CUA GGA amino acid sequence : val – Ala – Lys – Leu – Glu – Ala – Ala – leu – Gly - in sick person mRNA : GGG CCA AGC UUG AGG CAG CCC UAG GT Amino acid sequence:Gly– Pro–Ser –Leu–Arg – Gln– Pro. **Relationship gene-protein:** Mutation at the level 169 triplet by deletion of A nucleotide is changed reading	**1.5 pts**

	frame → synthesis of modified mRNA compare to normal mRNA→ synthesis of short amino acid sequence → altered Lamina A protein →appearance of disease.	
4	**a- RNA antisense Action :** RNA antisense binds in a complementary way to mRNA encoding for abnormal protein → stopped mRNA translation → stopped abnormal protein production responsible of disease. **b- suggestion of a technique :** Introducing a DNA sequence encoding for RNA antisense in genome of sick cells →genetically modified cells capable of to produce RNA antisense in permanent way.	**1 pt**
	Exercise 3 (4 pts)	
1	a)-from of first cross ,Mendel's first law has been verified : the parents are pure lineage and F1 homogenous composed of pink shell individuals without stripes, so : •the dominant alleles are responsible for pink colour and absence stripes. •the recessive alleles are responsible for yellow colour and presence stripes. b) -from second cross which is test cross. The generation obtained from second cross is composed of four phenotypes distributed in different way. The two genes are linked.	**0.5 pt** **0.5 pt**
2	Chromosomal interpretation **First cross :** **Phenotypes** [r , B]×[R , b] **Genotypes** $\frac{r\ B}{r\ B}$ $\frac{R\ b}{R\ b}$ **Gametes** r B R b — 100 % — 100 % $\frac{Rb}{r\ B}$ [R , B] 100 % F_1 **Second cross :** **Phenotypes** F1 [R , B]×[r , b] **Genotypes** $\frac{R\ b}{rB}$ $\frac{rb}{rb}$ **Gametes** R br BR Br br b — 39 % — 41 % — 9 % — 11 % — 100 % **Punnet square** Gametes: R b (39 %) / r B (41 %) / R B (9 %) / r b (11 %)	**0.5 pt** **0.5 pt** **0.5 pt**

	<table><tr><td>r b 100%</td><td>R b r b [R ; b] 39 %</td><td>r B r b [r ; B] 41 %</td><td>R B r b [R ; B] 9 %</td><td>r b r b [r ; b] 11 %</td></tr></table>	
3	**Comparison**: In the forest, the snails striped shells is more prey by the song thrush than the snails without striped shells. However, in meadows the snails without striped shells are more exposed to prey fall by song thrush than those who striped.	**0.5 pt**
4	**The evolutionary factors affecting the snail population** : natural selection **Explain:** •the forest is homogenous medium (uniform and dark) composed of dead grass → camouflage of snails without striped shells however the snails striped shells are most visible→ the snails striped shells are more exposed to prey fall by song thrush than those who without striped •in meadow :heterogeneous and herbaceous medium (dark and clear) → camouflage of the snails striped shells however the snails without striped shells are most visible→ the snails without striped shells are more exposed to prey fall.	**0.5 pt** **0.25 pt** **0.25 pt**
	Exercise 4 (3 pts)	
1	**a- Show the relationship** The decrease in viral load is expressed in copies of the viral genome/ml of blood between 6 week and 12 week associated to increases of lymphocytes T4 concentration in blood. **b-Description :** occurs the opportinistic deseases , appearence phase , the viral load increases quickly from 10^3 to 10^7 (copies of viral genome/ml of blood) in contrary to T4 lymphocytes in blood which decreases quickly by 300 LT4/µL of blood to cancel at the end of this phase.	**1 pt**
2	**Explain :** - in different batches from2to 6 : the time required to eliminate the virus is less than that observed in the control batch.. - in different batches from 2 to 6 : in comparison control batch, the lymphocyte survival rate (%) in 3,4 and 6 batches is null and at50% in batch5 while is at 100% in batch 2. The efficiency immune response required three types of lymphocytes T4;T8; B cell	**0.5**
3	**Description :** **Document 3 :** - for interleukin concentrations between 10 et 10^2 we has a low increase of lymphocytes B number ; - for interleukin concentrations beyond 10^2 we has a high increase of lymphocytes B number which reach 1000 plasma cells for 4.10^4intial cells. **Document 4 :** - before infection the number of lymphocytes CD8+T in spleen of mutant mice (deficient in interleukin 2) is slightly higher than that of normal mice	**0.75**

	approximately 15.10^6 of lymphocytes CD8+T in spleen. - after7 days after infection the number of lymphocytes CD8+T in mutant mice spleen decrease and continue to decrease to reach half of initial value in contrary of normal mice where decrease the number of lymphocytes CD+8T that 45.10 lymphocytes CD8+ T in spleen **Deduction :** The interleukin-2 boosts multiplication of lymphocytes B and lymphocytes CD8+T**.**	
4	An explanatory scheme illustrating the central role of LT4 in the immune response process.	**0.75 pt**