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

NS34E

★★★

المملكة المغربية
وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي

المركز الوطني للتقويم والامتحانات والتوجيه

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

Candidates may use non-programmable calculators

Section I : Knowledge Retrieval (5 pts)

I. Define the following notions: - Alcohol fermentation. - Oxidative phosphorylation. **(1 pt)**

II. For each of the following 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 transformation of a glucose molecule into tow molecules of pyruvic acid at the level of hyaloplasm is accompanied by a/an: **a.** reduction of 2 $NADH,H^+$ and production of 4 ATP. **b.** oxidation of 2 $NADH,H^+$ and production of 4 ATP. **c.** oxidation of 2 NAD and production of 2 ATP. **d.** reduction of 2 NAD and production of 2 ATP.	**2. The activity of the respiratory chain leads to a/an:** **a.** increase in proton concentration in the matrix. **b.** decrease in proton concentration in the matrix. **c.** increase in proton concentration in the intermembrane space. **d.** decrease in proton concentration in the intermembrane space.
3- The steps of muscle contraction are : 1- the fixation of ATP on the myosin heads; 2- hydrolysis of ATP ; 3- rotation of myosin heads ; 4- release of Ca^{2+} ; 5- formation of actomyosin complex ; 6- sliding of actin filaments towards the centre of the sarcomere. **The correct chronological sequence is:** **a.** 3 → 6 → 4 → 1 → 2→ 5 **b.** 6 → 4 → 1 → 5→ 2 → 3 **c.** 4 → 5 → 2→ 3 → 6 →1 **d.** 1→ 2 → 3 → 6 → 4 → 5.	**4- During phosphorylation of ADP, the proton gradient created by the respiratory chain is used by :** **a.** the proton channels of the mitochondrial inner membrane. **b.** the ATP synthase of the mitochondrial inner membrane. **c.** the electron carriers of the mitochondrial inner membrane. **d.** the coenzymes of the mitochondrial inner membrane.

III. Copy down on your exam sheet the number corresponding to each proposition and **write** whether the statement is **"true"** or "**false**". **(1 pt)**

1. In the muscle cell, the renewal of ATP from phosphocreatine is due to the intervention of ATP synthase.

2. In the matrix, the oxidation of $NADH,H^+$ is due to the intervention of the dehydrogenases.

3. In the hyaloplasm, alcohol fermentation produces an organic residue and releases CO_2.

4. In the mitochondria, pyruvic acid is converted to acetyl CoA.

IV. Match each recorded myogram (Group 1) to the corresponding state of stimulations applied on the muscles (Group 2). **Copy down** these pairs (1; ..), (2; ..), (3; ..), (4; ..), and **match** each number to its corresponding letter. **(1 pt)**

Group 1: Recorded myogram.	**Group 2 : Application of 2 effective stimulations on the muscle.**
1- Complete fusion of two muscle twitches.	**a-** The second stimulation is applied after completion of the first muscle twitch.
2- Incomplete fusion of two muscle twitches.	**b-** The second stimulation is applied during the latent period of the first muscle twitch.
3- Two isolated muscle twitches.	**c-** The second stimulation is applied during the contraction period of the first muscle twitch.
4- One isolated muscle twitch.	**d-** The second stimulation is applied during the relaxation period of the first muscle twitch.

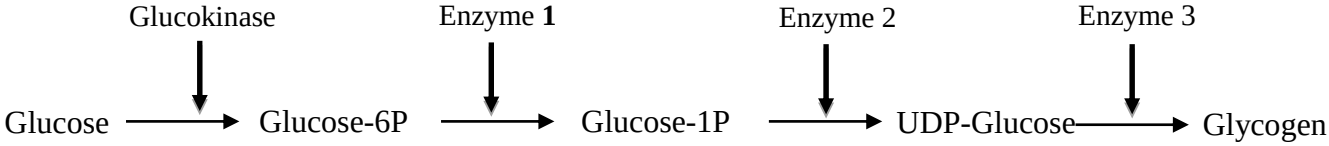
Section II : Scientific reasoning and communication in graphic and written modes (15 pts)

Exercise 1 (2.5 pts)

Mody-2 diabetes (Maturity Onset Diabetes of the Young) affects some people before the age of 20. People with this disease suffer from permanent hyperglycemia.

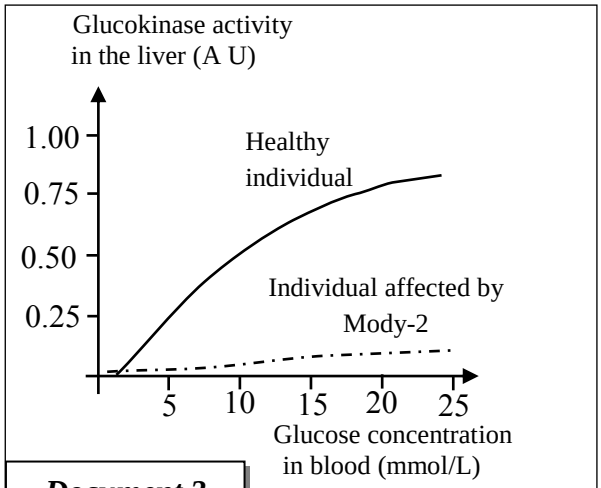
In order to highlight the genetic origin of this disease, we suggest the following data:

- The glucose is stored in the liver as glycogen (glycogenesis) by the intervention of a set of enzymes. Glucokinase is one of such enzymes. Document **1** shows the level of intervention of glucokinase in the chain of reactions of glycogenesis.



Document 1

- The measurement of glucokinase activity in the liver in a healthy individual and in another individual affected by Mody-2 has given the results presented in document 2.



Document 2

1. **Based** on documents 1and 2:

   a- **Describe** the glucokinase activity variations in the healthy individual and in the individual affected by Mody-2. **(0.5 pt)**

   b- **Explain** the permanent hyperglycemia in the individual affected by Mody-2. **(0.5 pt)**

- To know the origin of this disease, we suggest documents 3 and 4.

Document 3 presents part of a transcribed strand of the gene coding for glucokinase in a healthy individual and in another individual affected by Mody-2, and document 4 gives an extract of the genetic code.

Reading direction →

Number of nucleotide triplets :	277	278	279	280	281	282
Healthy individual :	…CAC	CTG	CTC	TCG	AGA	CGT…
Individual affected by Mody-2 :	…CAC	CTG	ATC	TCG	AGA	CGT…

Document 3

Amino acids	Glu	Met	Val	Stop	Lys	Ser	Asp	Gly	Ala
Codons	GAA GAG	AUG	GUG GUA GUC GUU	UAG UAA UGA	AAA AAG	AGU AGC UCU UCC	GAU GAC	GGU GGC GGA GGG	GCU GCA GCC GCG

Document 4

2 . Based on documents **3** and **4**, **determine** the amino acid sequence corresponding to each part of the gene coding for glucokinase in a healthy individual and in an individual affected by Mody-2. **(0,5 pt)**

3. Based on your previous answers, **explain** the genetic origin of Mody-2 disease. **(1 pt)**

Exercise 2 (2.5 pts)

In order to study the mode of transmission of the two hereditary characteristics (traits) in rabbits, we suggest the exploitation of the results of the two following crosses:

- First cross between two pure lineages of rabbits: one lineage has long hair (angora) and a uniform colour, and the other has short hair and variegated white colour.

The first generation obtained (F_1) is composed of individuals with short hair and variegated white colour.

- Second cross between females of F_1 and males with long hair (angora) and uniform colour.

This cross has given a generation F'_2 composed of:

- 338 rabbits with short hair and variegated white colour;
- 341 rabbits with long hair and uniform colour;
- 12 rabbits with long hair and variegated white colour;
- 9 rabbits with short hair and uniform colour.

1 . Based on the results of the two crosses, **determine** the mode of transmission of the two hereditary traits studied. **(0.75 pt)**

2. Interpret and **use** Punnett square to explain the results obtained in the second cross. **(0.75 pt)**

NB. *Use the symbols* ***L*** *and* ***ℓ*** *for 'hair length' trait and the symbols* ***P*** *and* ***p*** *for 'hair colour' trait.*

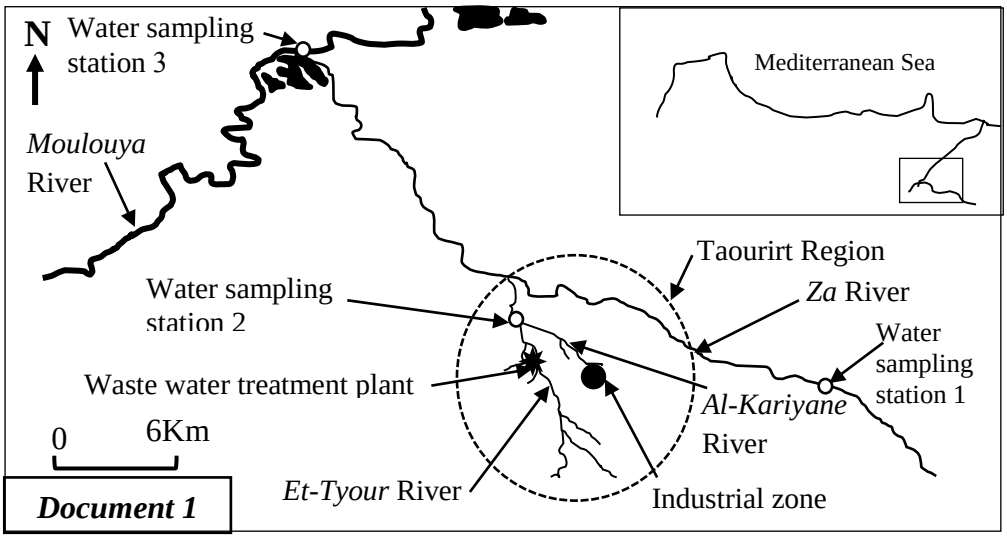
3. Determine the phenomenon responsible for the appearance of rabbits with long hair and variegated white colour and rabbits with short hair and uniform colour in generation F'_2. **Explain** this phenomenon by drawing a scheme. **(1 pt)**

Exercise 3 (5 pts)

In Taourirt – Zaio region, the *Moulouya* River is polluted by household waste and industrial activity. To highlight the impact of these activities on waters of the *Moulouya* River, we suggest the study of the following data:

● *Za* river and its streams, like *Al-Kariyane and Et-Tyour*, is one of the principal tributaries of the *Moulouya* River in Taourirt region. The growing demography and continuous development of the industrial sector have a direct impact on *Za* river waters. In order to evaluate the quality of these waters, a study was conducted in 2010 at level of three water sampling stations.

Document **1** shows the location of *Za* River and its streams, and the three water sampling stations (Station 1 is considered as reference). Document **2** presents the measurement results of water quality parameters of the three stations. And document **3** gives information about the types of industrial activities in Taourirt region and the conditions of its waste water treatment plant.



Document 1

Parameters / Stations	BOD5 (mg/L)	O_2 (mg/L)	Suspended matters (mg/L)	NH^+_4 (mg/L)
Station 1 (station of reference)	1	8.46	125	0.109
Station 2	881.6	0.1	3530	7.852
Station 3	8	7.13	212	0.133

Document 2

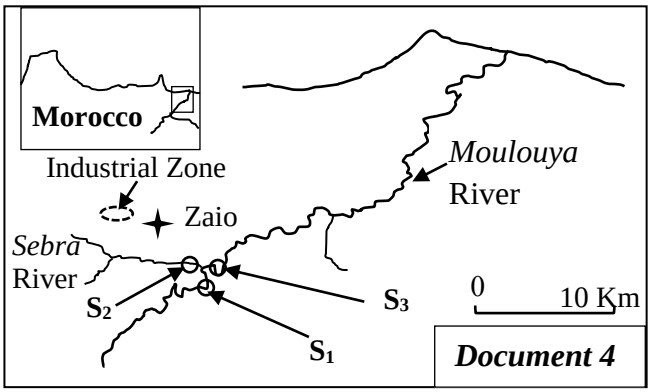
… The industrial sector in Taourirt includes 75 industrial units. 67 of those units are olive canneries. The sector generates 2321 m^3 of wastes every year, which is dumped without prior treatment into Al-Kariyane River. The wastewaters of Taourirt city have been dumped in Et-Tyuor River since 2005. Only 65% of these wastewaters are treated in the wastewater treatment plant, but the station's effectiveness and water yield have decreased due to the growth in the volume of industrial waste, particularly the olive industry and the residual waters of canning industry (fish, olives, apricots…).

Document 3

1. **By exploiting** documents 1, 2 and 3:
   - **a- Compare** the values recorded in stations 2 and 3 with the values recorded in the station of reference 1. **(1 pt)**

b- Explain the results recorded in station 2 by **specifying** its impact on the water of *Moulouya* River **(1.5 pts)**

● The industrial zone of Zaio city has a sugar factory that dumps its industrial wastes (mainly organic waste and chemical products) directly in Sebra river, (tributary of *Moulouya* River). Sebra river also receives household waste of Zaio city. In 2011, tons of dead fishes were thrown on the banks of *Moulouya* River. To determine the cause of those death fishes, an analysis of water samples, in July 2011, was carried out in three stations S_1, S_2 and S_3 as represented on the map in document 4. The obtained results are presented in document 5.



Document 4

Parameters / Stations	Suspended matter (mg/L)	Dissolved O_2 (mg/L)	BOD5 (mg/L)
S_1 (reference)	13.5	9.2	0.8
S_2	1350	0	3650
S_3	548	1.2	280

Document 5

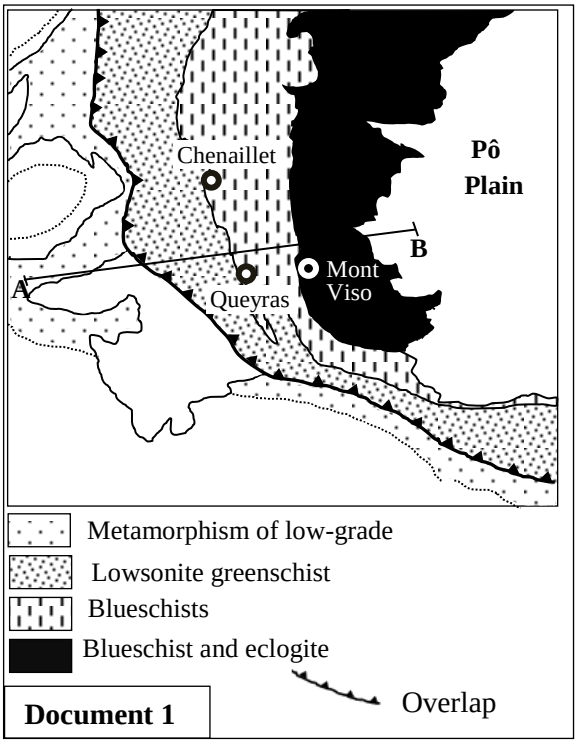
2. By exploiting data in documents 4 et 5, **explain** the death of the fishes in *Moulouya* River. **(1.75 pts)**

3.Based on the previous data, **suggest** three appropriate ways to reduce water pollution of *Moulouya* River. **(0.75 pt)**

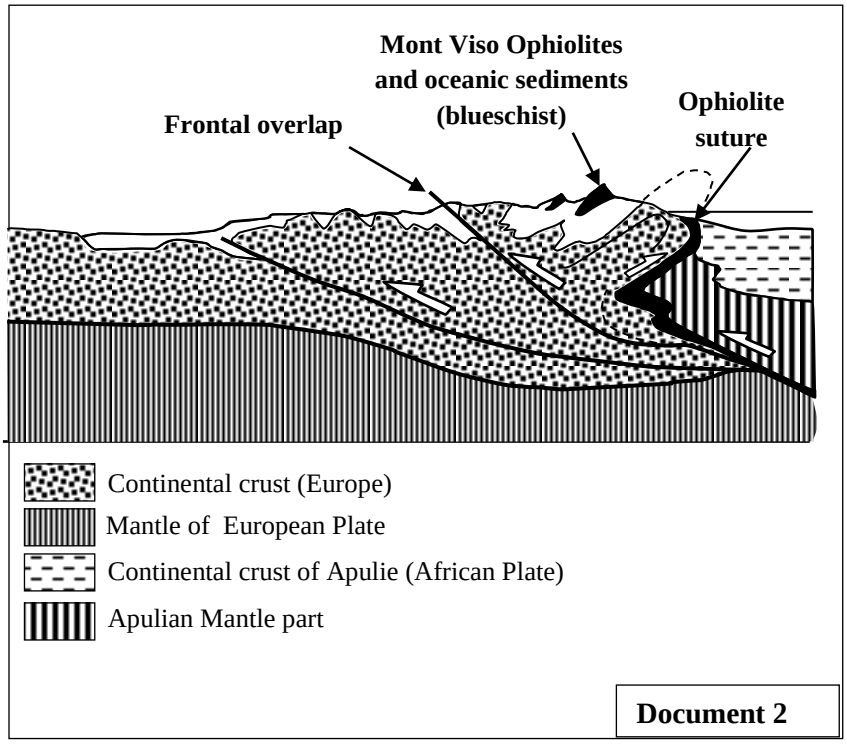
Exercise 4 (5 pts)

The European Aples form a mountain range extending over 1200 Km between the Mediterranean in the South and the Danube River in the East. Occidental Alpes show most of the range units of this mountain along 150 km. Currently, we consider that the Aples are the result of the closure of an old ocean, following a convergence and a confrontation of the European Plate and the African Plate. To determine the conditions and stages of this mountain chain formation, we suggest the following documents:

- **Document 1** presents a simple geological map of internal zones of Occidental Alpes.
- **Document 2** shows a geological cross section in the studied region according the (AB) axis.(***See* document 1**)



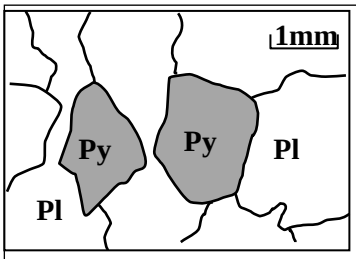
Document 1



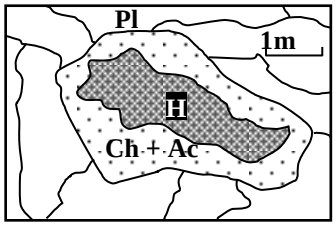
Document 2

1. From documents 1 and 2, **extract** the tectonic deformations that the internal zones of the Aples have witnessed, and the clues that show that the zone is the result of the closure of an old ocean. **(1.5 pt)**

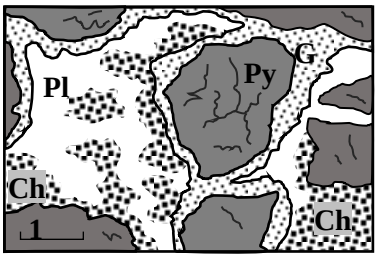
Among the rocks outcropping in Chenaillet, Queyras and Mont Viso, we find metamorphic rocks. Document 3 presents three thin-section microscopies of three metagabbros belonging to the studied region, and a thin section microscopy of gabbro. Document 4 presents the areas of stability of certain index minerals according to geothermic variables (pressure and temperature).



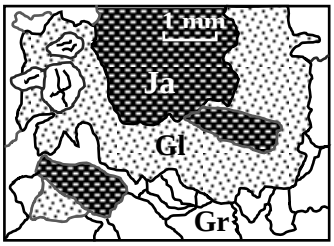
Gabbro : origin of metagabbros



MG1 : Metagabbro of Chenaillet



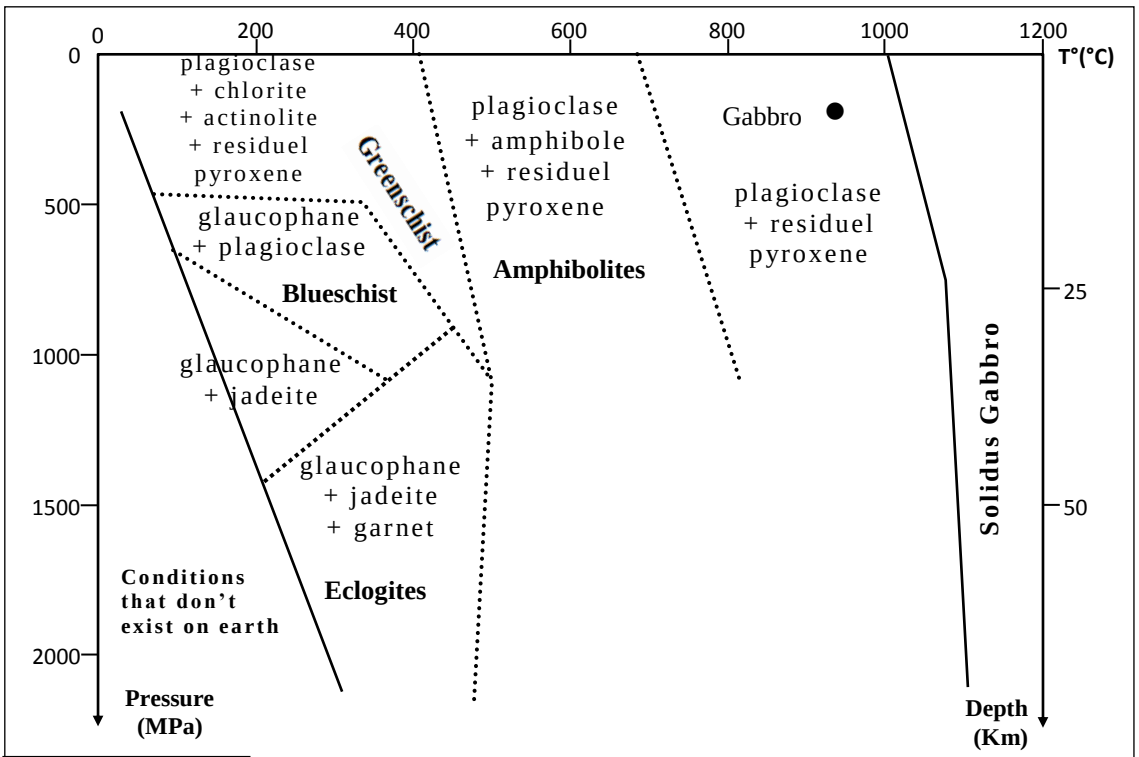
MG2 : Metagabbro of Queyras



MG3 : Metagabbro of Mont Viso

Py : Pyroxene ; Pl : Plagioclase ; H : Hornblende (amphibole) ; Ch : Chlorite ; Ac : Actinolite ; Gl : Glaucophane ; Ja : Jadeite ; Gr : Garnet

Document 3



Document 4

2. Taking into account that the actinolite and the chlorite result from the hornblende transformation (rock MG1), and **based** on documents 3 and 4, **show** that the rocks MG1, MG2 and MG3 are clues of a subduction that preceded confrontation of the European Plate and the African Plate, specifying the type of metamorphism that led to the formation of the studied rocks. **(2 pts)**

3. **Based** on your previous answers and your knowledge, **draw** three explanatory schemes that show the stages of the formation of the Alpine mountain range. **(1.5 pts)**