الصفحة	الامتحان الوطني الموحد للبكالوريا المسالك الدولية – خيار أنجليزية **الدورة الاستدراكية 2019** **- الموضوع -**	المملكة المغربية وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي المركز الوطني للتقويم والامتحانات والتوجيه
1 / 6	♣♣♣♣♣♣♣♣♣♣♣♣♣♣♣♣♣♣♣♣ RS34E	

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

Candidates may use non-programmable calculators

Section I : Knowledge Retrieval (5 pts)

I. **Define** the following notions: - Lixiviat – Organic fertilizer. **(1pt)**

II. 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 greenhouse effect is the result of air pollution by:** **a**- radioactive radiation. **b**- methane (CH_4) **c**- nitrogen N_2. **d**- hydrogen H_2.	**2. Eutrophication of lakes results from:** **a-** the proliferation of living beings in the lake. **b-** the enrichment of lake water with calcium. **c-** the enrichment of lake water with nitrates. **d-**the enrichment of lake water with chemical pesticides.
3. **Pollution of the waters by nitrates is essentially the result of:** **a**- excessive use of chemical fertilizers. **b**- lixiviat . **c**- excessive use of pesticides. **d**- industrial pollutants.	**4. Radioactive wastes type B are characterized by:** **a-** strong radioactive activity and short life. **b-** strong radioactive activity and long life. **c-** low radioactive activity and short life. **d-** low radioactive activity and long life.

III. Copy down the number corresponding to each proposition and **Write** whether the statement is **"true"** or "**false"**. **(1pt)**

1. Biogas is formed following the oxidation of organic wastes in an anaerobe under the action of microorganisms.

2. Acid rain results from the interaction of atmospheric water with the CFC complex.

3. The thinning of the ozone layer results from the interaction of ozone with sulfur oxides.

4. Half-life is the time necessary for all radioactive matter to disintegrate.

VI. Match each element in Group 1 with its appropriate definition in Group 2. **Copy down** these pairs (1; ..), (2; ..), (3; ..), (4; ..), and **match** the number to its corresponding letter. **(1 pt)**

Group 1	Group 2
1-BOD5	**a-** is an indicator of the state of the soil based on population of macroinvertebrates.
2- BI	**b-** is an indicat**or** expressing the oxygen demand necessary for the biological oxidation of organic matter in one liter of water for five days in darkness.
3- BISQ	**c-** is an indicator expressing the oxygen demand necessary for the chemical oxidation of organic matter in one liter of water.
4- COD	**d-** is an indicator for estimating water pollution based on aquatic population of invertebrates.

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

Exercise 1 (5 pts)

ATP is an essential intermediate metabolite for all cellular activities. The living cells regenerate their ATP by oxidation of organic molecules by adopting different metabolic pathways. In order to explain the difference in colony size in two strains of baking yeast P and G (*Saccharomyces cerevisiae*) and its relationship with the type of adopted metabolism, we propose the following data:

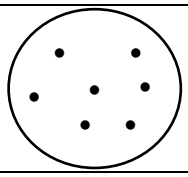
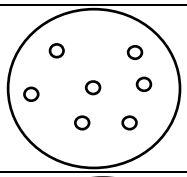
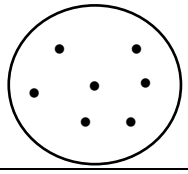
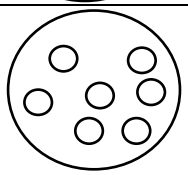
- In two identical Petri dishes, we cultivate two yeast strains on a complete agar medium, containing 5% of glucose and abundantly oxygenated. The cultures are placed at constant temperature. Document1 shows the aspect of yeast colonies at the beginning and at the end of this culture.

1. Bearing in mind that a colony is the result of the multiplication of cells:

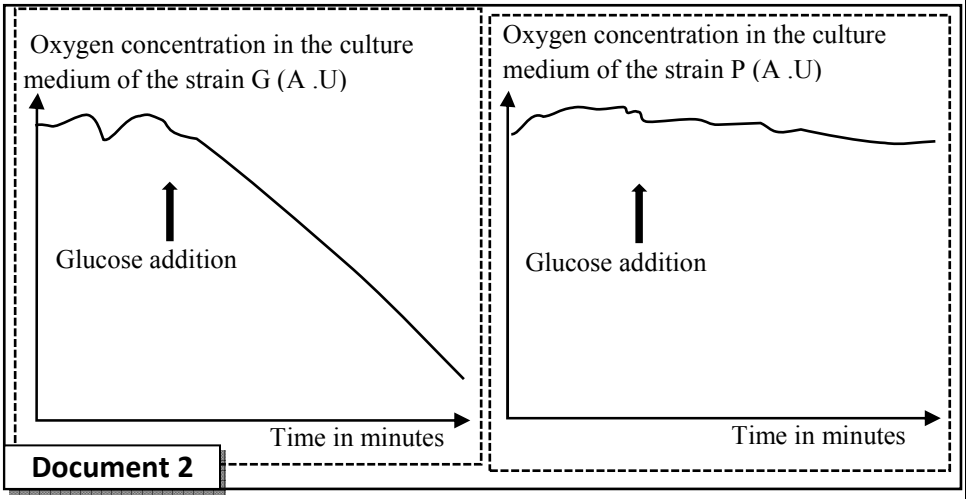
a. Compare the results at the end of the culture (document **1**) for the two yeast strains P and G. **(0,5pt)**

b. Suggest a hypothesis to explain the observed difference at level of strains P and G colony **(0,5pt)**

Document 1

	The appearance of yeast colonies	
	Beginning of culture	**End of culture**
Strain P		
Strain G		

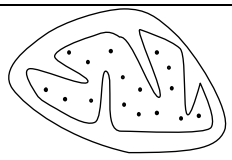
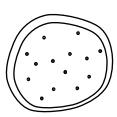
In order to explain the observed difference and its relationship with the cellular metabolism, we cultivate two yeast strains P and G on an agar medium abundantly oxygenated, without glucose, and placed at constant temperature. We measure the oxygen concentration before and after the addition of the same glucose quantity in the culture medium. The obtained results are represented in document **2**.



Document 2

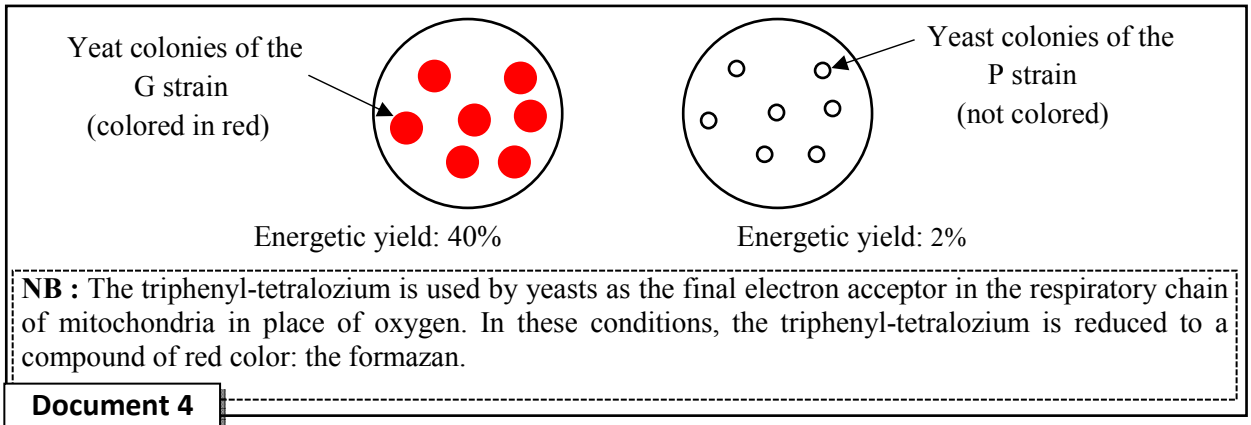
An observation of the two yeast strains using an electronic microscope at the end of this experiment allowed to get the results presented in document **3**.

2. By exploiting the results presented by documents **2** and **3**, **deduce** the metabolic pathway adopted by each yeast strain. **(1,5 pts)**

	Strain G	Strain P
Number of Mitochondria	about 15 per cell	about 4 to 5 per cell
The appearance of yeast		

Document 3

In order to compare the metabolic activity adopted by each yeast strain, the triphenyl-tetralozium is applied to each colony of both strains G and P. In parallel to that, other experiences are realized to measure the quantity of ATP produced by strains G and P. Through calculations, the respective energetic yield has been determined for each strain. Document **4** presents the results obtained. Document **5** illustrates the two metabolic pathways used by both strains P and G of yeast to produce the ATP.



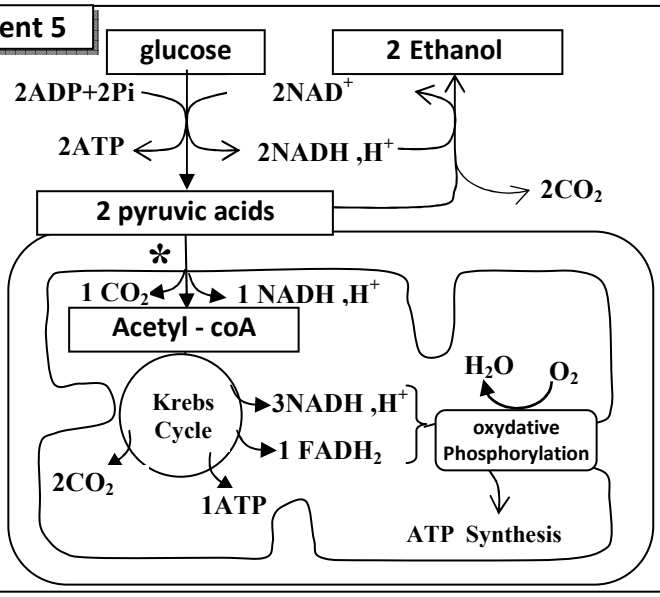
NB : The triphenyl-tetralozium is used by yeasts as the final electron acceptor in the respiratory chain of mitochondria in place of oxygen. In these conditions, the triphenyl-tetralozium is reduced to a compound of red color: the formazan.

Document 4

3. Based on documents **4** and **5**, **explain** the difference observed in energy yield in the both strains G and P**. (1,5 pts)**

4. Consider the link between the size of the colony, the cell structure and the adopted metabolic pathway to **verify** your hypothesis. **(1 pt)**

Document 5



* The asterisk means the consumption result of a pyruvate molecule at the level of the mitochondria. At the level of mitochondria, the oxidation of $1NADH,H^+$ gives 3ATP and the oxidation of $1FDH_2$ gives 2ATP.

Exercise 2 : (5 pts)

In order to study the genetic information transmission and the mechanisms of its expression, we propose the following data:

The hairiness characteristic of the Mexican dog breed is governed by a non-sex gene with two alleles (***Hr*** and ***hr***). To select a strain of Mexican bare-skinned dogs (hairless dogs), a breeder has several times made crosses between males and females of different phenotypes (presence or absence of hair). The obtained results are presented in document 1.

First cross :

Normal male dog (having hair) X Normal female dog (having hair)

↓

12 normal puppies (having hair)

Second cross :

Normal female dog (having hair) X Hairless male dog (having no hair)

↓

8 normal puppies (having hair)
8 hairless puppies (having no hair)

Third cross :

Hairless male dog (having no hair) X Hairless female (having no hair)

↓

6 normal puppies (having hair)
12 hairless puppies (having no hair)

Document 1

1. From the results of the first cross and the second cross, **give** the probable genotypes of normal dogs and hairless dogs, and **justify** your answer. **(1.5 pts)**

2. Use Punnett Square to **interpret** the results of the third cross. (**1pt)**

To explain the absence of hair in mammals, we propose the study of total alopecia (total loss of hair) in mice. This phenotype results from the inability of hair follicle to initiate its own cyclical renewal after a normal appearance of the first hair.

The maintenance of hair follicle cycle requires a structural and regulatory protein called HR which is localized in the nucleus and regulates the synchronization of epithelial cell differentiation in hair follicles and their cyclical renewal.

Document **2** presents the phases of hair cycle in a normal mouse (Figure a) and a hairless mouse (Figure b) and the results of a molecular study of the size and amount of HR protein in the two mice (Figure c).

Normal mouse:

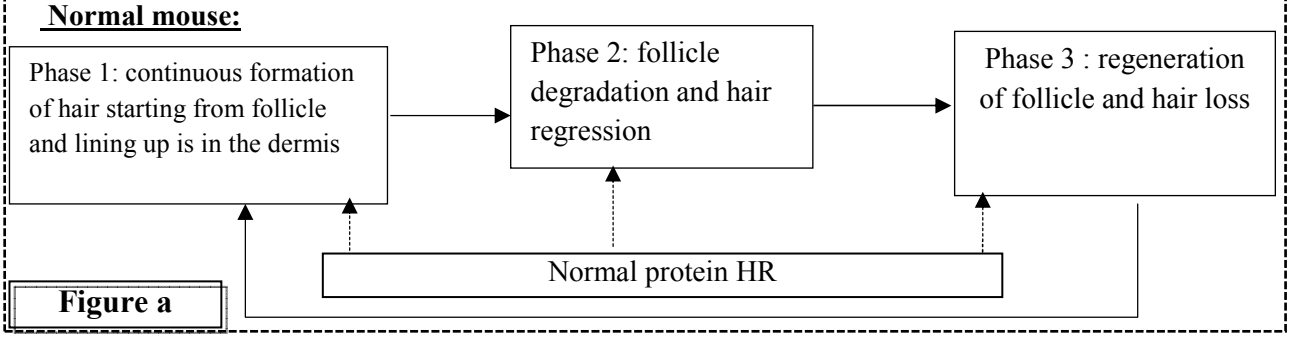


Figure a

hairless mouse:

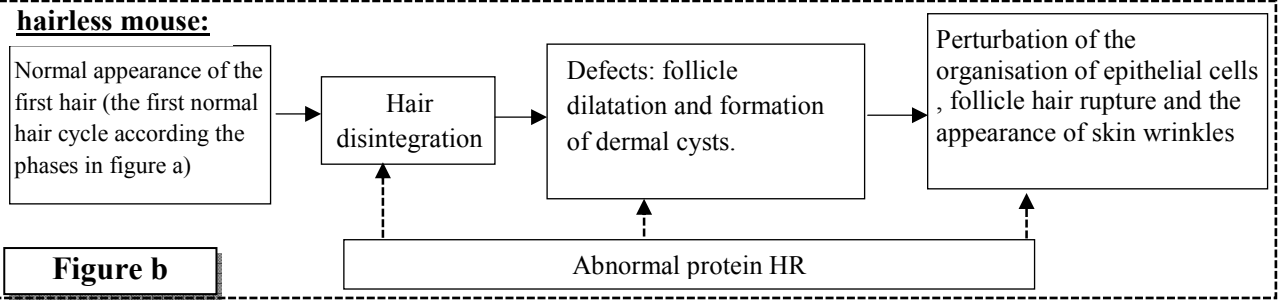


Figure b

Figure c

	Size of HR protein	Quantity of HR protein
normal mouse	normal	normal
hairless mouse	normal	high

Document 2

3. Based on document **1**, **compare** the data of the normal mouse with those of the hairless mouse, and then **deduce** the protein-trait relationship. **(1.5 pt)**

The synthesis of HR protein is controlled by a gene having two alleles. Document **3** shows part of the untranscribed strand of the normal allele in a normal mouse and part of the untranscribed strand of the mutant allele in a hairless mouse. Document **4** presents an extract from the table of the genetic code.

Number of triplets:	**957**	**958**	**959**	**960**	**961**	**962**	**963**
Part of the normal allele (untranscribed strand **) :**	**GCC**	**CAC**	**CAA**	**GGG**	**AAA**	**CTC**	**AAC**
Part of the mutant allele (untranscribed strand**):**	**GCC**	**CAC**	**CAA**	**TGG**	**AAA**	**CTC**	**AAC**

Document 3

→ ***Reading direction***

codons	GGU GGC GGA GGG	CAA CAG	AAA AAG	CAU CAC	UGG	CUU CUC CUA CUG	AAU AAC	GCU GCC GCA GCG	UGA UAA UAG	CGU CGC CGA CGG
Amino acids	Gly	Gln	Lys	His	Trp	Leu	Asn	Ala	Non sens	Arg

Document 4

4. Based on documents **3** and **4**, **determine** the mRNA sequence and amino acid sequence corresponding to each part of the gene controlling HR protein synthesis in the two mice studied, and **explain** the appearance of the hairless trait in mice. **(1 pt)**

Exercice 3 : (5 pts)

The Himalayan mountain chain stretches over 3000 km between India and Asia (Tibet region), and comprises three tectonic units formed 55 million years ago. To determine the geological phenomena accompanying the formation of this chain, the following documents are suggested:
Document **1** presents a simplified geological map of the Himalayas (Figure a), and a geological section in the same mountain range (Figure b).

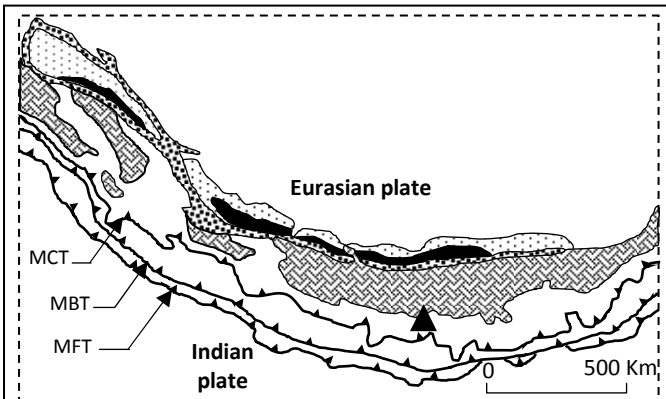


Figure a

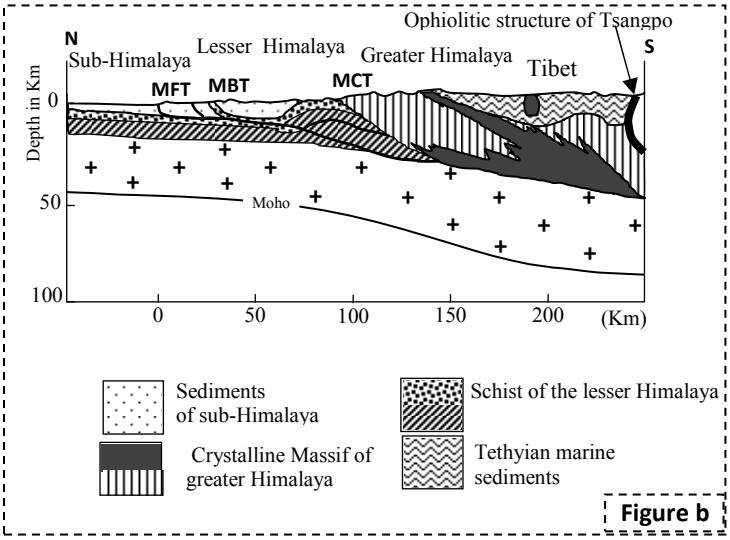


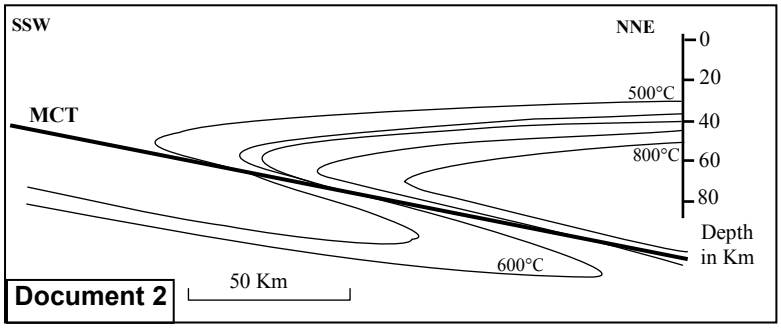
Figure b

Document 1

1. By **exploiting** Document **1**, **determine** the two geological phenomena at the origin of the formation of the Himalayas. **(1p)**

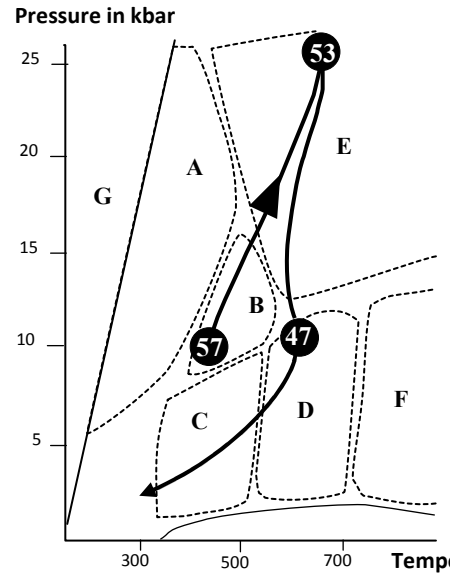
The geophysical study of the greater Himalaya unit has allowed to obtain the results presented in Document **2**.

2. **Describe** the variation in lithosphere temperature at the level of this unit (Document **2**) and **explain** this variation. **(1pt)**



Document 2

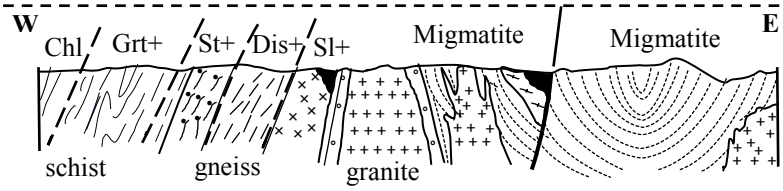
Greater Himalaya is characterized by the outcropping of eclogite blocks resulting from the metamorphism of gabbro, and the continental metamorphic rocks. Document **3** presents the PTt path (pressure - temperature - time) of the evolution of rocks belonging to the ophiolitic complex of the Himalaya, and document **4** presents the boundary separating the mineral assemblage found in the continental metamorphic sequence forming the crystalline massif of greater Himalaya (Figure a), and the diagram of metamorphic facies (Figure b).



A: Lawsonite blueschist ;
B: Epidote bleueschist ;
C : Greenschist ;
D : Amphibolites ;
E : Eclogites ;
F : Granulites ;
G : Conditions of pressure that don't exist on Earth.

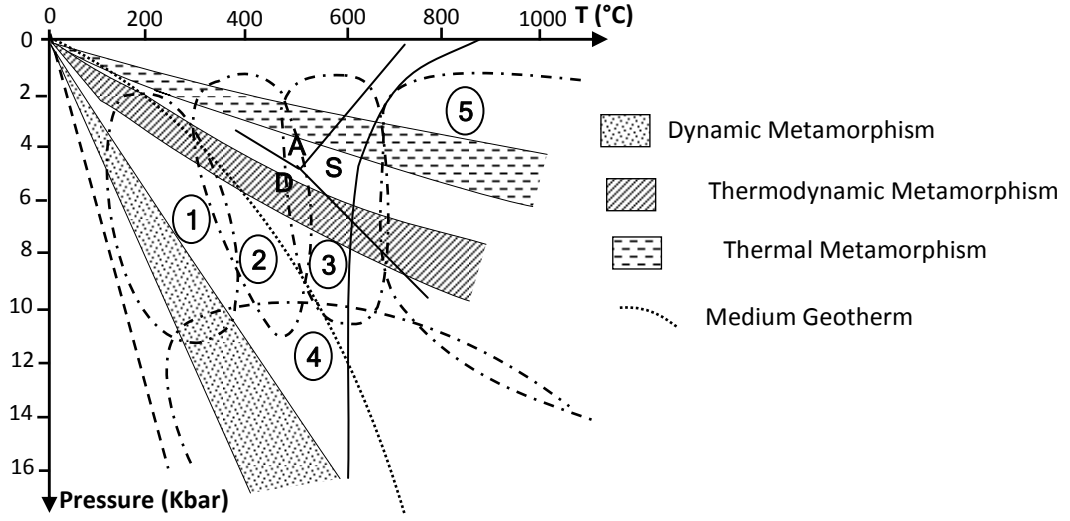
47 53 57 : Ages in millions of years obtained under conditions of : pressure and temperature.

Document 3



Chl : chlorite
Grt : garnet
St : staurolite
Dis : desthene
Sl : sillimanite
+ : appearance of mineral

Figure a



A : Andalousite ; S : sillimanite ; D : Desthene.
1 : Bleueschist (Glaucophane + Garnet + Epidote) ; 2 : Greenschist (Actinolite + Chlorite) ;
3 : Amphibolites (Hornblende + Plagioclases) ; 4 : Eclogites (Jadeite + Garnet),
5 : Granulites

Figure b

Document 4

3. By exploiting documents **3** and **4**:

a. Determine the type of metamorphism leading to the formation of the eclogite. **Justify** your answer. **(0.75pt)**

b. Determine the type of metamorphism leading to the formation of the crystalline massif of high Himalaya. **Justify** your answer. **(0.75pt)**

4. Based on your previous answers, **determine** the stage of formation of the Himalaya mountain range, by highlighting the geological phenomena that this region has known. **(1,5pts)**

§ GOOD LUCK §