

الصفحة 1 6	<p style="text-align: center;">الامتحان الوطني الموحد للبكالوريا المسالك الدولية – خيار إنجليزية الدورة العادية 2018 -الموضوع-</p>	<p style="text-align: center;">+XNΛε+ I HCYOεθ +εCεLεθ+ I εθXεε εεεεε Λ εθCε+X εЖε#εε Λ εθOHCε εεXHHε Λ εθOЖε εCεθεε</p> <p style="text-align: center;">المملكة المغربية وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي</p> <p style="text-align: center;">المركز الوطني للتقويم والامتحانات والتوجيه</p>
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3	مدة الإنجاز	علوم الحياة والأرض	المادة
7	المعامل	شعبة العلوم التجريبية : مسلك علوم الحياة والأرض – خيار إنجليزية	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)

<p>1. CO₂ released from the degradation of glucose is made during the reactions:</p> <p>a- of glycolysis at the level of hyaloplasm. b- of Krebs cycle in the mitochondrion. c- of pyruvate reduction in lactic acid at the level of hyaloplasm. d- of oxidation of the electron carriers at the mitochondrial level.</p>	<p>2. the light band of sarcomere contains:</p> <p>a- actin, troponin and tropomyosin. b- myosin, troponin and tropomyosin. c- actin, myosin and tropomyosin. d- actin, myosin and troponin.</p>
<p>3. the reactions of fermentation in sarcoplasm allow:</p> <p>a- the production of lactic acid and ethanol. b- pyruvate oxidation. c- the reduction of electron carriers. d- the phosphorylation of two ADP molecules.</p>	<p>4. the products of pyruvate degradation in the mitochondrion are:</p> <p>a- 3 NADH,H⁺ + 1 FADH₂ + 1 ATP. b- 3 NADH,H⁺ + 1 FAD + 1 ATP. c- 4 NADH,H⁺ + 1 FADH₂ + 1 ADP d- 4 NADH,H⁺ + 1 FADH₂ + 1 ATP.</p>

II. Based on your knowledge, **give** the global reaction of:

- Alcohol fermentation. (0.5 pt)
- ATP renewal from phosphocreatine. (0.5 pt)

III. Define the following:

- Glycolysis. (0.5 pt)
- The respiratory chain. (0.5 pt)

IV- **Copy down** the letter of each of the following propositions, and **write** whether the statements are « true » or « false »: (1 pt)

a	oxidation of NAD ⁺ takes place during the glycolysis and Krebs cycle.
b	incomplete tetanus happens when a muscle is stimulated by a single high impulse.
c	delayed heat accompanying the muscle contraction is the result of aerobic metabolic reactions.
d	ATP is regenerated rapidly during muscle activity by the phosphocreatine pathway.

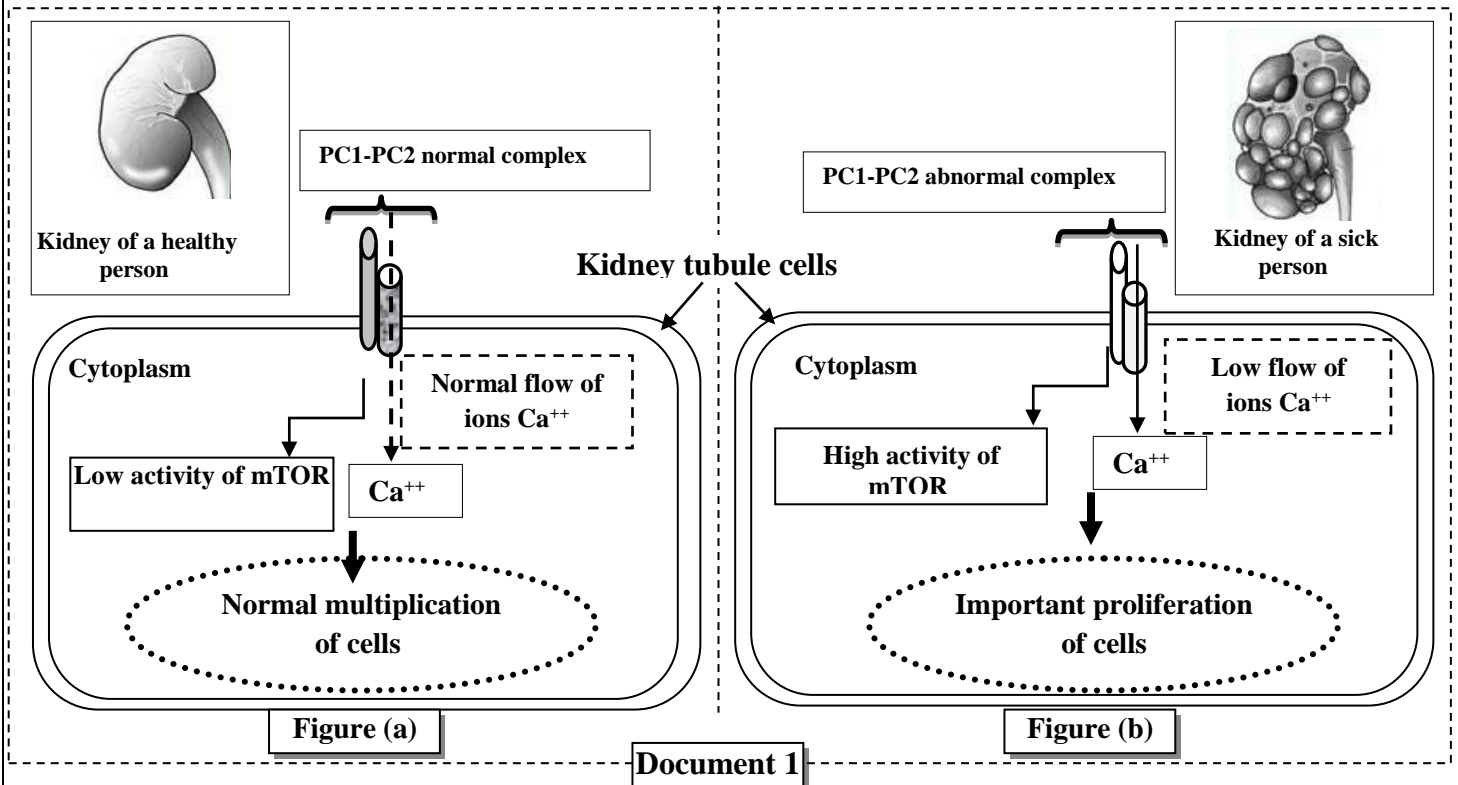
Section II: Scientific reasoning and communication in graphic and written modes (15 pts)

Exercise 1 (6 pts)

Polycystic kidney disease is the most common genetic disease affecting the kidneys; it is characterised by progressive development of multiple cysts in the kidneys that cause renal failure. This disease is also accompanied by other symptoms like arterial hypertension, appearance of blood in urine, and liver polycystic ... To determine its genetic origin and its transmission mode, the following data are presented:

• Data 1 :

Recent studies have shown that there is a relationship between polycystic kidney disease and the membrane protein complex of kidney tubule cells. This complex is formed of two proteins called Polycystin 1 (PC1) and Polycystin 2 (PC2). In normal cases, complex PC1-PC2 allows the control of calcium flow (Ca^{++}) and activates a protein called « mTOR » inside the cell. Any alteration at the level of the complex has an impact on cell growth and cell division. Document 1 shows the relationship between complex PC1-PC2 and tubular cell multiplication in a healthy person (figure a) and a sick person (figure b).



1. Use document 1 to compare the data related to a healthy person and a sick person. (1 pt)

• Data 2 :

Polycystin 1 synthesis is controlled by PKD1 gene. Figure (a) in document 2 presents the nucleotide sequence of part of PKD1 gene in a normal person, and in a sick person affected by the polycystic kidney disease. Figure (b), in the same document, gives an extract of the genetic code.

Number of triplets:

PKD1 Fragment gene in a normal person:

PKD1 Fragment gene in a sick person:

29073 29076 29079
 -GCT-GAC-CAC-GAC-GCC-GCC-CCG-

-GCT-GAC-CAC-GCC-GCC-CCG-

Reading direction

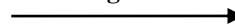


Figure (a)

Codons	CGA	GGU	CUA	GUA	UGA
	CGC	GGA	CUG	GUG	UAA
	CGG	GGG	UUG	GUC	UAG
	CGU	GGC	UUA	GUU	
	Amino acid	Arg	Gly	Leu	Val

Figure (b)

Document 2

2. Using the data in figures (a) and (b) in document 2, give the mRNA sequence and the amino acid sequence corresponding to each allele. Then explain the genetic origin of polycystic kidney disease.

(1.5 pts)

• Data 3: Document 3

represents a pedigree whose members are affected by the polycystic hereditary disease.

3. Notice that this disease is linked to a dominant allele located on 16th human chromosome:

a. Give the genotype of individual I₂, II₁ and II₂.

Justify your answer. (1.5 pt)

b. Using Punnett square, determine the probability of couple II₁ and II₂ so that they would give birth to a sick child. (0.5 pt)

(Use the symbols P and p for the two alleles of the gene referred to above)

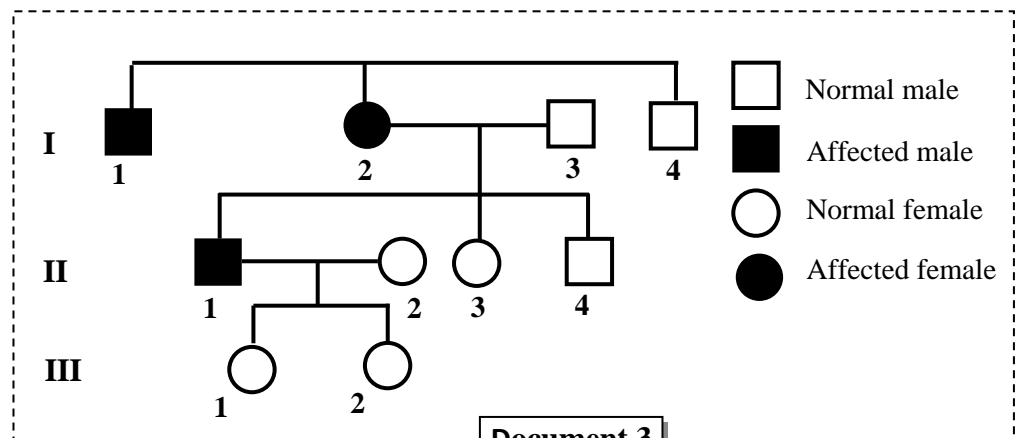
• Data 4 :

4. Polycystic kidney disease affects one person out of 1000 individuals of a given population. Let's suppose that this population abides by the Hardy-Weinberg equilibrium:

a. Calculate the frequency of the normal allele and the allele responsible for the disease. (1 pt)

b. Calculate the frequency of heterozygous individuals of the studied gene. (0.5 pt)

NB : The results must include four numbers after comma.



Document 3

Exercise 2 (3 pts)

In order to study the mode of transmission of hereditary characteristics (traits) in *Drosophila melanogaster*, we suggest the results of following crosses:

• **First cross** is realised between the wild-type *Drosophila* that have long wings and red eyes and *Drosophila* with vestigial wings and brown eyes; the first generation is composed of wild-type *Drosophila melanogaster*.

1. What do you deduce from the results of this cross? (0.75 pt)

• **Second cross** is realised between a male with vestigial wings and brown eyes and a female of generation F₁. The following table shows the obtained results in generation F₂ :

<i>Drosophila</i> phenotypes	long wings and red eyes	long wings and brown eyes	vestigial wings and red eyes	vestigial wings and brown eyes
Number of generation F ₂ individuals	716	296	238	702

2. a. Are the two genes independent or linked? **Justify** your answer. (0.5 pt)
 b. **Interpret** and **Use** Punnett square to explain the results obtained in the second cross. (1 pt)

Use the following symbols: -*L* and *l* for alleles responsible for the form of the wings;
 -*R* and *r* for alleles responsible for the colour of the eyes.

- **Third cross** is realised between double heterozygous female *drosophila* with clear body and red eyes and male *drosophila* with black body and brown eyes. This cross gives recombinant individuals representing a percentage of 7.51%.

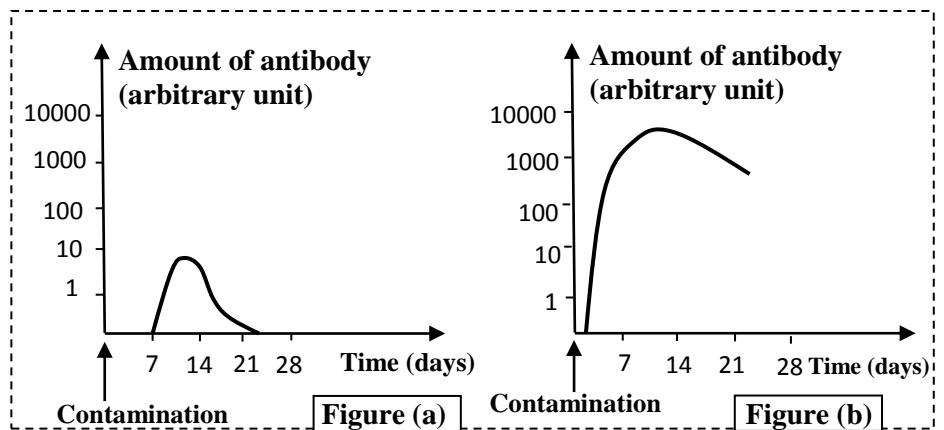
3. a. **Based** on the results of the second and third crosses results, **draw** the two possible gene maps that present the relative location of the three genes studied. (0.5 pt)

- b. **Suggest** a cross that allows to determine the distance between the gene responsible for the colour of the body and the gene responsible for the form of the wings. **Justify** your answer. (0.25 pt)

Use the symbols: *N* and *n* for alleles responsible for the colour of the body.

Exercise 3 (3 pts)

Vaccination, which is a major public health issue, allows the organism to acquire immunity against infectious diseases. To study the immune mechanisms allowing to explain the effect of vaccination, we suggest the following data:



Document 1

- **Data 1:** Document 1 presents the variation of the amount of antibodies according to time after the contamination by tetanus bacillus, in a person not vaccinated against tetanus (figure a) and in a person vaccinated against this disease (figure b).

1. **Compare** the reaction of the organism against tetanus bacillus in both the vaccinated person and the not vaccinated one. (1 pt)

- **Data 2:** Two batches of mice A and B receive a first injection of sheep red blood cells SRBCs in day 0. After 30 days, mice of batch A receive a second injection of SRBC, while mice of batch B receive an injection of rabbit red blood cells RRBCs. These SRBC and RRBC play the role of antigen for mice. Every two days, we collect one mouse spleen of each batch of mice to determine the number of plasma cells secreting antibodies of anti- SRBC in batch A mice, and the number of plasma cells secreting antibodies of anti- RRBC in batch B mice. Document 2 presents the obtained results.

Figure (a)	Mice of batch A					1 st injection of SRBC						2 nd injection of SRBC												
	Day of collecting the spleen																							
	0	2	4	6	8	30	32	34	36	38	40	42	0	3	15	90	20	1	180	850	500	300	100	70
Figure (b)	Mice of batch B					1 st injection of SRBC					injection of RRBC													
	Day of collecting the spleen											0	2	4	6	8	30	32	34	36	38	40	42	
	Number of plasma cells secreting antibodies of anti- RRBC (in thousands)											0	0	0	0	0	0	2	75	95	20	10	3	
Number of plasma cells secreting antibodies of anti- SRBC (in thousands)											0	2	30	92	20	1	1	1	0	0	0	0		

Document 2

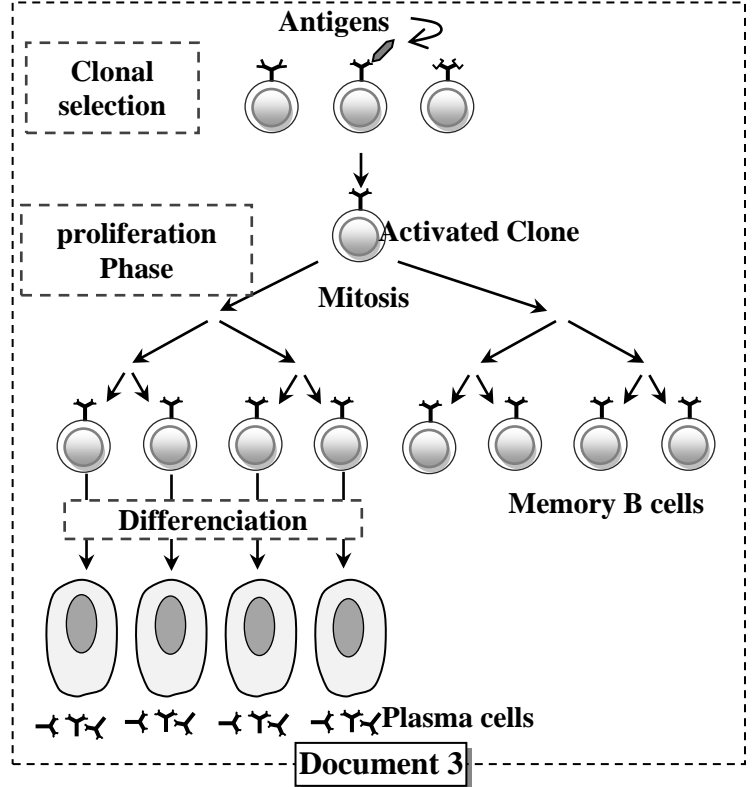
2. Deduce the two characteristics of the immune responses highlighted from the results presented in document 2, justify your answer. (1 pt)

• Data 3: The specific immune response against a given antigen takes place at the level of the peripheral (secondary) lymphoid organs. Document 3 presents the immune response phases.

3. By Exploiting data in document 3, explain:

a. the immune response of mice in batch A (document 2, figure - a-). (0.5 pt)

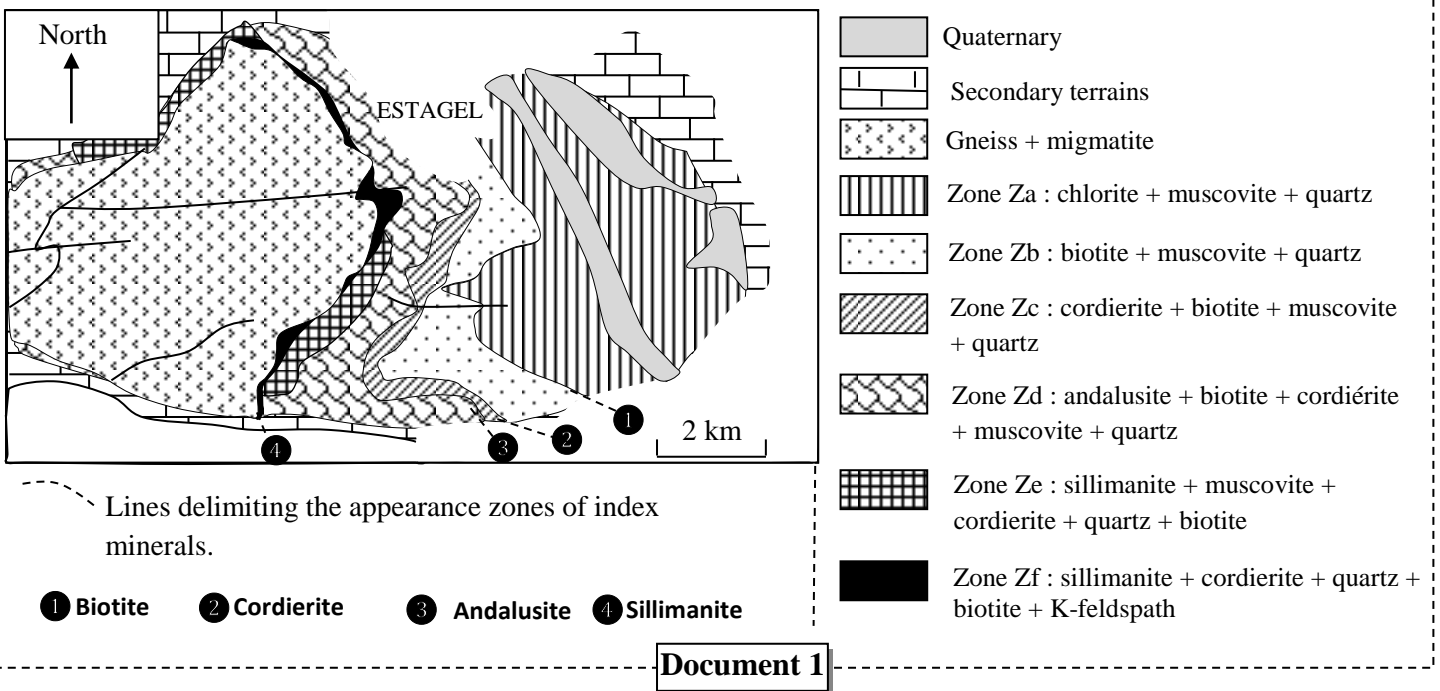
b. the immune response of mice in batch B (document 2, figure - b-). (0.5 pt)

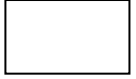


Exercise 4 (3 pts)

The formation of mountain ranges is accompanied by metamorphism of some rocks. The mineralogical composition of these rocks gives information about the conditions of their formation, which helps to trace the geological history of a mountain range.

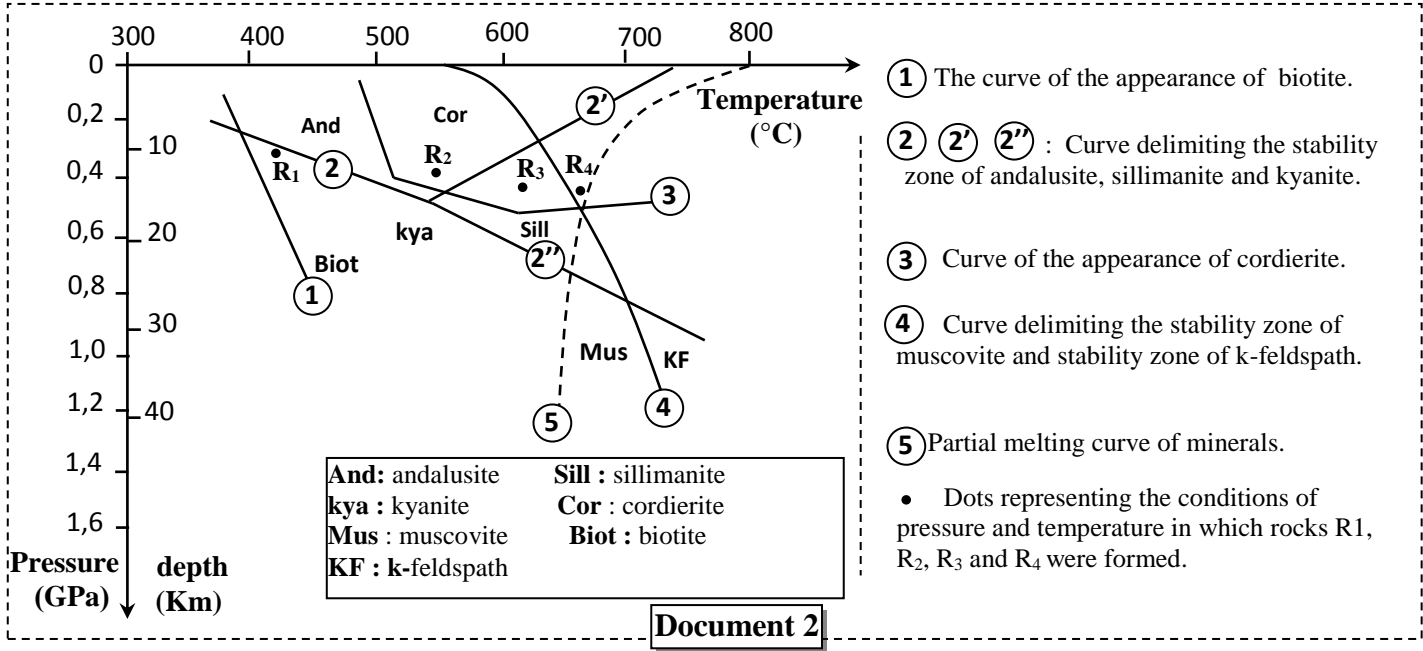
Located in the eastern part of the Pyrenees, the Agly massive is an ancient geological unit, reuniting many magmatic and metamorphic rocks. Documents 1, 2 and 3 present geological data of this massive zone. Document 1 presents a simplified geological map of the studied area with the distribution of some index minerals.





1. Based on data in document 1, **determine** the mineralogical changes when moving from Zb zone to Zd zone and from Ze zone to Zf zone. (0.5 pt)

Document 2 presents the different stability zones of minerals according to the pressure and the temperature, with a location point R₁, R₂, R₃ and R₄ succinctly representing the conditions in which the rocks sampled from zones Zb, Zd, Ze and Zf were formed.



2. Based on the graph in document 2, **explain** the mineralogical changes when moving from Zb zone (rock R₁ zone formation) to Zd zone (rock R₂ zone formation) and when passing from Ze zone (rock R₃ zone formation) to Zf zone (rock R₄ zone formation). (1 pt)

During the formation of mountain ranges, different types of metamorphism take place according to the conditions of pressure and temperature. Document 3 presents these different types of metamorphism.

3. a. Based on document 2, **determine** the minimum and maximum conditions of pressure and temperature that the studied zone has witnessed. (0.5 pt)

b. Using document 3, **deduce** the type of metamorphism that has allowed the formation of the studied rocks of Agly massive. **Justify** your answer. (1 pt)

