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الامتحان الوطني الموحد للبكالوريا
المسالك الدولية – خيار أنجليزية
الدورة الاستدراكية 2019
- الموضوع -

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المملكة المغربية
وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي

المركز الوطني للتقويم والامتحانات والتوجيه

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

Candidates may use non-programmable calculators

Section I : Knowledge Retrieval (5 pts)

I. 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. In the glycolysis process, there is the production of : a. pyruvate, CO_2 and ATP; b. pyruvate, ATP and NADH, H^+; c. lactate, CO_2 and ATP; d. lactate, ATP and NADH, H^+.	**2. Sarcomere light band is:** a. characterized by the presence of actin filaments; b. characterized by the presence of actin filaments and myosin filaments; c. bounded by two H bands ; d. bounded by two Z line.
3. At the level of inner mitochondrial membrane, there is: a. NADH, H^+ oxidation and ATP synthesis; b. NADH, H^+ oxidation and ATP hydrolysis; c. NADH, H^+ reduction and ATP synthesis ; d. NADH, H^+ reduction and ATP hydrolysis.	**4. Muscle fatigue is characterized by:** a. decrease in amplitude and in the muscle twitch period ; b. increase in amplitude and decrease in the muscle twitch period; c. decrease in amplitude and increase in the muscle twitch period; d. increase in amplitude and in the muscle twitch period.

II. Answer the questions by giving:

1. two structure characteristics of inner mitochondrial membrane . **(0.5 pts)**

2. two characteristics of fermentation. **(0.5 pts)**

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

a	Krebs cycle produces three NADH,H^+ molecules from a pyruvate molecule
b	Total yield of glycolysis is four ATP molecules
c	Lactic fermentation produces lactate and carbon dioxide
d	The length of Myofilament remains stable during sarcomere contraction

IV. Match the name of each molecule (Group 1) with its corresponding action (Group 2). **Copy down** these pairs (1; ..), (2; ..), (3; ..), (4; ..), and **match** each number with its corresponding letter. **(1 pt)**.

Group 1 : Molecules
1. ATP
2. Ca^{2+}
3. Myosin
4. ATP synthase

Group 2 : Action
a. ADP phosphorylation
b. is fixed on myosin head
c. is fixed on Troponin
d. binding Actin

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

Exercise 1 (4.5 pts)

Chronic obstructive pulmonary diseases (COPD) is characterized by alveolar dilatation under secreted protease by white blood cells creating bubbles called emphysema which expose lungs to infections.
The researchers have establish a relationship between this disease and a protein: α antitrypsin (AAT). This protein protect the lungs against lytic action of certain proteases.
Document **1** presents certain parameters related to this disease in a healthy person and a sick person.

	Parameters	AAT concentration	proteases	state of alveoles	state of lungs
	Healthy person	0.9 – 2.1 g/l	Normal level	Normal	Normal
Document 1	Sick person	≤ 0.5 g/l	High level	Fragile	Emphysema

1. **Compare the studied parameters** of the sick person and the healthy person, and establish the relation between α antitrypsin protein (AAT) and the disease. **(1 pt)**

AAT synthesis is controlled by SERPINA1 gene. Document **2** presents two allelic fragments (non transcribed strands), one is normal and the other is responsible for disease. Document **3** presents an extract of the genetic code table.

Document 2

Number of nucleotides : 7530 7540 7550

non transcribed fragment of normal allele : ACC AAT ATC TTC TTC TCC CCA

non transcribed fragment of abnormal allele : ACC AAT ATC TTC TCC CCA

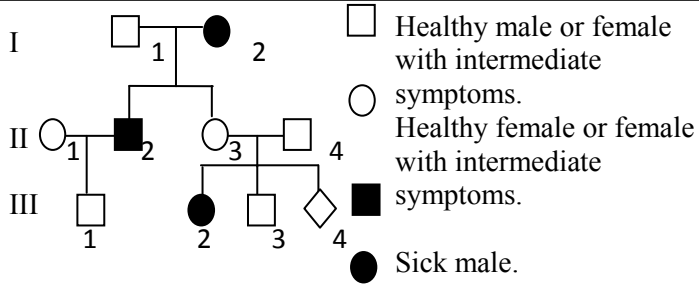
Reading direction →

Document 3

	Codons	UAA UAG	AAC AAU	ACU ACC	AUC AUU AUA	UUC UUU	CCA CCU	UCC UCA	GGG GGC
	amino acids	Stop	Asn	Thr	Ile	Phe	Pro	Ser	Gly

2. Based on documents **2** and **3**, **give** the mRNA sequences and amino acids sequences corresponding to the normal allelic fragment and the allelic responsible for the disease, then **explain** the genetic origin of the disease. **(1.5 pts)**

Document **4** presents a pedigree of a family infected by CPOD. Document **5** presents the result of electrophoresis of the gene responsible for this disease in some members of this family.



Document 4

individuals	I_1 ; II_3 ; II_4 ; III_1	I_2 ; II_2	II_1
Normal allele →			
Morbid* allele →			

*Morbid : responsible for the disease
individuals I_1 ; II_3 ; II_4 ; III_1 present intermediate symptoms of disease.

Document 5

3. By using documents **4** and **5** :

a. **Show** that the alleles responsible for phenotypes are autosomal codominant, then **give** the genotypes of individuals I_2 ; II_1 ; II_3 and II_4 **(1 pt)**

b. **Use** Punnett square to **determine** and **justify** the probability that couple II_3 and II_4 would give birth to a healthy child (manifesting no symptoms of the disease) **(1 pts)**

(Use the symbols N or n for normal allele and M or m for the allele responsible for the disease.)

Exercise 2 (4 pts)

I. On a fish farming, the breeders made fish crosses to obtain commercially attractive phenotypes. Among the targeted hereditary traits: eyes aspect and height of caudal fin.

- ❖ 1st cross: between males with funny eyes and fancy caudal fins and females with normal eyes and normal caudal fins. Individuals of F_1 from this cross have normal eyes and normal caudal fins.
- ❖ 2nd cross: among individuals of generation F_1. Generation F_2 from this cross is composed of the following phenotypes :
  - 57 % fish with normal eyes and normal caudal fins.
  - 18 % fish with normal eyes and fancy caudal fins.
  - 19.5 % fish with funny eyes and normal caudal fins.
  - 6.5% fish with funny eyes and fancy caudal fins.

1. What do you **deduce** from the first and the second crosses? **(1 pt)**

To meet the needs, providing the fish market with funny eyes and fancy caudal fins, the breeder realized crosses among generation F_2: he has made crosses between fishes with funny eyes and normal caudal fins and fishes with funny eyes and fancy caudal fins.

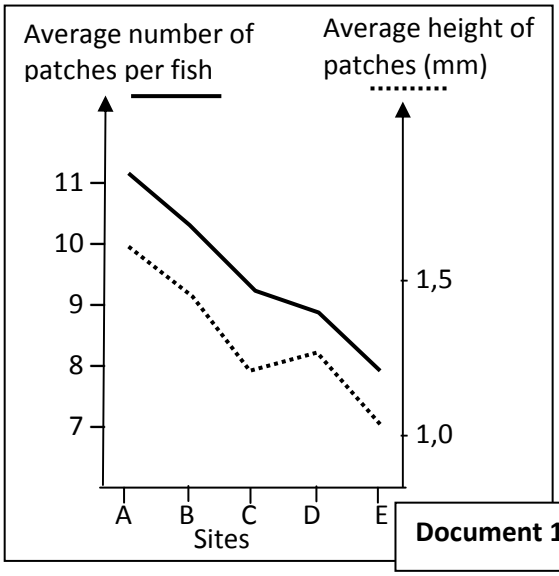
2. Use Punnett Square to **give** the percentages of the targeted phenotypes of this cross. **(1.25 pts)**
(Use the symbols D and d for alleles responsible for eyes color and N and n responsible for alleles height of caudal fin.)

II. Guppies are kind of fish liked by aquarists; the male fish have clearly colored patches that are varied in number and form. Those patches attract predators.

- Groups of guppies have been collected in different sites in different Venezuela Rivers. These sites are classified from A to E according to abundance of guppy predators (predators are less numerous in site A and more abundant in site E).

Document **1** represents results of counting the patches and height measures in guppies in different sites .

- 200 guppies from site E have been transferred to another isolated river where there are no guppies and no predators. After 2 years, the males of this population have developed more and bigger patches.

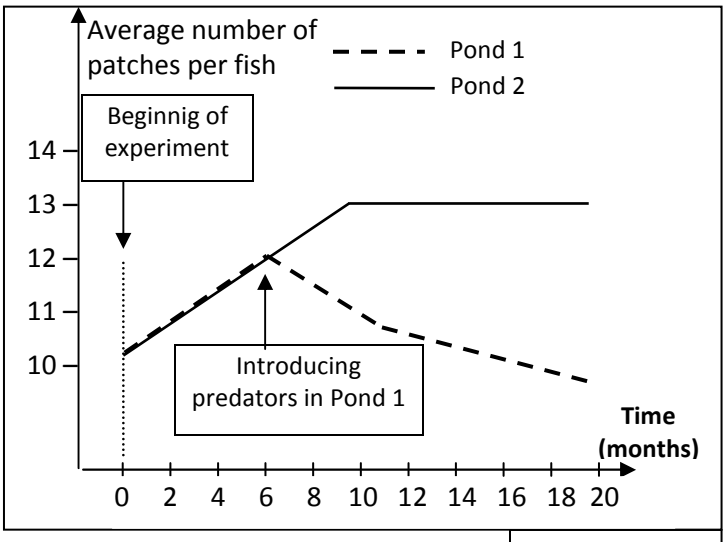


Document 1

3. Make a hypothesis to explain the variation in the phenotypes of male guppies in the different sites. (0.25 pts).

- Male and female guppies from different rivers have been transferred to two other artificial ponds 1 and 2. Six months later, predators have been introduced in pond 1, whereas in pond 2 the guppies were alone. Document 2 shows the evolution of an average number of male guppies with colored patches in both ponds before and after introducing predators in pond 1.

4. Compare the evolution the number of colored patches of male guppies in pond 1 and pond 2 before and after introducing predators. **(0. 5 pts)**



Document 2

5. **Based on previous data, find** the variation factor affecting the phenotypes in guppies**.** Justify your answer and verify the hypothesis suggested in question 3. **(1 pt)**

Exercise 3 (3,5 pts)

To highlight some aspect of immune response against the flu virus, we suggest the following data:

❖ The flu is viral infection having as main symptoms fiver, fatigue, runny and stuffy nose, headaches.
The flu virus is characterized by the presence of membrane glycoprotein molecules like « *Hemagglutinin* » (HA) which ensure the fixation of the virus on target cells and its multiplication in those cells. Document **1**presents the follow up of the virus concentration and that of antibodies (anti HA in people having flu).

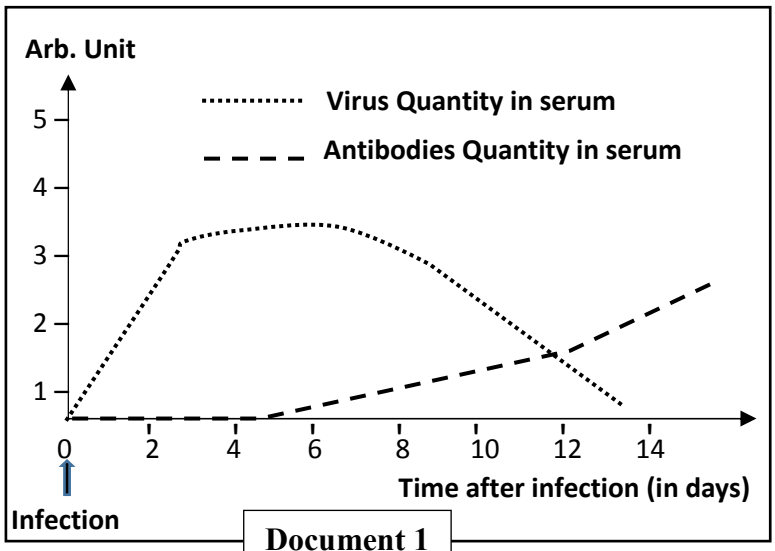
1. **Describe** obtained results and **deduce** the type of specific immune response developed by the organism against flu virus. (**1.25 pts**)

❖ In order to determine the way the immune system gets read of the flu virus, we realize the following study:

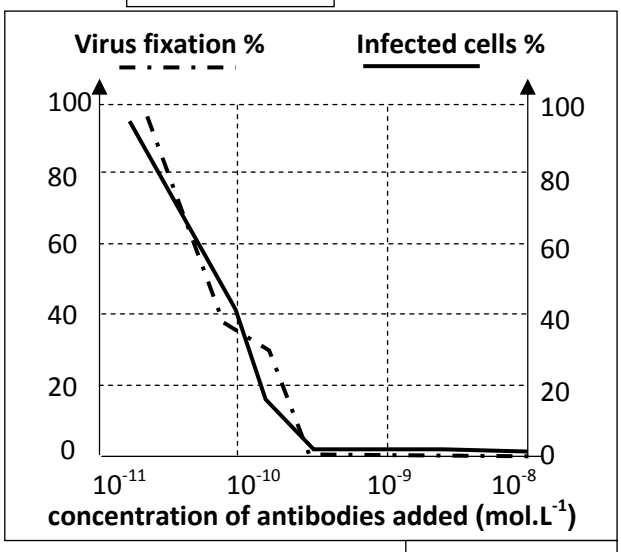
- In the presence of rising concentration of antibody (anti HA) produced during of a flu infection, we measure the binding level of flu virus on the cells in culture and the rate of infection of those cells. Document **2** presents results obtained.

2. Based on data in the document 2, **describe** the result obtained, then **deduce** the role of antibodies during the infection by the flu virus. **(1.25 pts)**

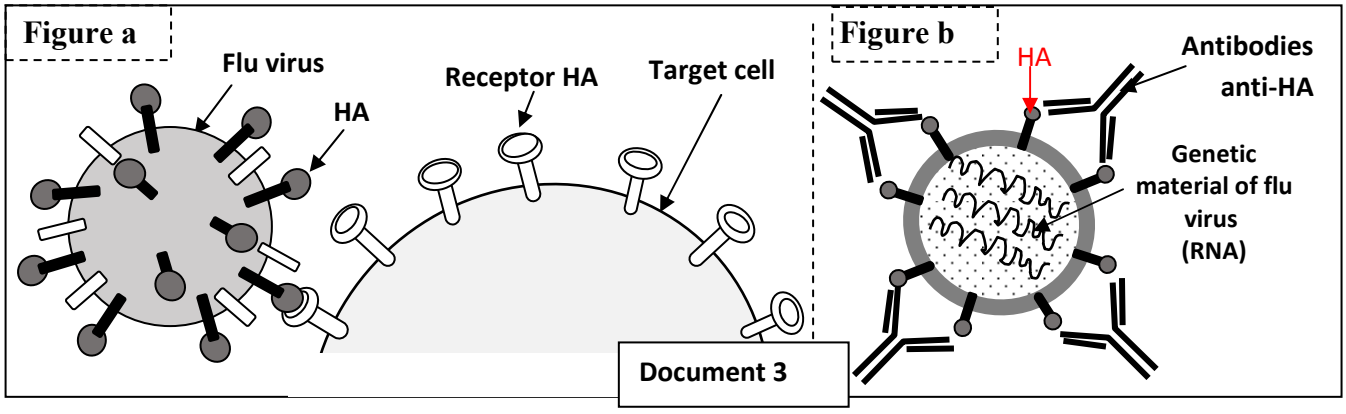
- Figure **a** in document **3** below presents the fixation method of the flu virus on target cells, and figure **b** in the same document presents the fixation method of antibodies (anti-HA) on the flu virus.



Document 1



Document 2



Document 3

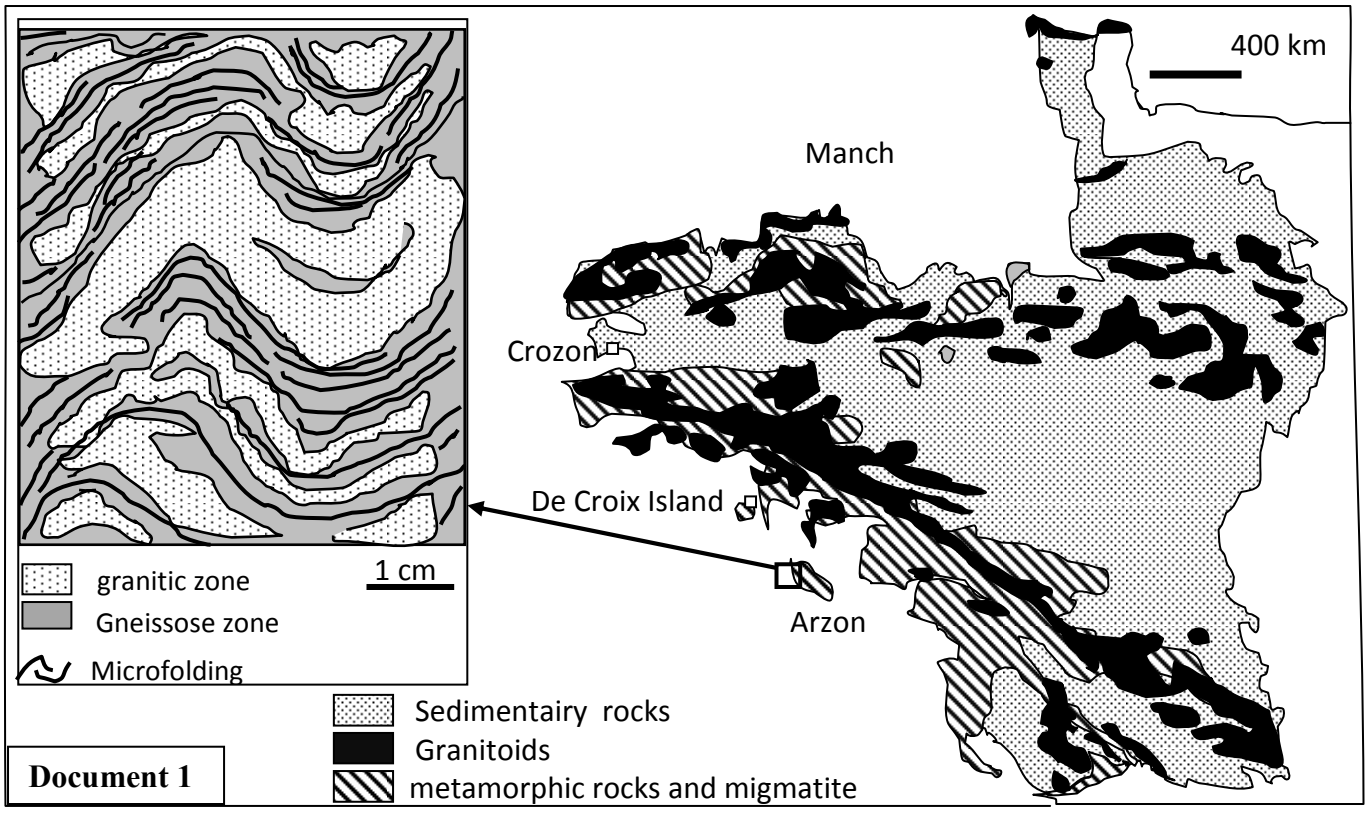
3. Based on your answer to question **2** and data in document **3**, **explain** how the flu virus is eliminated **(1 pt)**

Exercise 4 (3 pts)

In the light of studies dealing with geological phenomena about the formation of mountain ranges, we suggest the following data:

The Armoricain massive, which is situated in the north-west of France, has been the subject of many geological studies. This geological entity of feeble height would correspond to a mountain rage. To verify and trace back some aspects of the geological history of that massive, we suggest the study of the following documents:

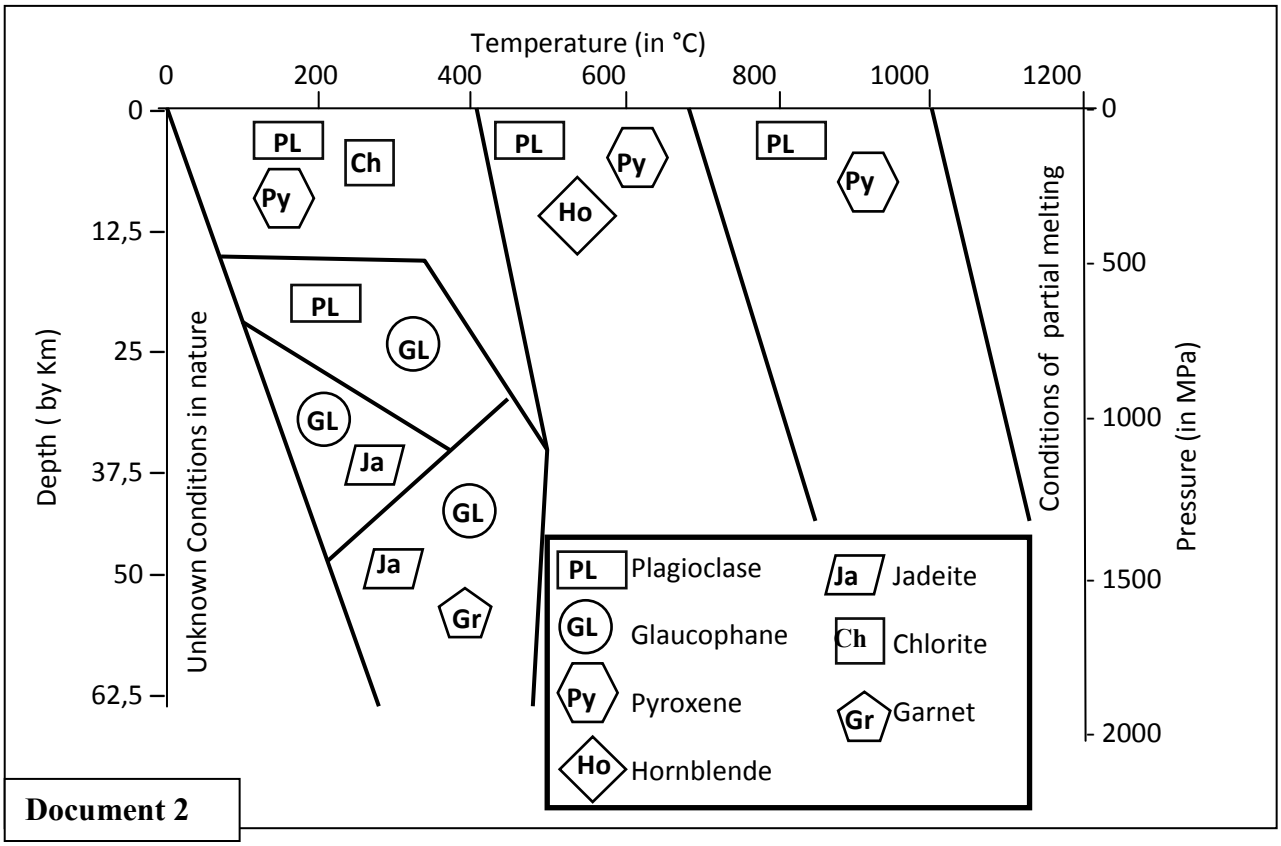
Document **1** presents a distribution map of granitoid and metamorphic rocks in the Armoricain massive with the simplified scheme of migmatite of the Arzon region (the light bands of granite mineralogy are rich in quartzofeldspathic minerals, and the dark bands rich in biotite).



Document 1

1. Based on document **1, find** clues that show that the region has undergone regional metamorphism followed by anatexis. **(0.75 pts)**

The mineralogical test of some rocks from De Croix Island shows the presence of glaucophane minerals, jadeite and garnet. Document **2** presents the stability conditions of certain mineral groupings in relation to pressure and temperature.



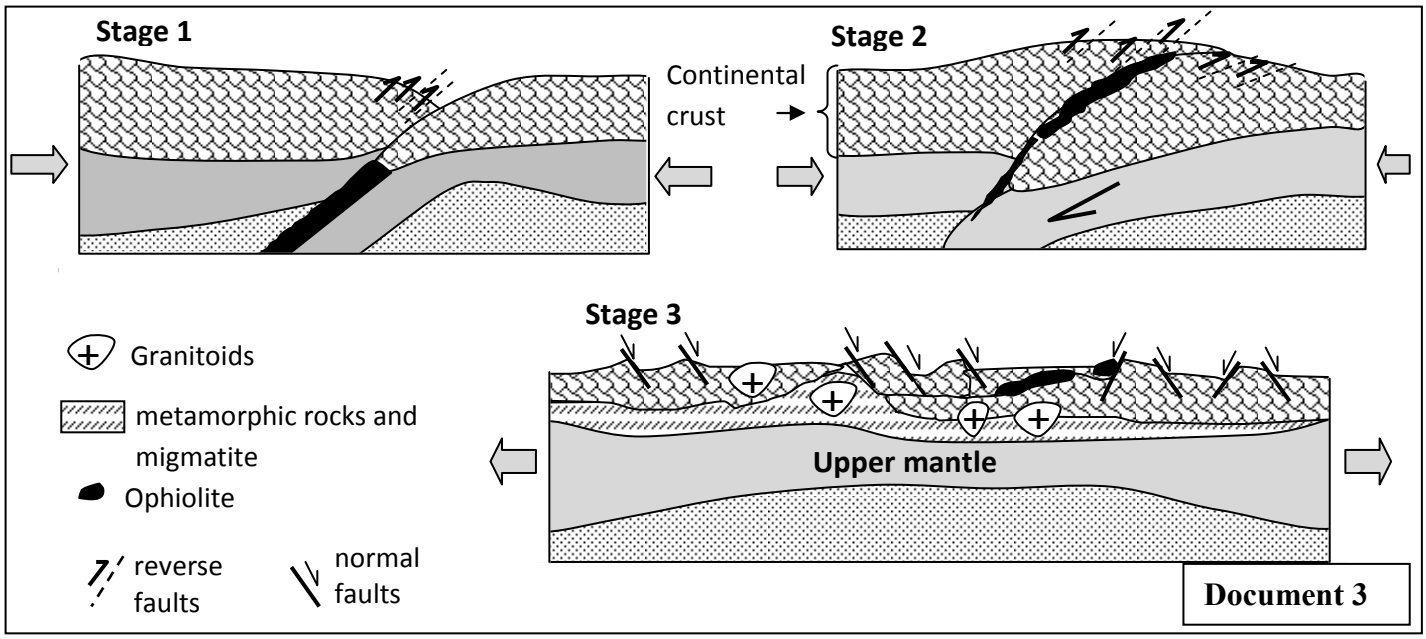
Document 2

2. Based on the diagram in document **2**:

a. Determine the conditions of the rock formation of De Croix Island. (**0.75)**

b. Deduce the type of metamorphism that has affected the rocks of this region and **specify** the geodynamic context prevailing in this region. (**0.75)**

The figures in document **3** represent three evolution stages of a mountain range collision.



Document 3

3. With the help of document **3**, trace back the geological history of the Armoricain massive **(0.75 pts)**

§---------- END -------§