الامتحان الوطني الموحد للبكالوريا
المسالك الدولية
الدورة الاستدراكية 2020
- الموضوع –

SSSSSSSSSSSSSSSSSS | RS 34E

المملكة المغربية
وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي
المركز الوطني للتقويم والامتحانات

المادة	علوم الحياة والأرض	مدة الإنجاز	3
الشعبة أو المسلك	شعبة العلوم التجريبية مسلك العلوم الفيزيائية (خيار إنجليزية)	المعامل	5

General exam guidelines

The exam contains:

- Exercises that must be answered: the questions in the first part and the exercises 1,2 and 3 in the second part.

- Exercises of your choice: exercises 4 and 5 of the second part.

Answer either exercise 4 or exercise 5, depending on your choice.

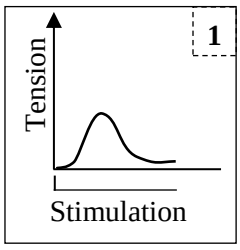
It is allowed to use the non- programmable calculator

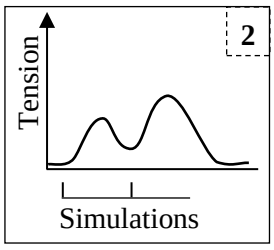
Exercises that must be answered

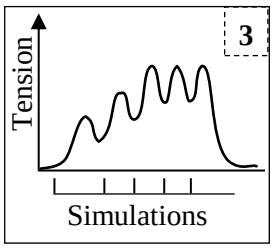
Section I : Knowledge Retrieval (5 pts)

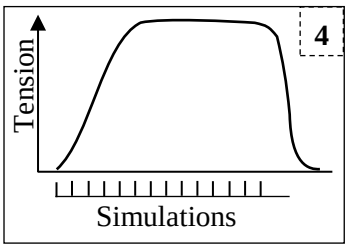
I. **Define** the following notions: - Krebs Cycle - Phosphocreatine **(1pt)**

II. The myograms below show the recordings obtained following effective stimulation of skeletal muscle. Give the name corresponding to each of these myograms numbered from 1 to 4. **(1pt)**









III. Relate each phenomenon to the appropriate balance response. **Copy** the pairs (1;...); (2;...); (3;...); (4;...) and **address** each number with the corresponding letter. **(1 pt)**

Phenomenon	Balance sheet reaction
1- the glycolysis	a- $C_6H_{12}O_6$+ 2 ADP + 2 Pi → 2 CH_3CH_2OH + 2 CO_2 + 2 ATP
2- The Krebs cycle	b- $C_6H_{12}O_6$ + 2 ADP + 2 Pi → $2CH_3CHOHCOOH$ + 2ATP
3- The lactic-acid fermentation	c- $C_6H_{12}O_6$ + 2 ADP + 2 Pi + 2 NAD^+ → 2 $CH_3COCOOH$ + 2ATP + 2 NADH,H^+
4- The alcoholic fermentation	d- $CH_3COCOOH$ + 2ATP → CH_3COOH + 2ADP + 2Pi
	e- CH_3CO-SCoA +3NAD^+ + 3H_2O + FAD + GDP +Pi → →2CO_2 +HSCoA + 3NADH,H+ + $FADH_2$ + GTP

IV. 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. during muscle contraction, a shortening of the sarcomere is observed at the level of the:
a. dark bands (A);
b. light bands (I);
c. myosin filaments;
d. actin filaments.

2- The myosin head has two specific binding sites at:
a. ATP and actin;
b. ATP and tropomyosin;
c. actin and troponin;
d. actin and Ca^{2+} ions.

3. The respiratory chain allows the synthesis of ATP following a :
a. reduction of RH2 to R and oxygen to water;
b. reduction of R to RH2 and oxidation of water to oxygen;
c. oxidation of R to RH2 and reduction of oxygen to water;
d. Oxidation of RH2 to R and reduction of oxygen to water.

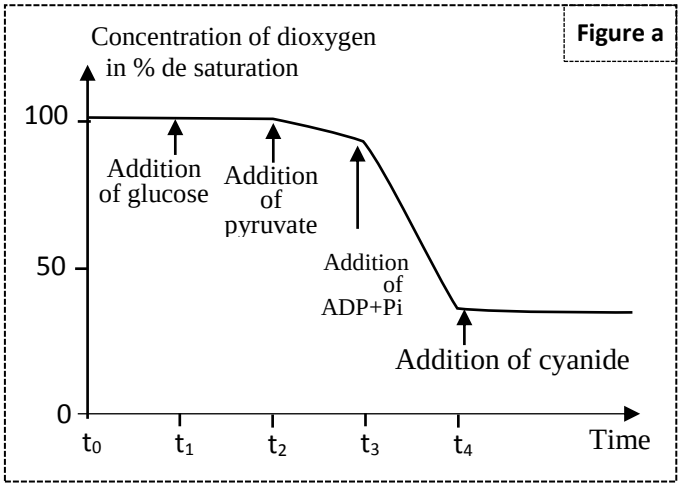
4. during the synthesis of ATP by oxidative phosphorylation :
a. the transfer of electrons results in an accumulation of H^+ protons in the mitochondrial matrix;
b. the flow of H^+ protons towards the matrix takes place through the CIV protein complex;
c. the transfer of electrons to oxygen takes place through the complexes of the respiratory chain;
d. the different complexes in the respiratory chain pump the protons to the mitochondrial intermembrane space.

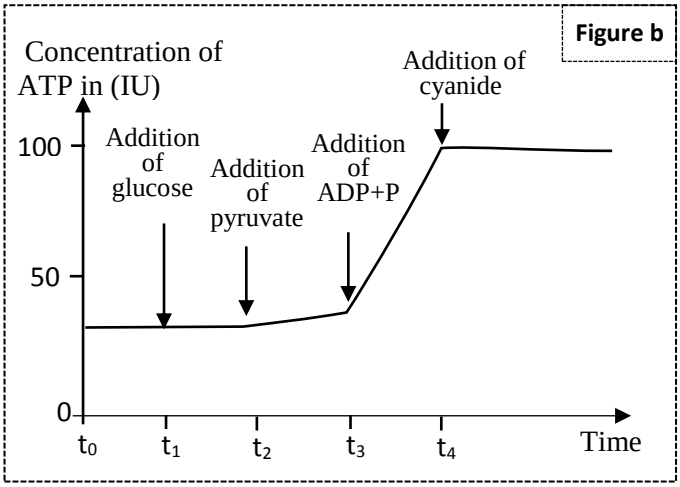
Section II : Scientific reasoning and communication in graphic and written modes (15pts)

Exercise 1 (3 pts)

During muscle contraction, chemical energy (ATP) is converted into mechanical energy in the striated skeletal muscle. This conversion which requires a continuous renewal of ATP. To highlight the conditions for ATP synthesis and the pathways for its renewal in skeletal muscles, the results of the following experiments are suggested:

The first experiment: was carried out on a suspension solution of mitochondria in a medium saturated with oxygen having a pH of 7.5. Document 1 presents the conditions and the results of this experiment.





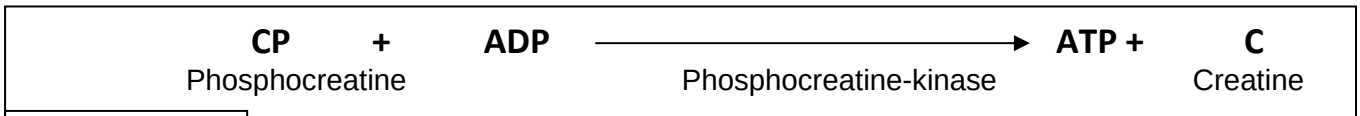
Note : *Cyanide is a substance that inhibits the action of specific mitochondrial enzymes.*

Document 1

1. Using Document 1, **deduce** the conditions for mitochondrial synthesis of ATP. **(1.25pt)**

The second experiment: Three frog muscles were electrically stimulated under the following experimental conditions:

- The muscle1: was not subjected to any treatment (control);
- The muscle 2: was treated with iodo-acetic acid, which inhibits glycolysis;
- The muscle 3: was treated in the same way as the second muscle with the addition of an inhibitor of the enzyme "phosphocreatine kinase" which catalyzes the reaction presented in document 2:



Document 2

The table of document 3 summarizes the response of the three muscles and the measurement results of the ATP and phosphocreatine molecules at the muscle level.

The Muscles		**Muscle 1**	**Muscle 2**	**Muscle 3**
Muscle response		Muscle contraction for three minutes	Muscle contraction for three minutes	Muscle contraction for a few seconds
Dosage of ATP in mg/g of muscle	Before contraction	2	2	2
	After contraction	2	2	0
Dosage of Phosphocreatine in mg/g of muscle.	Before contraction	1,5	1,5	1,5
	After contraction	1,5	0,4	1,5

Document 3

2. Using documents 2 and 3:

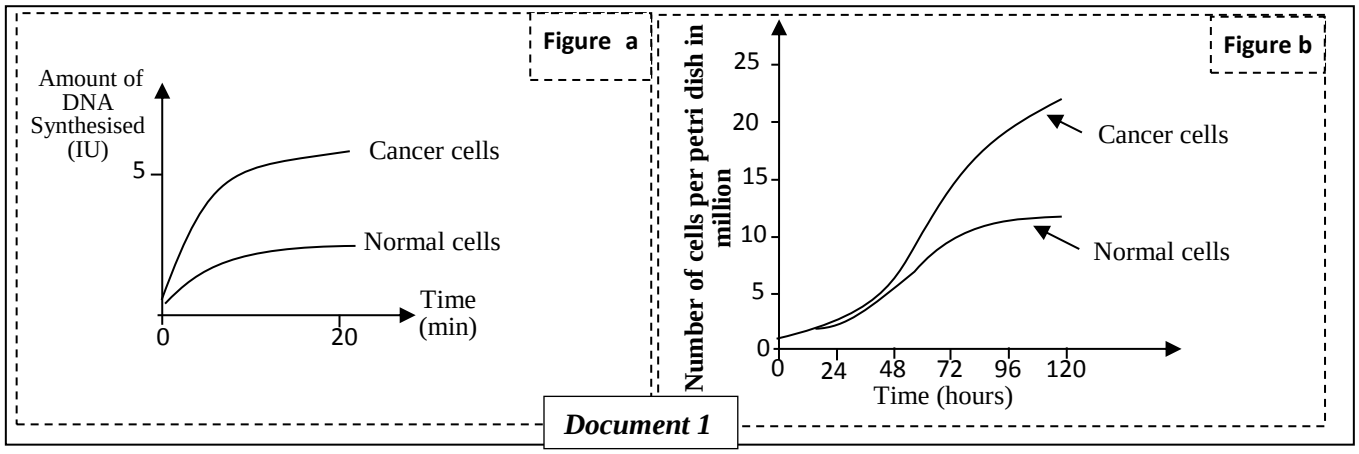
a. Compare the results recorded for muscle 2 and muscle 3 with those for muscle 1. **(1pt)**

b. Explain the results recorded for muscle 2 and muscle 3, highlighting the ATP renewal reactions in the muscle cell. **(0.75pt)**

Exercise 2 : (4 pts)

Lung cancer is an increasingly common disease. It is caused by the appearance of cancer cells that eventually form a lung tumor. The proliferation of lung cells is controlled by the EGFR gene, located at chromosome 7 in humans. To understand the causes of this disease, we propose the following data:

Document 1 presents the results of measuring the speed of DNA replication of normal and cancer cells (figure a) and counting normal and cancer cells after culture under the same conditions (figure b).



Document 1

1- **Using** the data from document 1, **suggest** a hypothesis to explain the occurrence of lung cancer in humans. **(1 pt)**.

Document 2 presents a fragment of the transcribed strand of the EGFR gene in a healthy person and a person suffering from lung cancer. Document 3 presents an extract from the genetic code table.

Number of triplets:		1	2	3	4	5	6	7	8
Part of the EGFR allele of a healthy person:	…	CCC	GTC	GCT	ATC	AAG	GAA	TTA	AGA
Part of the EGFR allele of a person with lung cancer :	…	CCC	GTC	CGC	TAT	CAA	GGA	ATT	AAG

Reading direction →

Document 2

Codons	**CAG CAA**	**UGA UAG UAA**	**UCC UCG UCU**	**GUU GUC**	**GGU GGA GGG**	**UUU UUC**	**AUC AUA AUU**	**CGA CGU**	**GCG GCU**	**CCA CCU**
amino acid	Gln	Codon stop	Ser	Val	Gly	Phe	Ile	Arg	Ala	Pro

Document 3

2. Based on documents 3 and 4:

a. Give the mRNA sequence and the amino acid sequence corresponding to the parts of the EGFR alleles in the healthy and a person with lung cancer. **(1pt)**

b. verify the hypothesis proposed in your answer to question 1 **by determining** the genetic origin of the disease. **(2pt)**

Exercise 3 : (4 pts)

To understand the mode of transmission of two hereditary traits(color and form of corolla) in snapdragon plant, the results of the following two crosses are proposed:

● **First cross:** between two pure lineages of snapdragon, one with a white and irregular corolla and the other with red corolla and axial symmetry. The first generation obtained (F1) is composed of individuals with pink and irregular corolla.

● **Second cross:** between the F1 individuals, this cross gave an F2 generation composed of :

- 94 plants with pink and irregular corolla;
- 39 plants with red and irregular corolla;
- 45 plants with white and irregular corolla;
- 28 plants with pink corolla and axial symmetry;
- 15 plants with red corolla and axial symmetry
- 13 plants with white corolla and axial symmetry

1. Based on the results of the two crosses, **determine** the mode of transmission of the two studied hereditary traits. **(1.5pt)**

2. Interpret and **use** Punnett square to **explain** the results obtained in the second cross. **(1. 5pt)**

*Use the symbols **R** or **r** for the trait " red corolla " and the symbols **B** or **b** for the trait " white corolla " and the symbols **A** and **a** for the trait " form of corolla ".*

A farmer wants to obtain the largest possible proportion of plants with axially symmetrical and pink corolla snapdragon, and hesitates between the following two crosses:

- **Crossing A**: between plants with pink corolla and axial symmetry between them;
- **Crossing B**: between plants with white corolla and axial symmetry and plants with red corolla and axial symmetry;

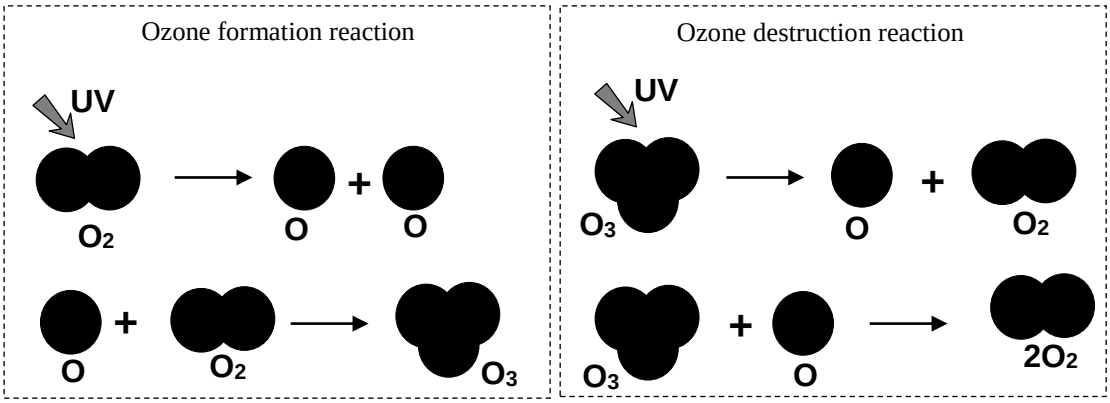
3. Among these two crosses A and B, d**etermine** the cross which allows this farmer to obtain the largest possible proportion of snapdragon plants with axially symmetrical and pink corolla. **Justify** your answer.**(1pt)**

Answer either exercise 4 or exercise 5, depending on your choice

Exercise 4 (4 pts)

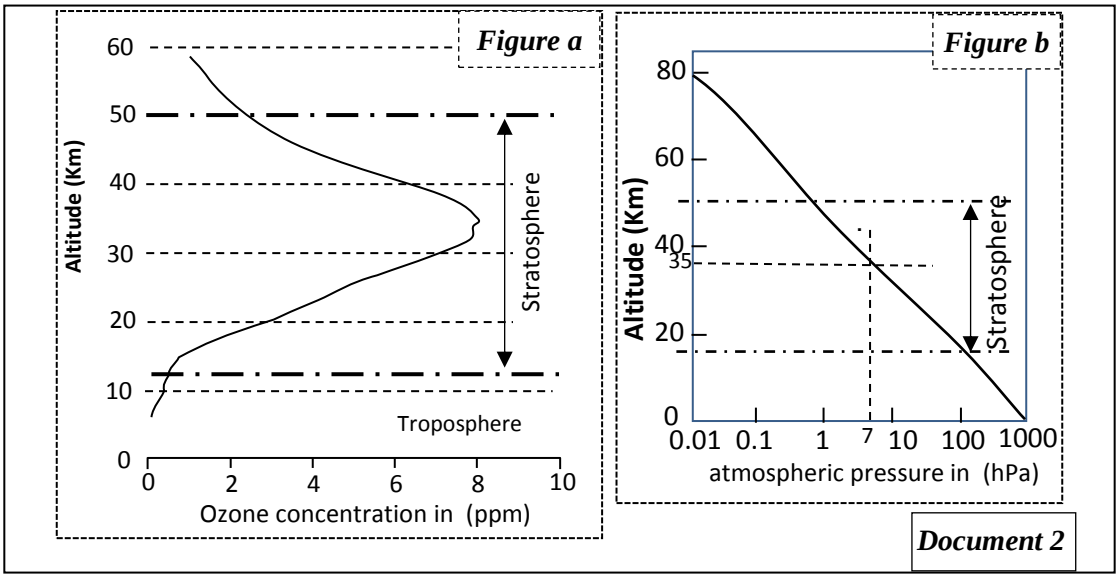
Ozone (O3) is present in the Earth's atmosphere in limited quantities, this molecule plays an essential role by filtering ultraviolet solar rays whose effects can be harmful on living beings. Starting from the 1980s, mainly over Antarctica, a significant decrease in the total amount of ozone was observed "the ozone hole". To highlight the causes behind this decrease, we propose studying the following data:

The document 1 shows a simplified representation of the reactions of production and destruction of ozone in the stratosphere. Document 2 presents the vertical distribution of ozone in the stratosphere (figure a) and the variation of pressure with altitude.



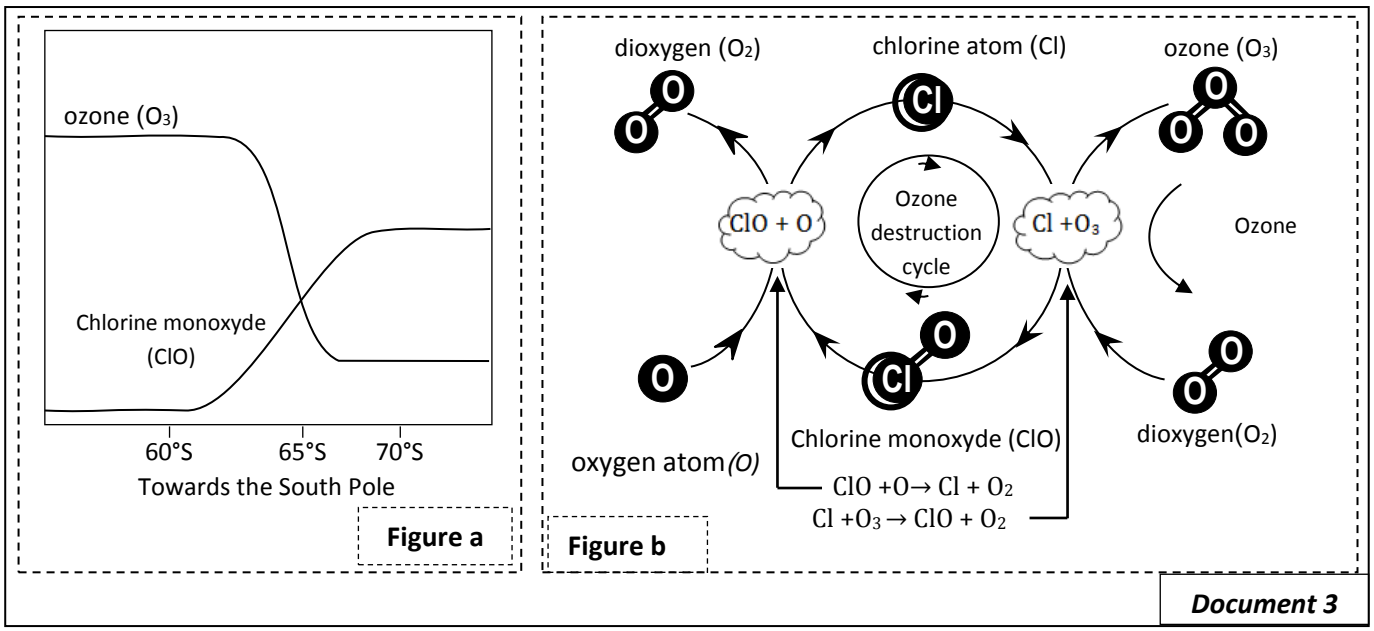
NB: *The dominant reaction (formation or destruction of ozone) in the stratosphere is linked to atmospheric pressure.*

Document 1



1. **By exploiting** documents **1** and **2**:
   a- Describe the vertical distribution of ozone in the stratosphere. **(0.5pt)**
   b- Establish the relationship between the change in the distribution of ozone and atmospheric pressure at the level of the stratosphere **by highlighting** the dominant reactions. **(1pt)**

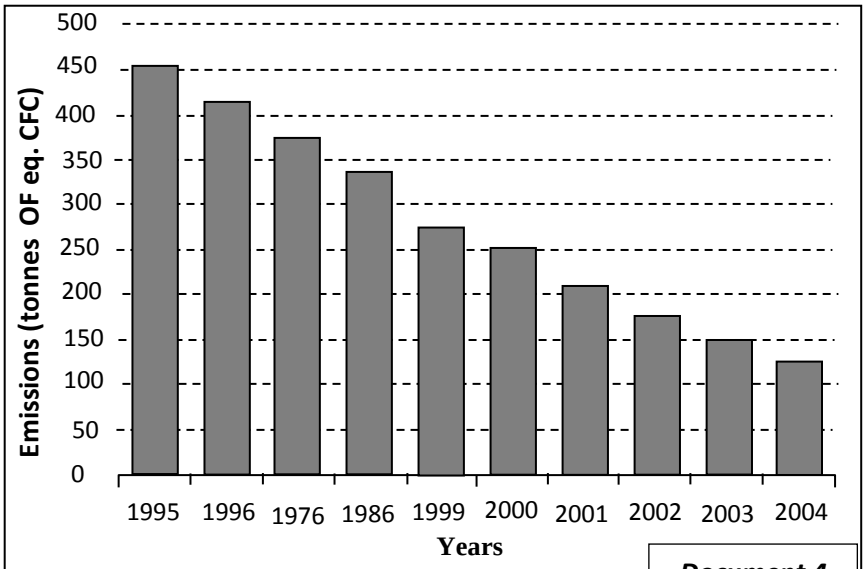
To determine the relationship between the decrease in the quantity of ozone and the concentrations of certain compounds of industrial or agricultural origin (nitrogen, chlorine or bromine compounds) in the atmosphere , we propose document 3 which gives the variation of the quantities of chlorine monoxide and ozone in the atmosphere (figure a) and the effect of chlorine monoxide on the ozone. (figure b)



2. **Based** on Document **3.**
   a. Describe the evolution of the quantity of chlorine monoxide and ozone. **(0. 5pt)**
   b. Show the danger of chlorine on the stratospheric ozone. **(0. 5pt)**

With the aim of eliminating the production of ozone-depleting substances, the Copenhagen Accord in 1992 recommended the complete phase-out of CFC compounds. Document 4 shows the variation in the quantity of CFCs in the stratosphere of the Walloon region after the application of this agreement.

Document 5 presents the lifespan of three compounds and their capacity to destroy the ozone; CFC and two alternatives: Hydrochlorofluorocarbons (HCFCs) and Hydrofluorocarbons (HFCs).



Document 4

Composés	Lifespan in years	ozone-depleting capacity
CFC	100	1
HFC	28	0
HCFC	1,6	0,01

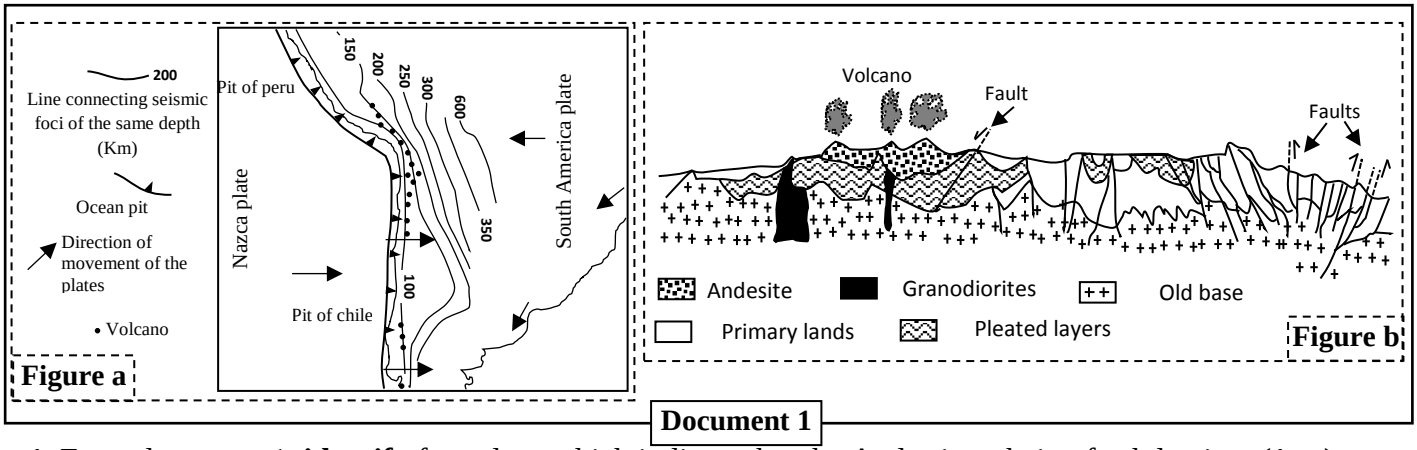
Document 5

2. **Based** on documents 4 and 5, express your opinion on the effectiveness of the decision made by CFC producing countries. Justify your answer. **(1.5pt)**

Exercise 5 (4 pts)

The Andes is a chain of subduction that stretches along the Pacific coast of South America for almost 8,900 kilometers. Its formation is accompanied by intense magmatism. In order to show the origin of this magmatism and its relationship with plate tectonics, we offer the following data:

Document 1 presents the geodynamic situation of part of the Andes range (figure a) and a geological section at the level of this mountain range (figure b).



Document 1

1. From document 1, **identify** four clues which indicate that the Andes is a chain of subduction. **(1 pt)**

Geologists suppose that the magma in the subduction zones results from a partial fusion of the peridotite below the volcanic zone and above the dip plate. The depth of this area varies from 80 to 100 km.

To determine the origin of this magma, we propose document 2 which presents a model for plotting isotherms in a subduction zone (figure a) and the conditions for the fusion of peridotite in a subduction zone (figure b).

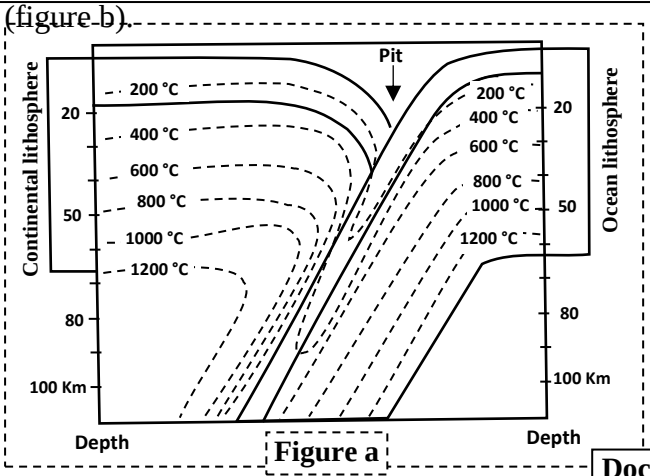


Figure a

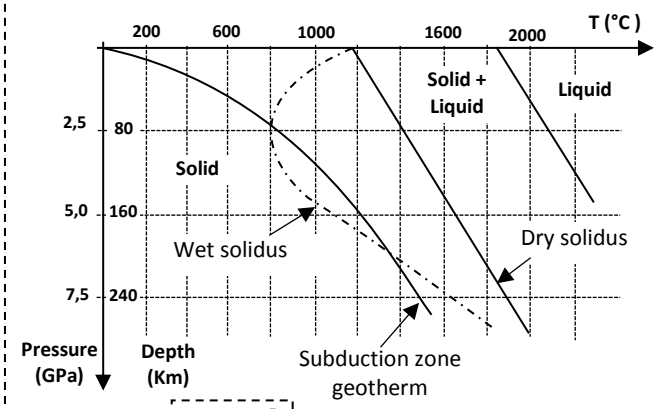


Figure b

Document 2

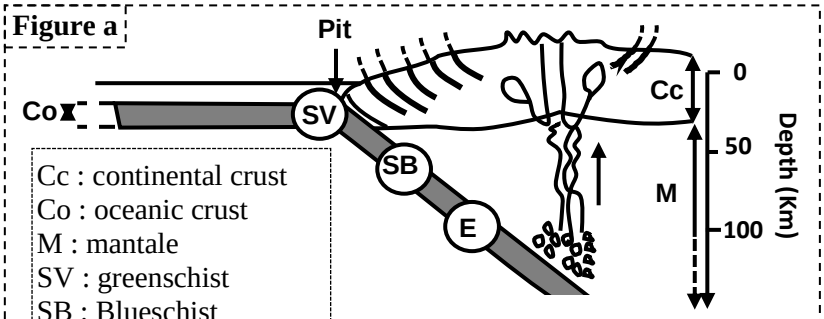
2. By using document 2:

a. From figure a, **determine** the range of the prevailing temperature in the partial melting zone of peridotite at the level of the subduction zone**. (0.25 pt)**

b. Based in figure b, **Explain** the need for the presence of water for the partial fusion of peridotite in the subduction zone. **(1.25 pt)**

To determine the origin of the hydration of the peridotites of the overlapping plate, we propose document 3 which presents the localization of certain metagabbros belonging to different metamorphic facies in a subduction zone (figure a) and the mineralogical composition of these metagabbros (figure b). Document 4 gives certain mineralogical reactions generated under the effect of the conditions prevailing in a subduction zone (figure a) and the stability domains of certain minerals (figure b).

Figure a



Cc : continental crust
Co : oceanic crust
M : mantale
SV : greenschist
SB : Blueschist
E : eclogite

Facies metagbbro sample	Mineralogical composition
greenschist	Plagioclase, chlorite and actinote
Blueschist	Glaucophane
Eclogite	Garnet and jadeite

Figure b

Document 3

3. Using documents 3 and 4, **show** that the metagabbros of the subducted oceanic crust underwent a dynamic metamorphism **by deducing** the origin of the water necessary for the genesis of magma in the subduction zones. **(1 pt)**

4. Based on the above, show the relationship between plate tectonics and the genesis of magma in the subduction zones. **(0.5 pt)**

Reaction 1: plagioclase + chlorite + actinote → glaucophane + water
Reaction 2: plagioclase + glaucophane → garnet + jadeite + water
***** chlorite and actinote are hydrated minerals present in the subducting oceanic lithosphere.

Figure a

Minerals	Stability conditions	
	Pressure	Temperature
Chlorite - Actinote	0 to 0,5 GPa	300 to 450 °C
Glaucophane	> 0.5 GPa	100 to 450 °C
Garnet - Jadeite	> 1 GPa	> 200 °C

Figure b

Document 4