★★★

الامتحان الوطني الموحد للبكالوريا
المسالك الدولية ـ خيار أنجليزية
الدورة الاستدراكية 2017
ـ الموضوع ـ

RS 34E

المملكة المغربية
وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي

المركز الوطني للتقويم والامتحانات والتوجيه

المادة	علوم الحياة والارض	مدة الإنجاز	3
الشعبة أو المسلك	مسلك العلوم الفيزيائية – خيار أنجليزية	المعامل	5

Candidates may use non-programmable calculators.

Section I: Knowledge Retrieval (5 pts)

I. Define the following notions: **Ophiolite - Foliated texture.** **(1pt)**

II. **Give** three characteristics (structural and petrographic) of obduction mountain chains. **(0,75pt)**

III. 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. Metamorphic sequence of clay rocks resulting from increasing pressure and temperature is : a. clay →gneiss→ schist → mica schist b. clay → schist → gneiss → mica schist. c. clay → schist → mica schist → gneiss. d. clay → gneiss → mica schist → schist.	**3- Eclogite is a metamorphic rock that has been formed under the following conditions :** a. high pressure and high temperature. b. high pressure and low temperature. c. low pressure and high temperature. d. low pressure and low temperature .
2- Intrusive granite is surrounded by: a. migmatites. b. metamorphic aureole. c. gneiss. d. peridotite.	**4- Migmatites form a rock complex that separate:** a. rocks of contact metamorphism of the fusion area. b. rocks of dynamic metamorphism of the fusion area. c. anatectic granite of intrusive granite. d. gneiss of anatectic granite.

IV. The figures below are drawings of rock deformations accompanying the formation of chain mountains.

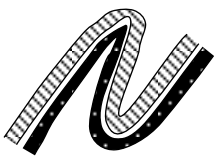


Figure 1

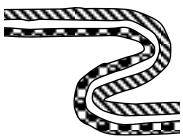


Figure2

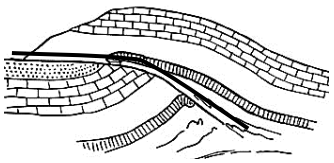


Figure 3

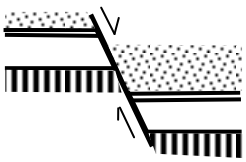


Figure 4

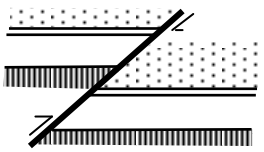


Figure 5

Give the appropriate name for each figure choosing from the list below. **(1.25pts)**

Thrust fault - Normal fault - Reverse fault - Horizontal fault - Upright fold - Recumbent fold - Overturned fold.

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

Exercise 1 (5 pts)

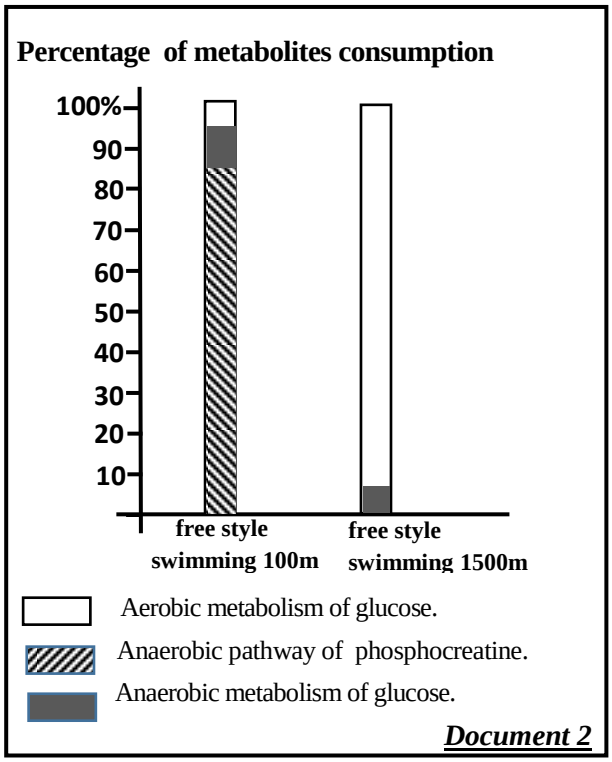
During some sporting competitions, some athletes have been disqualified by the Olympic Games federation because they have used doping products.

In order to study the effect of physical exercise and the use of doping products on metabolic pathways producing energy at the cellular level in some sportsmen and sportswomen, we suggest the following data:

- The measure of the concentration of certain metabolites at the level of striated muscle and the determination of the consumption of glucose and phosphocreatine in percentage in a swimmer after a 100m exercise and another swimmer after a 1500m exercise allows to obtain the results presented in document 1 and 2.

	Metabolite concentrations in 10^{-6}mol/g of muscle			
	Lactic acid	**Glycogen**	**Phospho-creatine**	**ATP**
rest	1.1	80	17	4.6
free style swimming 100 metres (1mn)	30.5	60	10	3.4
free style swimming 1500 metres (15min)	3	38	16	4.7

Document 1



Document 2

1. **a**. **Based** on document 1**, determine** the variations of the concentration of metabolites in the two swimmers after the muscle effort. **(1 pt)**

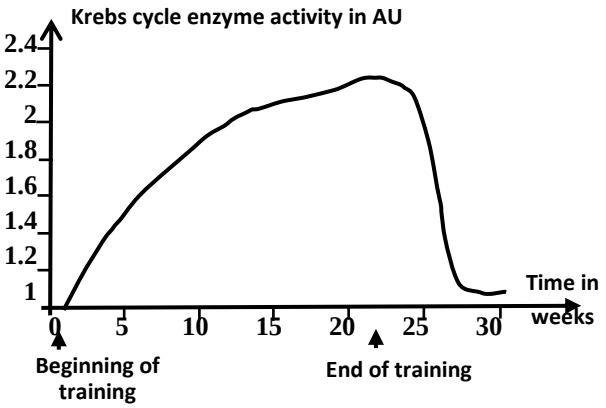
b. Based on documents 2, **extract** the metabolic pathways used by the muscle of each of the two swimmers to produce energy. **(1 pt)**

To understand the effect of the long duration muscular effort on the muscle metabolism, we suggest the data in documents 3 and 4.

- A training of long duration (1500m free style swimming during 21 weeks, nearly 5 sessions per week) makes it possible to observe the following changes in the muscular cells:

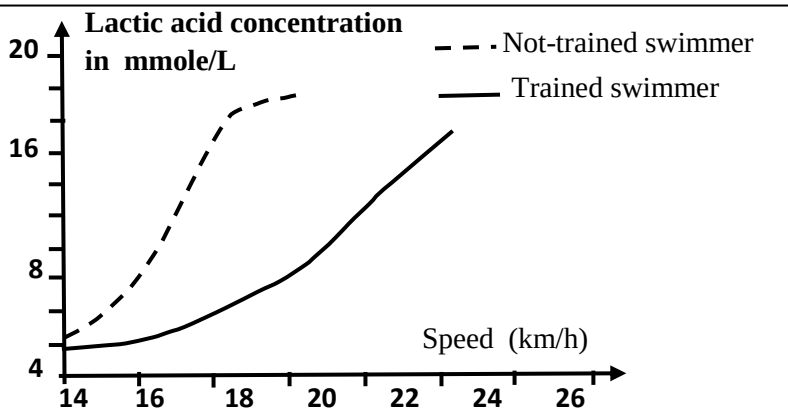
  - an increase in the number of mitochondria by 120 %
  - an increase in the size of mitochondria by 14 to 40 %

- Measures of Krebs cycle enzyme activity realised from muscle extracts taken from different sportsmen and sportswomen (1500m free style swimming) before and after training are represented in the graph on the right-hand side.



Document 3

- Measuring the lactic acid quantity according to the swimming speed of a trained swimmer and a non-trained one has permitted to draw the graph on the right-hand side.



Document 4

2. **Using** the data in documents 3 and 4, **determine** the impact of training on the muscular metabolism and **explain** the effect of the long duration muscular effort on the metabolic reactions of the muscle. **(1 pt)**

- Despite the serious side-effects of these doping products on health, some swimmers, so as to improve their sporting performance, use different doping products depending on the kind of swimming activity.

In order to understand the mechanism of action of the doping products, we suggest the data in document 5.

EPO or Erythropoietin is a hormone secreted by the kidney. This hormone is found in synthetic form that swimmers of long distances use as a doping product. The table below presents the recorded changes taking place in the blood of an individual before and after an EPO injection.

	Before the EPO injection	**After the EPO injection**
Number of red blood cells / litre of blood	$4{,}9.10^{12}$	6.10^{12}
hemoglobin quantity in g/litre of blood	150	200

Figure a

The ATP concentration is determined in the quadriceps muscles of two swimmers specialised in 100 meter free-style swimming. The first one has received supplementary creatine for 5 days, while the other has received a placebo (a pill containing no creatine). This concentration has been evaluated before the physical exercise (at rest), at the end of the exercise and after 3 minute after regaining breath.

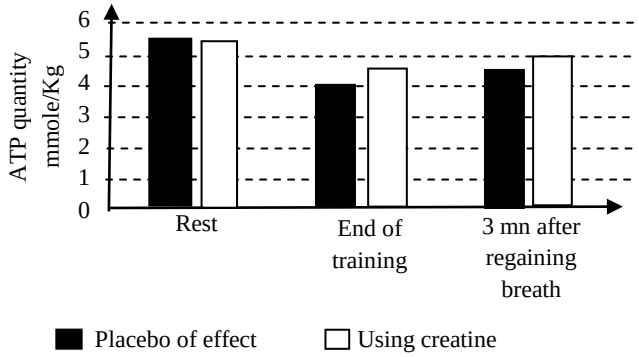


Figure b

Document 5

3. **Based on the exploitation** of data in document 5 and the **use** of your background knowledge, **show** the EPO effect and creatine on the muscular metabolism. **(1 pt)**

- Some athletes choose to train in mountainous regions (Ifrane for example) to improve their pulmonary ventilation and increase the number of their red blood cells and the hemoglobin quantity.

4. **Based** on your previous answers, **show** that it is possible to improve the sporting performance without using EPO. **(1pt)**

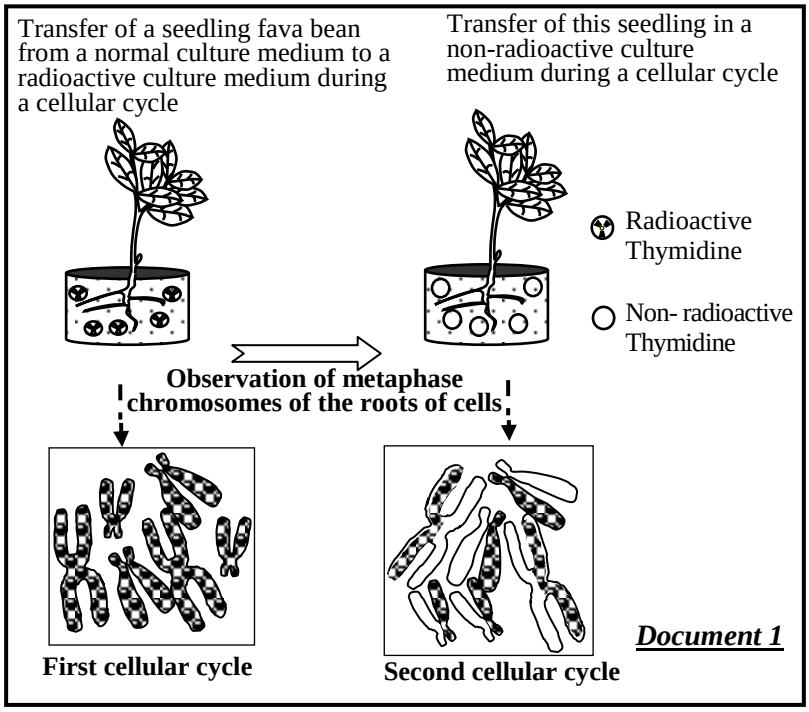
Exercise 2 (3pts)

To study certain aspects of transmission and the expression of genetic information, we suggest the following data:

- During each cellular cycle, the cell is subject to a number of biological phenomena that intervene in maintaining the genetic information during its transmission from one cell to another. Document 1 presents the results of an experience that highlights one of those phenomena and its importance.

NB. Thymidine (**T**) is used in DNA synthesis.

1. **Explain** the results of the experience in Document 1, **justify** your answer drawing an appropriate scheme of the highlighted biological phenomenon. **(1.5 pts)**

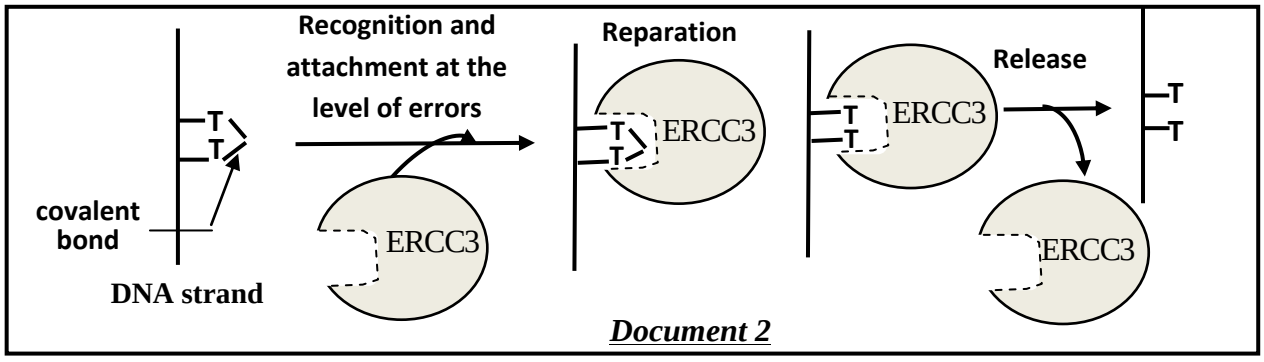


Document 1

- Xeroderma pigmentosum Type B is a rare genetic disease characterised by hypersensibility to UV rays. It causes skin and eye lesions that may develop to cancer. This disease is the result of the loss of cellular capacity to repair errors at the level of DNA.

The UV provoke modifications of the DNA structure forming covalent bonds between two successive thymines (T) of the same DNA strand. This aberration is normally corrected by the intervention of an enzyme called ERCC3 and this takes place before the DNA duplication.

Document 2 summarises the action mode of this enzyme.



Document 2

Document **3** presents the nucleotide sequence of part of the gene coding the enzyme ERCC3 in a normal person and in another person affected by XPB. Table of document **4** gives an extract of the genetic code.

Reading direction →

		66	67	68	69	70	71
Normal person	untranscribed strand	CCA	ACT	TGT	GAT	AAC	TGC
	transcribed strand	GGT	TGA	ACA	CTA	TTG	ACG
Person affected by XPB	untranscribed strand	CCA	ATT	GTG	ATA	ACT	GCA
	transcribed strand	GGT	TAA	CAC	TAT	TGA	CGT

Document 3

Document 4

Codons	ACC ACU ACG	GUG GUA GUG	UAA UAG	CCU CCA	UGU UGC	GCU GCA GCG	AAU AAC	AUU AUA AUC	UUU UUC	GAU GAC
amino acids	Thr	Val	Stop	Pro	Cys	Ala	Asn	Ile	Phe	Asp

2. Using the data in documents 2, 3 and 4, **determine** the amino acid sequence corresponding to each part of the gene responsible for the protein synthesis ERCC3 in the two individuals, and **explain** the genetic origin of this disease. **(1,5 pts)**

Exercise 3 (2 pts)

In the pigeon population, the female is heterogamete XY and the male is homogametic XX. To understand the transmission mode of the two traits (the colour of plumage and the colour of the eyes) in a pigeon breed called Roman, we suggest studying the results of the following crosses:

- **First cross between two lineages**: pure lineage males having blue plumage and black eyes with pure lineage females having brown plumage and orange eyes. The first generation F_1 is composed only of individuals with blue plumage and black eyes.

- **Second cross between two lineages**: pure lineage males having brown plumage and orange eyes with pure lineage females having blue plumage and black eyes. The first generation F'_1 is composed of 50% of male individuals having blue plumage and black eyes and 50% of female individuals having brown plumage and black eyes.

1. Analyse the results of the two crosses 1 and 2 and then **deduce** the transmission mode of the studied traits in the Roman pigeon. **(1pt)**

2. **Using** Punnett square, **give** the expected results in a cross case of males F_1 with females having brown plumage and orange eyes. **(1pt)**

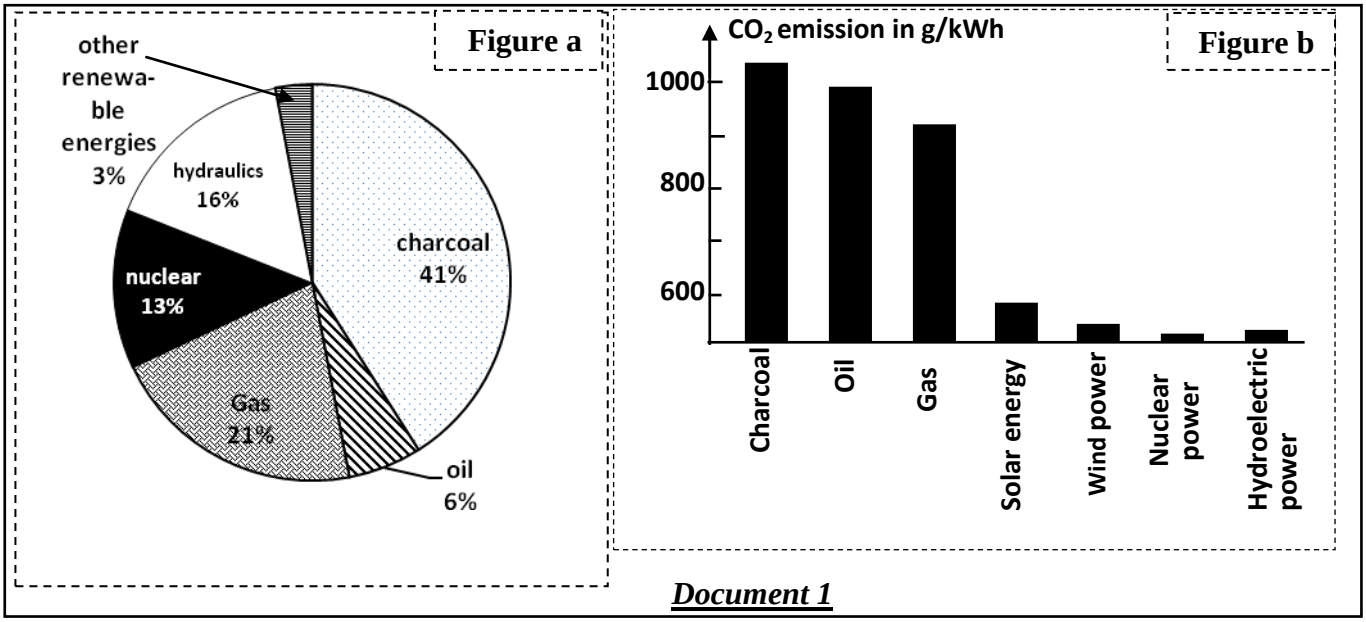
NB. Use the symbols (B, b) for the colour of plumage and (N, n) for the colour of the eyes.

Exercise 4 (5 pts)

Countries participating in COP 22 in Marrakech have agreed to implement the Paris axes (COP 21) so as to avoid the eminent ecological disasters that would result from the greenhouse effect before the year 2050.The agreement has fixed as an objective the reduction of global warming by 2°C.

To highlight Morocco's commitment and its strategic vision in the field of energy, in comparison to the experiences of other countries, we suggest the study of the following data:

- Carbon dioxide (CO_2) is a greenhouse gas, its emission in the atmosphere has known a progressive increase for the last century. Document 1 shows the world electricity production according to the different resources used in 2006 (figure **a**), and figure **b** of the same document shows the CO_2 emissions in the atmosphere by these resources.



Document 1

1. Using the figures in document 1:

a. Show the relationship between the greenhouse effect and the production of electricity. **(1.5pts)**

b. Suggest two adequate procedures to limit the aggravation of the greenhouse effect. **(0.5 pt)**

During the summit COP 21 in Paris, Morocco has committed itself to reduce carbon dioxide (CO_2) to 32% by the year 2030. To achieve that Morocco has adopted a strategy based on renewable energies. The figures in document 2 present data related to the realised energy projects.

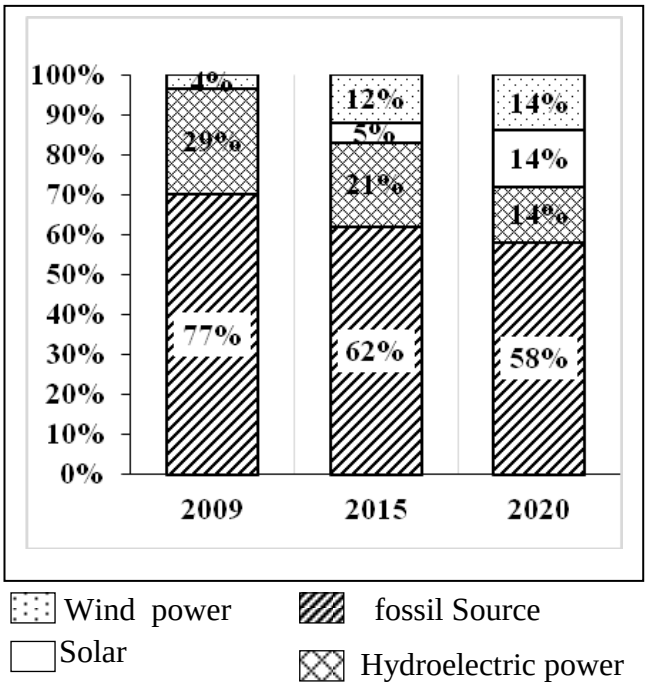


Figure a: Evolution of electricity production from different sources in Morocco.

	Wind energy	**Solar energy**
Stations or wind farms built (2000-2015)	8 wind farms with a production reaching 1060 MW	6 stations with a production reaching 1060 MW
Objective to be attained by the year 2020	- 14% of national electricity production - decrease in CO_2 emissions by 5.6 million tons /year.	14% of national electricity production - decrease in CO_2 emissions by 3.7 million tons /year.

Figure b: Renewable energy projects in Morocco.

Document 2

2. Based on the data in document 2, **show** the efficiency of these procedures to maintain Morocco's commitment towards COP 21. **(1pt)**

- Contrary to Morocco, other countries have continued to produce electricity from nuclear energy. Some nuclear stations have witnessed incidents causing radioactive leaks in the environment. Document 3 presents data in relation to some of these incidents.

	Chernobyl (1)	Fukushima(2)
Radioactive Iodine	4260 PBq	408 PBq
Radioactive caesium	168 PBq	85 PBq
Rare gases	6533 PBq	6550 PBq

(1): International Nuclear Energy Agency - 2005.

(2): Estimation of the Institute of nuclear safety and radioprotection

Figure a : *radioactive emissions after the* Chernobyl and Fukushima disasters.

Type of cancer	Total number of cases	Total number of the dead	Percentage of the dead
Goitre	137000	13700	10%
Blood	12000	8040	67%
Other	123000	71340	58%

Figure b : *Estimated number of dead people affected by cancer following the Chernobyl disaster.*

Document 3

3. Using the data in document 3, **determine** the impact of nuclear energy in the production of electricity on the human health and on the environment. **(1pt)**

4. By considering the previous data, **give** your opinion about Morocco's choice of using energy in comparison to the nuclear energy model adopted by other countries. **(1pt)**