

الصفحة	<p style="text-align: center;">الامتحان الوطني الموحد للبكالوريا الممالك الدولية الدورة العادية 2020 - الموضوع -</p>		<p style="text-align: center;">  المملكة المغربية وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي المركز الوطني للتقويم والامتحانات </p>	
1				
8				
***	SSSSSSSSSSSSSSSSSSSS	NS 34E		
3	مدة الإنجاز	علوم الحياة والأرض		المادة
5	المعامل	شعبة العلوم التجريبية مسلك العلوم الفيزيائية (خيار إنجليزية)		الشعبة أو المسلك

General exam guidelines

This exam is composed of two sections:

✿ **Section I:** The Knowledge Restitution section offers two choices:

- Choice 1 is related to the unit of the use of organic and inorganic materials.
- Choice 2 is related to the unit of geological phenomena accompanying the formation of mountain ranges and their relationship with plate tectonics.

Answer only the questions of one of the two choices. If questions from both choices are answered at the same time, the whole section will be scored zero.

✿ **Section II:** The Scientific Reasoning and Written and Graphic Communication section offers three exercises. All of them should be answered:

- Exercise 1 is related to the unit of organic matter consumption and energy flow.
- Exercises 2 and 3 are related to the unit of the nature of genetic information and its mechanism of expression- transmission of genetic information during sexual reproduction.

Answer the questions of the three exercises.

It is permissible to use a non-programmable calculator.

الصفحة	2	NS 34E	الامتحان الوطني الموحد للبكالوريا - الدورة العادية 2020 - الموضوع - مادة: علوم الحياة والأرض - شعبة العلوم التجريبية مسلك العلوم الفيزيائية (خيار إنجليزية)
8			

Section I : Knowledge Retrieval (5 pts)

Choice 1

- I. Define** the following concepts: - Renewable energy - Household waste sorting (1pt)
- II.** For each of the statements 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. In Morocco household waste is characterized by :</p> <p>a- high level of humidity. b- low level of humidity. c- low level of quantity of organic matter. d- low level of quantity of recyclable material.</p>	<p>2.To reduce environmental pollution resulting from agricultural activities, it is possible to use:</p> <p>a- chemical control. b- biological control. c- fertilizers. d- cultivation in greenhouses.</p>
<p>3. The greenhouse effect is explained by the following events:</p> <p>1. The earth's surface absorbs a part of the sun's radiation; 2. Reflection of part of the solar radiation on the earth's surface; 3. Reception of solar radiation by the earth's surface; 4. Blocking and absorption of solar radiation by greenhouse gases; 5. Increase of temperature on the earth's surface. The chronology of these events is:</p> <p>a- 3 → 1 → 4 → 2 → 5 b- 3 → 2 → 4 → 1 → 5 c- 3 → 1 → 2 → 4 → 5 d- 3 → 4 → 2 → 1 → 5</p>	<p>4. The discharge of untreated wastewater into the aquatic environment leads to :</p> <p>a- a decrease in the quantity of organic matter and the content of O₂ dissolved in water . b- an increase in the quantity of organic matter and the content of O₂ dissolved in water. c- an increase in the quantity of organic matter and a decrease in the quantity of O₂ dissolved in water. d- a decrease in the quantity of organic matter and an increase in the quantity of O₂ dissolved in water.</p>

III. Suggest two appropriate measures to reduce the impact of household waste on the underground water. (1pt)

IV. Copy down the pairs (1 ;...) ; (2 ;...) ; (3 ;...) ; (4 ;...) in your separate sheet, and complete them with the letters of group 2 corresponding to the appropriate number of group 1. (1 pt)

Group 1: Waste treatment techniques	Group 2 : definition or objective of the technique
1- Biogas production.	a- Reduction of the quantity of solid waste and production of reusable materials.
2- Composting.	b- Occurs under anaerobic conditions, using microorganisms that decompose organic matter by fermentation.
3- Incineration.	c- Occurs under aerobic conditions with the intervention of microorganisms that oxidize organic matter.
4- Recycling.	d- Reduction of the quantity of organic waste and production of thermal energy.

الصفحة	3	NS 34E	الامتحان الوطني الموحد للبكالوريا - الدورة العادية 2020 - الموضوع - مادة: علوم الحياة والأرض - شعبة العلوم التجريبية مسلك العلوم الفيزيائية (خيار إنجليزية)
8			

Choice2 :

I. Define the following notions: - Obduction - Schistosity (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 magma of the subduction zones is the result of the:

- a- total fusion of hydrated peridotite following a release of water from the overlapping plate.
- b- partial fusion of hydrated peridotite following a release of water from the overlapping plate.
- c- total fusion of hydrated peridotite following a release of water from the overlapping plate.
- d- partial fusion of hydrated peridotite following a release of water from the overlapping plate.

3. The existence of sillimanite in a metamorphic rock indicates that it has been subjected to:

- a- low temperature and high pressure.
- b- high temperature and high pressure.
- c- high temperature and low pressure.
- d- low temperature and low pressure.

2. Micaschist and gneiss are characterized by:

- a- a similar chemical composition and a different texture and crystals size.
- b- a similar texture and crystals size and a different chemical composition.
- c- a similar texture, crystals size and chemical composition.
- d- a different chemical composition, and a different texture and crystals size.

4. In mountain ranges, the ophiolites are fragments of a :

- a- recent metamorphosed oceanic lithosphere containing granite and gabbro.
- b- ancient non-metamorphosed oceanic lithosphere containing granite and gneiss.
- c- ancient metamorphosed oceanic lithosphere containing basalt and metagabbro.
- b- recent non-metamorphosed oceanic lithosphere containing eclogite and greenschist.

III. Copy down the pairs (1 ; ...) ; (2 ; ...) ; (3 ; ...) ; (4 ; ...) in your separate sheet, and complete them with the letters of group 2 corresponding to the appropriate number of group 1. (1 pt)

Group 1
1 The metamorphic sequence
2- The metamorphic facies
3- The strike-slip fault
4- Foliation

Group 2
a- Structure of some metamorphic rocks characterized by alternating light and dark bands.
b- Horizontal movement of the two compartments of the fault.
c- Assembly of metamorphic rocks whose determination is based on their mineralogical composition.
d- Metamorphic rocks resulting from the same original rock under the effect of increasing pressure and temperature.

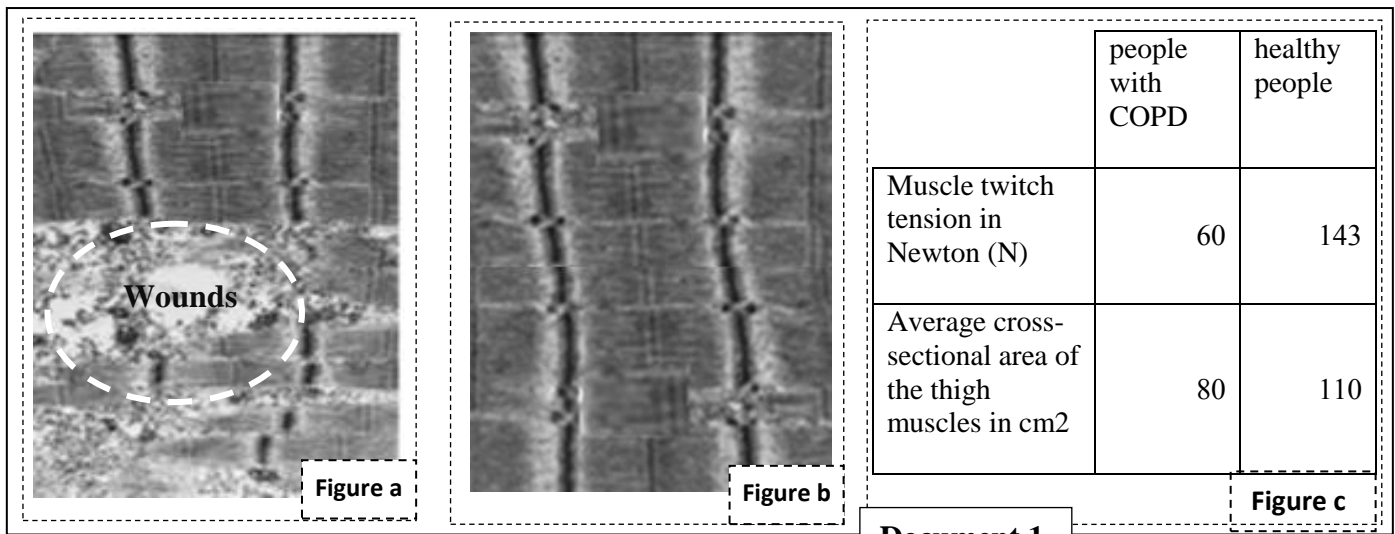
IV. Give two petrographics and two geophysicals indices that characterize subduction zones. (1 pt)

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

Exercise 1 (7 pts)

People with a lung disease called COPD (Chronic Obstructive Pulmonary Disease) suffer from a serious dysfunction of some physiological functions. The deterioration of the muscle function is considered one of the common symptoms of this disease. To know the manifestations and causes of the deterioration of the function of the striated skeletal muscles in COPD patients, we suggest the following data:

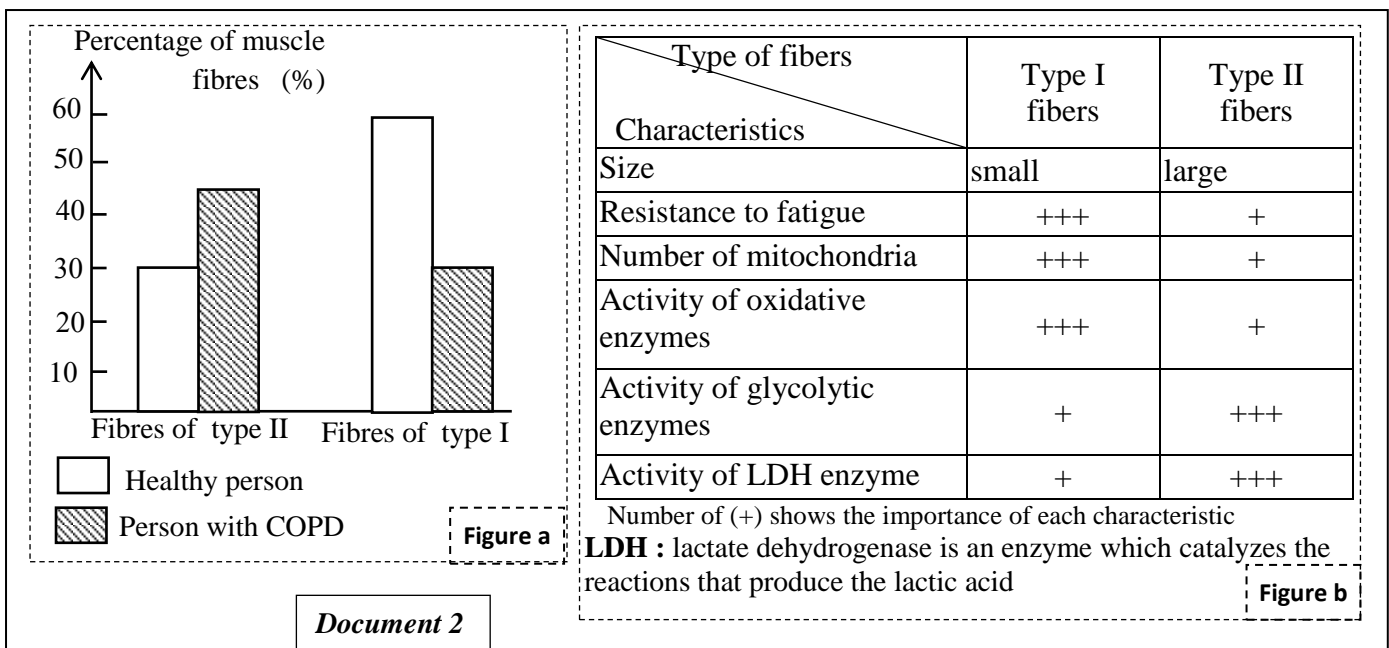
Document 1 presents a microscopic observation of myofibrils of the quadriceps muscle in a person with COPD (Figure a) and a healthy person (Figure b) and the results of measurements of certain muscle characteristics in COPD patients and in healthy people (figure c).



Document 1

1. Based on Document 1, extract the manifestations of the deterioration observed in the striated skeletal muscles that characterize COPD disease.(0.75pt)

In order to determine the causes of the low muscle activity in patients with COPD, we suggest document 2 which gives the results of a study of the distribution of the types of muscle fibers in a person suffering from COPD and in a healthy person (figure a), and some properties of muscle fibers (Figure b).

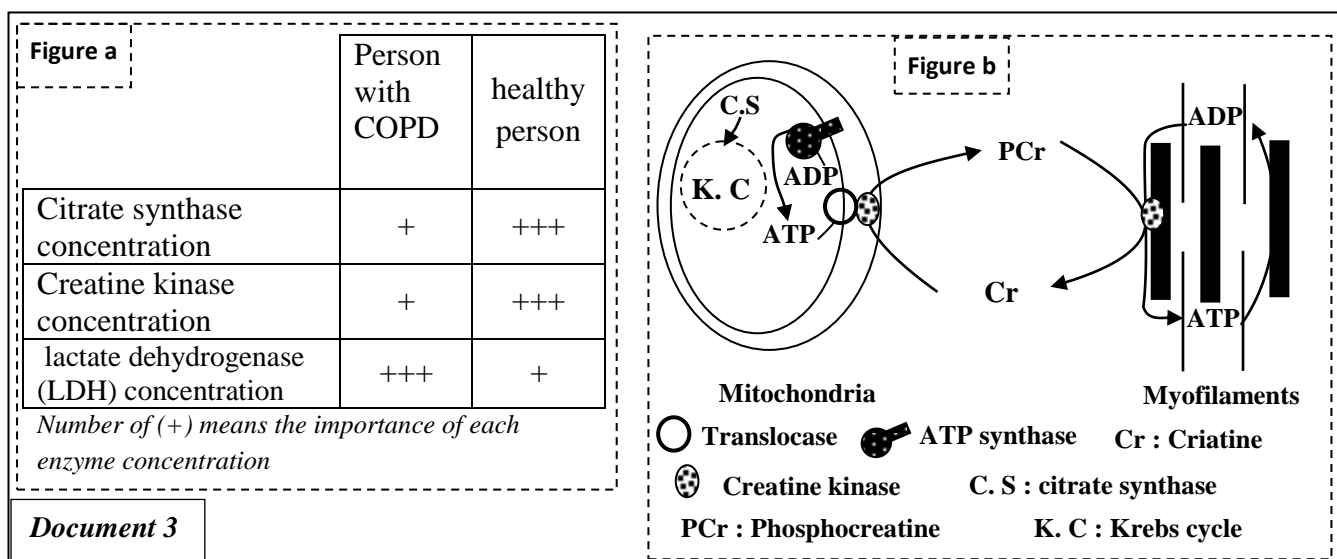


Document 2

2. Using the data on document 2, **Compare** the distribution of muscle fibers between the person with COPD and the healthy person, and **deduce** the dominant metabolic pathway to produce the energy at level of the muscles in the person suffering from COPD. **Justify** your answer. (1.75pts)

3. **Based** on the previous data and your knowledge, **explain** the low muscle activity observed in the person with COPD. (1pt)

The lactate dehydrogenase (LDH), creatine kinase and citrate synthase are the enzymes that play a key role in energy production at the level of the muscle, document 3 presents the results of measuring the concentration of these enzymes in a healthy person and a person with COPD (Figure a) and the role of creatine kinase and citrate synthase in the production of ATP (Figure b).



Document 3

4. **Based** on document 3, **explain** the dominance of the metabolic pathway, as determined in your answer to question 2, in a person with COPD. (2pts)

To improve the function of the striated skeletal muscles, patients with COPD undergo special training exercises. Document 4 shows the measures of some characteristics of the quadriceps muscle in patients with COPD before and after training for 4 weeks.

Document 4	Before training	After training
Muscle twitch tension in newton (N)	60	67
Creatine kinase activity	+	+++
Citrate synthase activity	+	+++
Production of lactic acid	+++	+
Oxygen consumption	+	+++

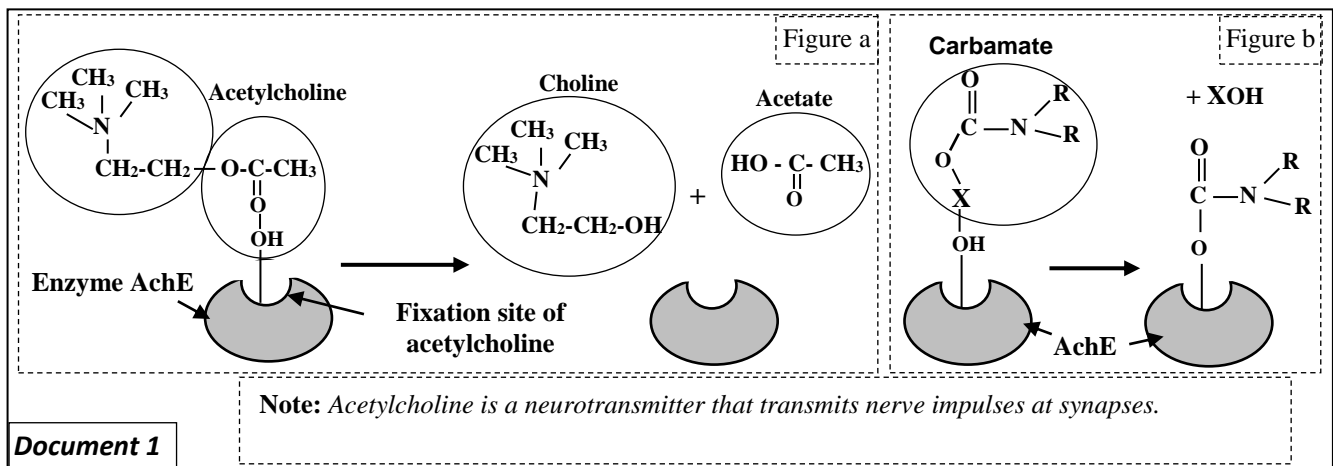
Number of (+) shows the degree of importance

5. **Based** on document 4 and previous data, **show** the relationship between training and improved skeletal muscle function in COPD patients. (1.5pts)

Exercise 2 : (4 pts)

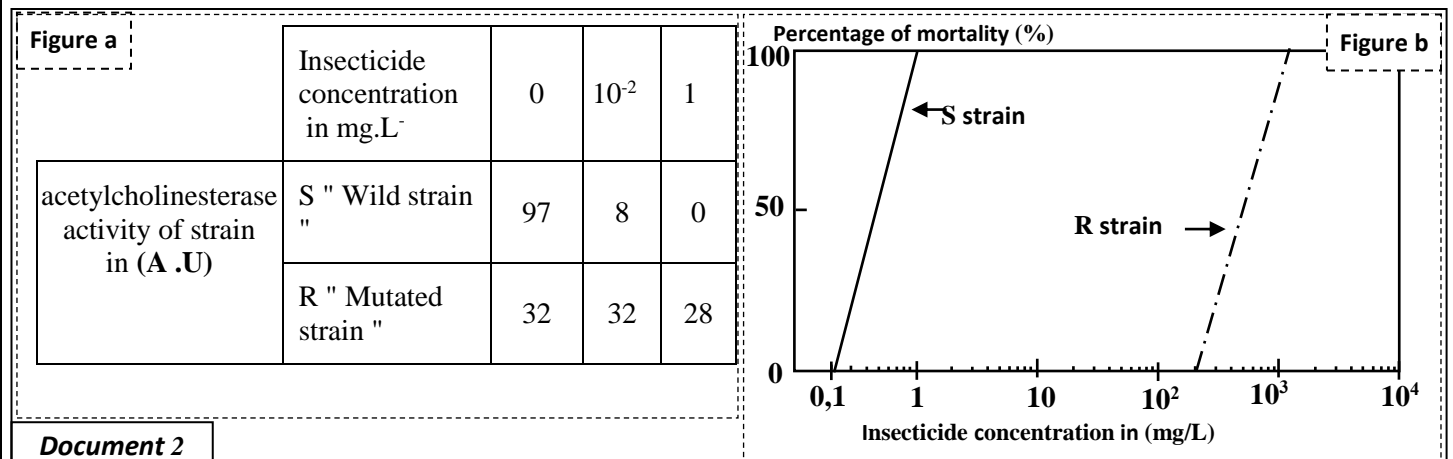
The *Culex pipiens* mosquitoes transmit many diseases (filariasis, Nile fever...) through their bites. They are currently becoming resistant to carbamate insecticides. To explain the origin of this resistance, we propose the following data:

Acetylcholinesterase (AChE) is an enzyme that hydrolyses acetylcholine at cholinergic synapses. This degradation is essential for the normal functioning of the nervous system of insects. Carbamates act on the level of the nervous system of insects by inhibiting the acetylcholinesterase activity. Document 1 presents the enzymatic reaction of acetylcholinesterase (figure a) and the action of carbamate on the active site of this specific enzyme for the fixation of the acetylcholine (figure b).



1. Based on document 1, describe the mode of action and the effect of carbamate on acetylcholinesterase (AChE) enzyme. (1pt)

In mosquito populations, such as *Culex pipiens*, the synthesis acetylcholinesterase is controlled by a gene with two different alleles. The resistant mosquitoes (R strain) have two mutated alleles (Ace-R alleles), while the susceptible mosquitoes (S strain) have two wild alleles (Ace-S alleles). Document 2 presents the results of studies of the action of a carbamate insecticide on the two strains of mosquitoes. The figure (a) presents the measurement of acetylcholinesterase activity (in arbitrary units) of each strain as a function of the concentration of carbamate insecticide applied. The figure (b) shows the mortality rate of each strain based on the concentration of insecticide applied.



2. Using Document 2, show the relationship between the mortality of different mosquito strains S and R and the acetylcholinesterase activity, and suggest a hypothesis to explain the resistance of R strains to the insecticide applied. (1 pt)

In order to verify your hypothesis, we suggest document 3 which gives the nucleotide sequence of a part of the allele (untranscribed strand) of the Ace gene encoding to acetylcholinesterase synthesis in both S and R strains and document 4 which presents an extract of the genetic code.

→ <i>Reading direction</i>									
Number of nucleotide triplets:	243	244	245	246	247	248	249	250	251
S strain Allele Ace-S:	ATC	TTC	GGG	GGT	GGC	TTC	TAC	TCC	GGG
R strain Allele Ace-R:	ATC	TTC	GGG	GGT	AGC	TTC	TAC	TCC	GGG
									Document 3

Codons	UUA UUG	GGU GGC GGA GGG	AGU AGC UCU UCC	AUU AUC AUA	UUU UUC	UAU UAC	CGU CGC CGA CGG	CCU CCC CCA CCG	UAA UAG UGA
Amino Acid	Leu	Gly	Ser	Ile	Phe	Tyr	Arg	Pro	Stop
									Document 4

3. Using the data of documents 3 and 4, determine the mRNA sequence and amino acid sequence corresponding to each alleles of the Ace gene in both strains S and R and verify your hypothesis to highlighting the relationship gene-trait. (2pts)

Exercise 3 : (4 pts)

The drosophila of the wild phenotype with a striped grey body and red eyes has undergone many mutations concerning the color of the body and eyes: the "black" mutation results in a black body, the "cinnabar" mutation and the "cardinal" mutation result in eyes of a red color different from that of wild flies. In order to determine the mode of transmission of these non-sex-linked traits, we propose the results of the following studies:

- **Study 1:** the crosses are realized between two groups of drosophila of pure breed (lineage)
 - Group A:** wild drosophila with a striped grey body and red eyes;
 - Group B:** mutant drosophila with black body and "cinnabar" eyes

Crosses	Parents	Descendants
Cross 1	Drosophila of group A with drosophila of group B	F1 generation composed of drosophila with wild phenotype (striped grey body and red eyes)
Cross 2	Drosophila of F1 with drosophila of group B	- 46% of wild drosophila - 46% of fruit flies, black body and cinnabar eyes - 4% of fruit flies, grey striped body and cinnabar eyes - 4% of fruit flies black body and red eyes

1. By exploiting the results of the cross 1 and cross 2, determine the mode of the transmission of the two studied hereditary traits. (0.5 pt)

الصفحة	8	NS 34E	الامتحان الوطني الموحد للبكالوريا - الدورة العادية 2020 - الموضوع - مادة: علوم الحياة والأرض - شعبة العلوم التجريبية مسلك العلوم الفيزيائية (خيار إنجليزية)
8			

- **Study 2:** the crosses are realized between two groups of drosophila of pure breed (lineage)
Group C: wild drosophila with a striped grey body and red eyes;
Group D: mutant drosophila with black body and "cardinal" eyes

Crosses	Parents	Descendants
Cross 3	Drosophila of group C with drosophila of group D	Generation F'1 composed of drosophila with wild phenotype
Cross 4	Drosophila F'1 with drosophila of group D	- 25% of wild drosophila - 25% of drosophila with a black body and cardinal eyes - 25% of fruit flies with gray striped bodies and "cardinal" eyes - 25% of drosophila with black body and red eyes

- By exploiting** the results of the cross 3 and cross 4, **determine** the mode of the transmission of the two studied hereditary traits. **(0.5 pt)**
- Show** that the results of these crosses prove the existence of two different genes controlling eye color in drosophila. **(0.5 pt)**
- a. Give** the chromosomal interpretation of crossing 2 by **establishing** a Punnett square. **(0.75pt)**
Use the symbols **G** and **g** for body color, **R** and **r** for eye color.
- b. Give** the chromosomal interpretation of crossing 4 by **establishing** a Punnett square. **(0.75pt)**
Use the symbols **G** and **g** for body color, **D** and **d** for eye color.
- Explain** the percentages of phenotypes obtained in the descendant of the cross 4. **Draw** an explanatory scheme. **(1pt)**