وزارة التّربية والتّعليم العالي
المديريّة العامّة للتّربية
دائرة الامتحانـات الرّسميّة

امتحانات الشّهادة المتوسّطة

دورة العام ٢٠١٩ الاستثنائية
الثلاثاء ٢٣ تموز ٢٠١٩

مسابقة في مادّة علوم الحياة والأرض
المدّة: ساعة واحدة

الاسم:
الرّقم:

Answer the following four exercises.

Exercise 1 (5 points) Cell Division and Formation of Gametes

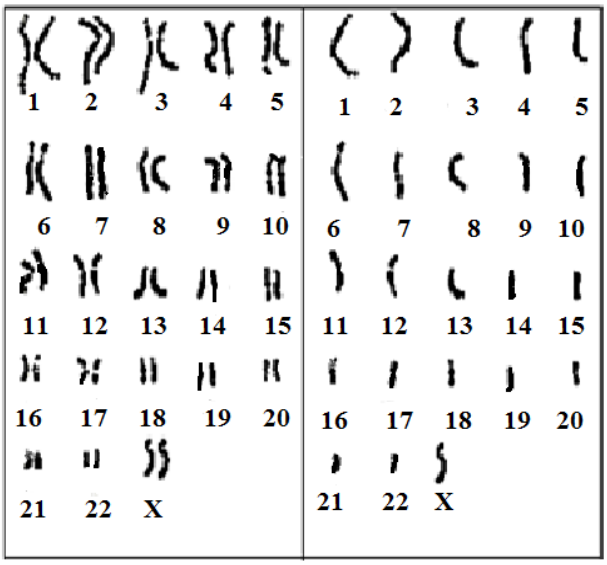
A karyotype represents the set of chromosomes in a cell, arranged according to well defined criteria. It permits us to determine the sex of the fetus and to detect the chromosomal abnormalities.

1- Pick out the aims of performing a karyotype.

2- Indicate one criterion to arrange the chromosomes in a karyotype.

The gametes originate from reproductive mother cells. Documents 1 and 2 show two karyotypes of two cells extracted from the same person:

- a gamete G
- a mother cell M of the gametes.



Document 1 **Document 2**

3- Identify the karyotype which corresponds to:
3-1- the mother cell M
3-2- the gamete G.

4- Specify if the gamete G is male or female.

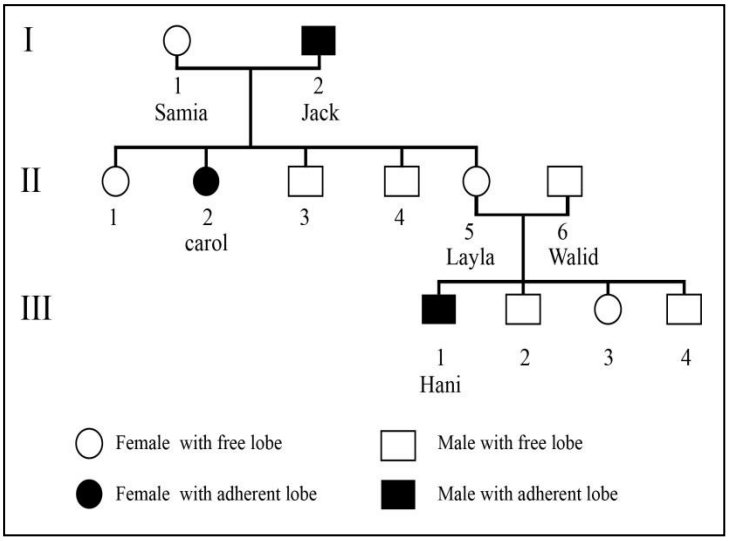
5- Name the cell division at the origin of the formation of gamete G from the mother cell M. Justify the answer.

Exercise 2 (5 points) Transmission of a Hereditary Trait

The ear lobe can be either free or adherent. This hereditary trait is due to a gene located on an autosome. This gene exists in two alleles:

- an allele responsible for the phenotype "free lobe"
- an allele responsible for the phenotype "adherent lobe".

The adjacent document represents the genealogical tree of a family whose certain members have "adherent lobes".



1-1. Show that the allele responsible for the phenotype "adherent lobe" is recessive.

1-2. Designate by symbols the corresponding alleles.

2. Indicate the genotype of Samia and that of Hani. Justify the answer.

3. Make the necessary factorial analysis to verify the phenotypic results of the descendants of Layla and Walid.

Exercise 3 (4.5 points) Characteristics of Blood Capillaries

Blood circulates in the body through different types of blood vessels: arteries, veins and blood capillaries…However, the capillaries that are very numerous and have very thin walls, permit the exchange of substances between blood and cells.

1- Pick out two characteristics of the blood capillaries which favor this exchange.

2- Name two substances which pass from blood to cells.

The adjacent document shows the average diameter of different types of blood vessels as well as the average speed of the blood circulation in each type.

Type of blood vessel	Average diameter (cm)	Speed of blood circulation (cm/sec)
Arteries	**2.5**	**40**
Capillaries	**0.1**	**2**
Veins	**1.3**	**17**

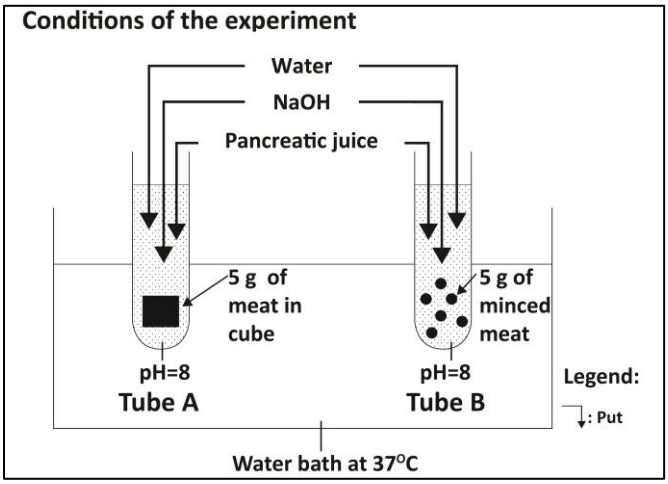
3- Show, by referring to above document that the blood circulation slows down in the blood vessels with smaller diameter.

4- Explain, based on all what precedes, that the blood capillaries are structures well adapted for the exchange between blood and cells.

Exercise 4 (5.5 points) Effect of Mechanical Digestion

In order to study the effect of mechanical digestion on the chemical digestion, the following experiment is performed:
5 g of meat in cube and 5 g of minced meat are put in tubes A & B respectively. Then, the same amount of pancreatic juice, water and NaOH is put in both tubes. These experimental conditions are shown in document 1.

The mass of meat is then measured in both tubes at different intervals of time.The results are represented in document 2.



Document 1

1- Draw out the experimental condition that varied in this experiment.

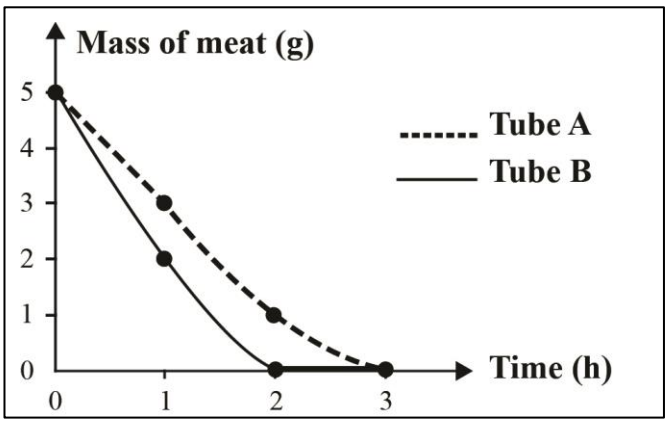
2- Formulate the hypothesis tested in this experiment.

3- Represent in one table the obtained results shown in document 2.

4-1. Analyze the obtained results, document 2.

4-2. What do you conclude concerning the effect of the mechanical digestion on the chemical digestion?

5- Suggest, based on this experiment, a good food habit that you can follow while eating your meals.



Document 2

أسس التصحيح

مسابقة في مادّة علوم الحياة والأرض
المدّة: ساعة واحدة

Q	Exercise 1(5 points) Cellular Division at the Origin of Gametes	Mark
1.	Performing karyotype permits to: - determine the sex of the fetus. - detect the chromosomal abnormalities.	0.5 0.5
2.	The criterion used to arrange the chromosomes in a karyotype is: -size of the chromosome, or - the position of the centromere, or banding pattern Or the homologous pairs of chromosomes are arranged in decreasing order of length.	0.5
3-1.	Since the karyotype shown in document 1 reveals the presence of pairs of homologous chromosomes (2n = 46), then karyotype 1corresponds to the mother cell M.	1
3-2.	Since the karyotype shown in document 2 reveals that each chromosome exists in one copy (n=23), then karyotype 2 corresponds to the gamete G.	1
4.	Gamete G is a female gamete. Since the mother cell M and the gamete G originate from the same person, and since the karyotype of the mother cell M reveals the presence of 2 sex chromosomes (XX), this means that the mother cell M belongs to a female (and eventually the gamete originating from it is a female gamete).	0.75
5.	Meiosis (a reductional division). Since, the number of chromosomes in the mother cell "M" is reduced from 46 chromosomes to 23 chromosomes (half the number) in the gamete (G).	0.75

Q	Exercise 2 (5 points) Transmission of a hereditary trait	Mark
1-1.	Layla and Walid have the phenotype "free lobe"; their son Hani has the phenotype "adherent lobe". This indicates that the allele responsible for the phenotype "adherent lobe" is present in the parents, but masked by the allele responsible for the "free lobe". Thus the allele responsible for phenotype "adherent lobe" is recessive with respect to the allele responsible for the "free lobe" allele which is dominant.	1.25
1-2.	Let "**F**" be the symbol of the allele that determines the phenotype "free lobe". Let "**a**" be the symbol of the allele that determines the phenotype "adherent lobe".	0.5
2.	- The genotype of Samia is **F // a**. Since she has the phenotype "free lobe", thus she possesses the dominant allele "F". And, since her daughter Carol shows the recessive phenotype "adherent lobe" and recessivity is a characteristic of purity. Therefore, Carol should have inherited an allele "a" from her mother who must be heterozygous. - The genotype of Hani is **a // a**. Since recessivity is a characteristic of purity.	0.75 0.75
3.	Parent's phenotypes: ♀ [F] X ♂ [F] Parent's genotypes: ♀ F // a X ♂ F// a Gametes of the Parents: ½ F ½ a ½ F ½ a **Table of cross:** γ♀ \ γ♂: F ½ | a ½ ; F ½ | F//F 1/4 | F//a 1/4 ; a ½ | F//a 1/4 | a//a 1/4 Phenotypic proportions: 3/4 children having free lobes 1/4 children having adherent lobes The theoretical results verify the phenotypic results of the descendants of the couple Layla and Walid.	1.75

Q	Exercise 3 (4.5 points) Characteristics of blood capillaries	Mark
1.	The characteristics of the blood capillaries favoring the exchange: -They are very numerous. - They have very thin walls.	 0.25 0.25
2.	-Oxygen gas -Nutrients: (glucose, mineral salts….)	0.5 0.5
3.	By referring to the document, when blood passes through the arteries, having large diameter (2.5cm), its speed is the highest (40cm/sec). On the contrary, when it passes through the blood capillaries having the smallest diameter (0.1 cm), blood circulates at a speed of 2cm/sec, corresponding to the smallest speed. This shows that, as the diameter of the blood vessel becomes smaller, the blood circulation is slower. Moreover, when the blood passes through veins, having diameter of 1.3cm (greater than that of blood capillaries), the blood circulates more rapidly with a speed of 17 cm/ sec. This confirms that the blood circulation slows down in the blood vessels with smaller diameter.	1.5
4.	On one hand, the large number of blood capillaries in the organs increases the surface area of exchange. On the other hand, the very thin wall favors the process of exchange (diffusion) of substances; moreover, slow circulation of blood due to the small diameter of the capillaries increases the duration of exchange. These characteristics render the capillaries structures well adapted for exchange.	1.5

Q	Exercise 4 (5.5 points) Transmission of a Hereditary Trait	Mark
1.	The size of meat piece.	0.5
2.	Tested hypothesis: The mechanical digestion of food facilitates its chemical digestion. Or The mechanical digestion of food may facilitate its chemical digestion.	0.5
3.	Title : A table showing the variation in the mass of meat as function of time in tubes A and B	2
4-1.	The 2 tubes are under the same experimental conditions (same temperature, same amount of meat (5 g), of pancreatic juice, same pH). However, in tube A where meat is in cube, the mass of the meat decreases progressively from 5 g to 0 g during 3 h, while in tube B where meat is minced, the mass of the meat decreases more rapidly from 5 g to 0 g during 2 hours only (a shorter period of time).	1.5
4-2.	Mechanical digestion of food accelerates (facilitates) its chemical digestion.	0.5
5.	The individual is advised to well masticate (grind) the food. Do not swallow the food before chewing it..	0.5

Time (in h) / Mass of meat (g).	0	1	2	3
Tube A	5	3	1	0
Tube B	5	2	0	0