

دورة سنة 2009 العادية	الشهادة المتوسطة	وزارة التربية والتعليم العالي المديرية العامة للتربية دائرة الامتحانات
الاسم: الرقم:	مسابقة في مادة علوم الحياة والأرض المدة: ساعة واحدة	

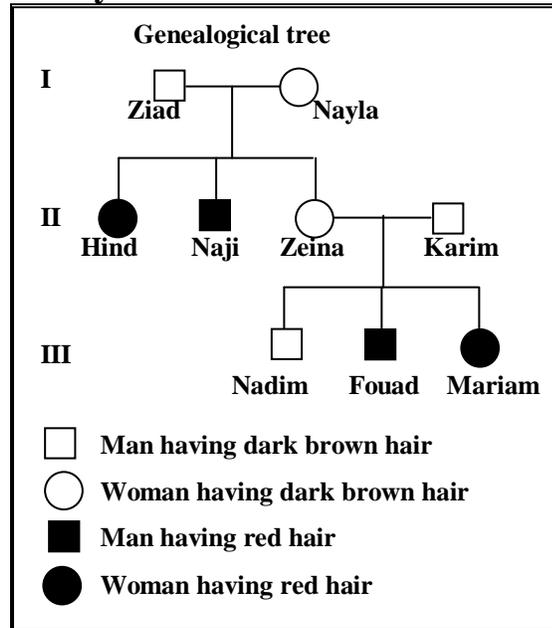
Answer the following exercises.

### Exercise I (5 points)

#### Transmission of a hereditary character in man

The opposite document represents the genealogical tree of a family whose some members have dark brown hair and others have red hair.

- 1- Is the character "red hair" expressed uniquely in men? Justify the answer by referring to the genealogical tree.
- 2- Is the allele responsible for red character dominant or recessive? Justify the answer.
- 3- Designate by symbols the corresponding alleles.
- 4- Write the possible genotype(s) of Nadim. Justify the answer.



### Exercise II (5 points)

#### Chromosomes and genetic information

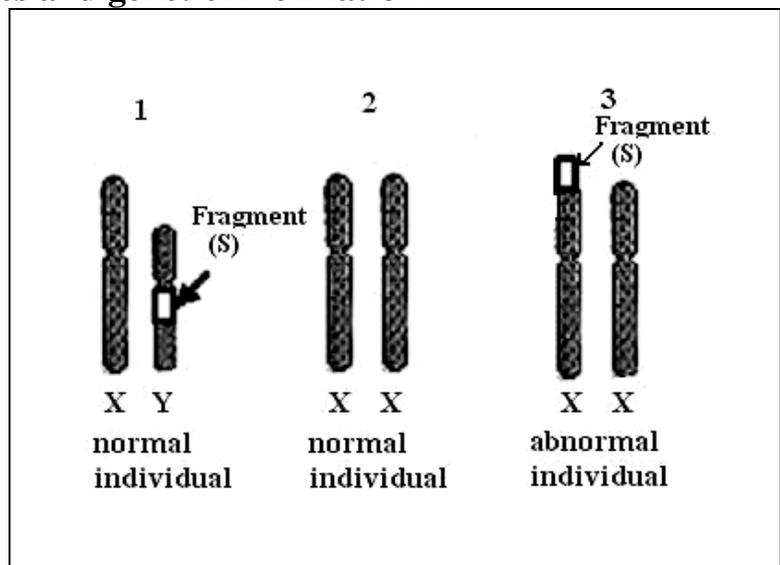
The chromosomes are carriers of the genetic information. Any change in the number or form of a chromosome can lead to a modification in the expression of the genetic program. A fragment (S), located only on chromosome Y, carries the genetic information responsible for the appearance of masculine characteristics. The opposite document shows the sex chromosomes of three individuals.

- 1- Indicate the sex of individuals 1 and 2. Justify the answer in each case.

- 2- a- Compare the sex chromosomes of individual 2 to that of individual 3.

b- Derive the origin of the abnormality in individual 3.

c- What would the consequence of this abnormality be in individual 3?



### Exercise III (5 points)

#### Molecular simplification of starch

Wheat starch is a complex molecule constituted of many molecules of glucose. In the course of its digestion, starch reacts with water and is degraded into very small-sized molecules. This chemical reaction is called hydrolysis. The enzymes, contained in saliva and pancreatic juice, activate the hydrolytic reaction and favor the molecular simplification of starch. These enzymes remain intact at the end of this reaction.

- 1- In reference to the text :
  - a- Indicate the constituent molecules of wheat starch.
  - b- Define « hydrolysis ».
  - c- Pick out the sentence that shows the role of enzymes.
- 2- Name the enzyme responsible for the molecular simplification of wheat starch.
- 3- Schematize the molecular simplification of starch (cooked starch) in the presence of saliva.

### Exercise IV (5 points)

#### Assimilation and transport of oxygen gas

Assimilation is the mechanism where cells are capable of forming new molecules of proteins, for example hemoglobin, from amino acids using energy. Hemoglobin is the protein of red blood cells which plays a role in the transport of respiratory gases: oxygen ( $O_2$ ) and carbon dioxide ( $CO_2$ ).

- 1- Derive from the text the elements necessary for assimilation.

After the formation of hemoglobin, we measured the quantity of oxygen gas ( $O_2$ ) transported by this protein. The results are shown in the table below:

Quantity of hemoglobin (in arbitrary units)	4	6	8	10
Quantity of oxygen transported (in %)	25	50	70	98

- 2- Draw a curve showing the variation of the quantity of the transported  $O_2$  gas in function of the quantity of formed hemoglobin.
- 3- Analyze the obtained results.
- 4- "Hemoglobin is a functional protein". Justify this statement.

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**Answer the four following questions:**

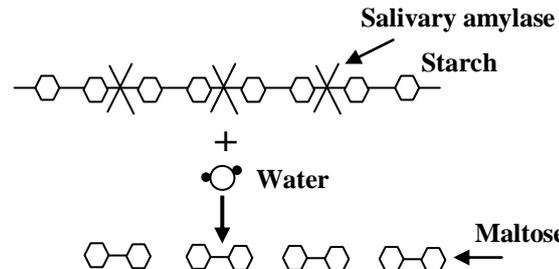
**First question (5 points)**

Part of the Q	Answer	Mark
1	No, because the character " <b>red hair</b> " is expressed in men and women : Hind and Mariam are women with red hair, Naji and Fouad are men with red hair.	1
2	The allele responsible for red hair character is recessive, because Ziad and Nayla or Zeina and Karim, two couples, phenotypically having dark brown hair had some children (Hind, Naji, Fouad and Mariam) having red hair. This indicates that these couples are heterozygotes, carriers of the recessive red allele masked by the dominant dark brown allele	1.5
3	Symbol of alleles: <b>B</b> : brown, dominant allele <b>r</b> : red, recessive allele.	0.5
4	Genotype of : Hind : <b>rr</b> , because the <b>r</b> allele is recessive and is only expressed in the homozygous state. Nadim : <b>BB</b> or <b>Br</b> , because the <b>B</b> allele is dominant and is expressed in the homozygous or heterozygous state. <b>Or</b> Nadim has two parents (Zeina and Karim) having dark brown hair that are heterozygotes of genotype <b>Br</b> . In this case, Nadim can have genotype <b>BB</b> , or genotype <b>Br</b> .	2

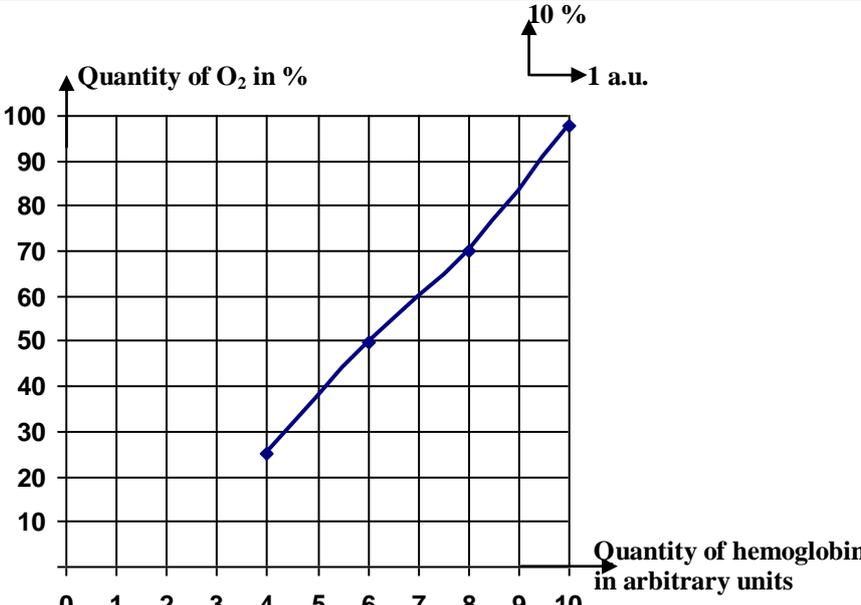
**Second question (5 points)**

Part of the Q	Answer	Mark
1	Man 1 of normal karyotype have two sex chromosomes <b>X</b> and <b>Y</b> that differ in size : <b>X</b> chromosome is longer than <b>Y</b> chromosome (or <b>Y</b> is smaller than <b>X</b> ).	1
2-a	Man 2 has an <b>X</b> chromosome that is similar to the <b>X</b> chromosome in woman 3 (they have same size), whereas, the other <b>X</b> chromosome in man 2 is longer than that in woman 3 : fragment of <b>Y</b> chromosome is linked to the long <b>X</b> chromosome in man 2.	1.5
2-b	The origin of the abnormal karyotype in this man is the abnormal presence of fragment of the chromosome <b>Y</b> on <b>X</b> chromosome.	1
3	The presence of a fragment of chromosome <b>Y</b> that is linked to chromosome <b>X</b> carries the information of the masculine character; therefore the masculine sex is expressed by this man having chromosomes <b>XX</b> as woman 3.	1.5

**Third question (5 points)**

Part of the Q	Answer	Mark
1-a	Glucose molecules are the main constituent of starch.	1
1-b	A hydrolytic reaction is a reaction where starch reacts with water and is degraded into molecules of very small sizes.	1
1-c	The enzymes activate the hydrolytic reaction and favor the molecular simplification of starch while remaining intact at the end of digestion.	1
2	Starch is subjected to molecular simplification in the presence of saliva and pancreatic juice, both containing amylase that acts on starch.	1
3		1

**Fourth question (5 points)**

Part of the Q	Answer	Mark
1	The elements are amino acids and energy.	1
2	 <p><b>Graph showing the variation of the quantity of O<sub>2</sub> transported in function of the quantity of formed hemoglobin.</b></p>	1.5
3	The quantity of transported O <sub>2</sub> , increases from 25% to 98% as the amount of formed hemoglobin increases from 4 a.u to 10 a.u respectively.	1.5
4	Hemoglobin is called functional protein because it assures the transport of the respiratory gases: <ul style="list-style-type: none"> <li>- O<sub>2</sub> gas of the lungs to the cells,</li> <li>- CO<sub>2</sub> of the cells to the lungs.</li> </ul>	1

