مسابقة في علوم الحياة والارض	الاسم :
المدة : ساعة واحدة	الرقم :

*Answer the four following exercises.*

Exercise 1 (5 points)

Transmission of a hereditary trait in humans

In humans, blood group is an autosomal hereditary character that is determined by a gene having three alleles: **A**, **B** and **O**.

The genealogical tree, opposite **document**, represents the transmission of this character in a family.

1- Indicate the origin of each of the two alleles:
  a- in child 3
  b- in child 4.
2- Precise the genotype of the father and that of the mother.
3- Make a factorial analysis that permits to find the possible genotypes of the expected child.
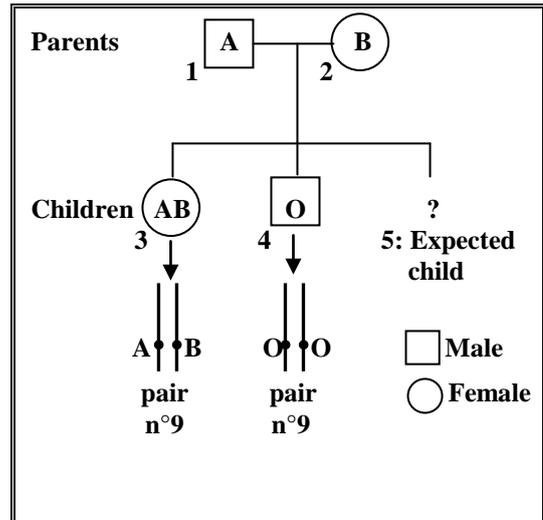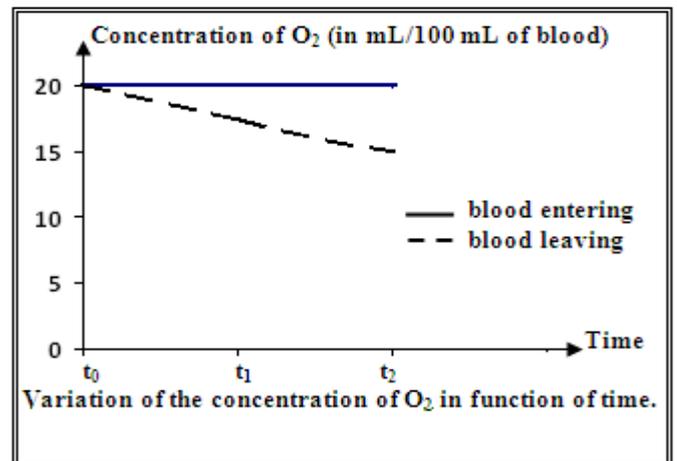

Exercise 2 (5 points)

Circulation and respiration

The opposite **document** shows the measured results of the concentration of oxygen (O_2) gas in the blood entering and leaving the muscle.
1- Name the blood vessel through which:
  a- blood enters the muscle
  b- blood leaves the muscle.
2- Indicate the color of blood entering and that leaving the muscle.
3- By referring to the **document**, calculate the difference in the concentration of O_2 gas between the blood entering and leaving the muscle at time t_2.
4- Did the muscle consume O_2 gas? Justify the answer based on the analysis of results shown in the **document**.

Exercise 3 (5 points)

Down syndrome or trisomy 21 among twins

A study was realized on 13 cases of identical twins and 59 cases of fraternal twins to verify the following hypotheses:

First hypothesis
The identical twins, resulting from the same fertilized egg (zygote), are both affected by trisomy 21 in the cases where this anomaly occurs.

Second hypothesis
The fraternal twins, resulting from the fertilization of two ova by two different sperm cells, are both affected by trisomy 21 in the cases where this anomaly occurs.
The results of this study are given in the **table** below.

	Number of cases	**Number of cases where two twins are affected**	**Number of cases where one of the two twins is affected**
Identical twins	13	13	0
Fraternal twins	59	0	59

1- Justify the expression « trisomy 21 ».
2- Which of the two hypotheses is validated? Justify the answer based on the above results.
3- Explain why:
    a- in the case of identical twins, the two twins are affected
    b- in the case of fraternal twins, one of the two twins is affected.

Exercise 4 (5 points)

Temperature and enzymatic activity

Grade 9 students posed the following question: "What is the convenient temperature for the activity of an enzyme?"
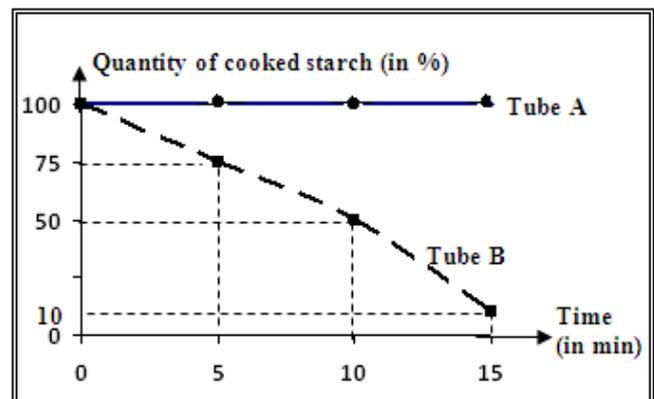For this reason, they realized the experiment described below:
-They put the same quantity of cooked starch in each of the two test tubes **A** and **B.**
-They added a small quantity of fresh saliva to each of the two tubes.
-Then, they placed both tubes for a convenient duration at different temperatures:
  ▪Tube **A** in ice where the temperature is 0°C
  ▪Tube **B** in a water bath where the temperature is 37°C.
N.B.: ▪Saliva contains an enzyme: amylase.
      ▪The chemical medium is neutral in both tubes **A** and **B**.

By using an appropriate technique, these students obtained the results shown in the opposite **document**.

1- Represent, in the same table, the variation of the quantities of cooked starch in the tubes **A** and **B** in function of time.
2- Pick out the posed problem by grade 9 students.
3- Analyze the obtained results. What do you conclude?

اسس التصحيح
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Exercise 1 (5 points)

Part of the Q	Answer	Mark
1-a	Child 3 has an allele **A** of paternal origin and allele **B** of maternal origin.	1
1-b	Child 4 has an allele **O** of paternal origin and another allele **O** of maternal origin.	1
2	The genotype of the father is: $\dfrac{A}{O}$; that of the mother is $\dfrac{B}{O}$.	0.5
3	Genotypes of parents : ♂ $\dfrac{A}{O}$ × ♀ $\dfrac{B}{O}$ γP : (A) (O) (B) (O) ½ ½ ½ ½ Table of cross :	1

♀ \ ♂	**A** ½	**O** ½
B ½	$\dfrac{A}{B}$ ¼	$\dfrac{B}{O}$ ¼
O ½	$\dfrac{A}{O}$ ¼	$\dfrac{O}{O}$ ¼

According to the table of cross, We have four possible genotypes for the expected child:

¼ $\dfrac{A}{B}$; ¼ $\dfrac{B}{O}$; ¼ $\dfrac{A}{O}$; ¼ $\dfrac{O}{O}$.

(Marks: 0.5 ; 1)

Exercise 2 (5 points)

Part of the Q	Answer	Mark
1-a	The blood vessel through which blood enters the muscle is an artery.	0.5
1-b	The blood vessel through which blood leaves the muscle is a vein.	0.5
2	The color of blood entering a muscle is bright red.	0.75
	The color of blood leaving the muscle is dark red.	0.75
3	At time t_2, the concentration of **O₂** gas in the blood : - entering is 20 mL - leaving is 15 mL. The difference in the concentration of O_2 gas is: $20 - 15 = 5$ mL.	1

| 4 | Yes.
Because the concentration of O_2 gas is 20 mL at time t_0 in the blood entering and leaving the muscle. This concentration decreases in the blood leaving to reach 15 mL at time t_2; while, it remains constant (20 ml) in the blood entering the muscle within the same duration. So, the muscle has consumed O_2 gas. | **1.5** |

Exercise 3 (5 points)

Part of the Q	Answer	Mark
1	« Trisomy 21 » means the presence of 3 copies of chromosome 21.	**1**
2	The first hypothesis is validated. Because the number of cases where both twins are affected is 13 out of 13 cases studied in identical twins; however, this number is zero out of 59 cases studied in fraternal twins. So, identical twins will be both affected by trisomy 21 if it occurs.	**2**
3-a	The two twins are affected in the case of identical twins because identical twins result from the same fertilized egg (zygote).	**1**
3-b	One of the two twins is affected in the case of fraternal twins because fraternal twins result from the fertilization of two ova by two different sperm cells. (or it results from two fertilized eggs.)	**1**

Exercise 4 (5 points)

Part of the Q	Answer	Mark
1	<table><tr><td>Time (in min) Quantity of cooked starch (in %)</td><td>0</td><td>5</td><td>10</td><td>15</td></tr><tr><td>Tube **A**</td><td>100</td><td>100</td><td>100</td><td>100</td></tr><tr><td>Tube **B**</td><td>100</td><td>75</td><td>50</td><td>10</td></tr></table>Table showing the variation of quantities of cooked starch in both tubes **A** and **B** in function of time.	**2.5**
2	The posed problem is:"What is the convenient temperature for the activity of an enzyme?"	**0.5**
3	The quantity of cooked starch is 100% in both tubes **A** and B at time 0 minutes. During 15 minutes, this quantity of starch remains constant (100%) in tube **A** placed at 0°C, but it decreases to reach 10 % in tube **B** placed at 37°C. This indicates that the cooked starch is not digested in tube **A** but it is in tube **B**. Therefore, the convenient temperature for the activity of an enzyme is 37°C.	**2**